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# DAIRY RESEARCH

## A Report to the Empire Marketing Board

by

SIR WILLIAM DAMPIER, Sc.D., F.R.S.  
(formerly Dampier-Whetham)



NOVEMBER, 1931.

LONDON:

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE  
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:  
Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh;  
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff;  
15, Donegall Square West, Belfast;  
or through any Bookseller.

1931.

Price 1s. 0d. Net.

λ311:7-1-3,8

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### PREFACE.

**I**N a letter from the Empire Marketing Board dated 23rd December, 1929, the following questions were referred to me:—

(1) What is dairy research? i.e., what is the proper line of division between a specialist dairy research institute and the work of other research institutions in the sphere of nutrition, animal diseases and low temperature research?

(2) What is being done in this field in England, Scotland and elsewhere?

(3) What extensions are contemplated or desirable and what are the most important scientific or practical problems to which attention should be directed?

To each of these three questions I propose to devote one Chapter of this Report. Special and more limited problems, on which I was asked to present an Interim Report, will here be dealt with incidentally.

## CHAPTER I.

### INTRODUCTION.

#### *What is Dairy Research ?*

1. This preliminary question must, I think, be answered in some such terms as follow :

Dairy Research is the study by scientific methods of the dairy industry and its products, and of the fundamental scientific principles underlying its operations.

2. Such a definition shows the wide scope of the subject. The dairy industry begins with the dairy farm, including the growth of fodder, both grass and arable crops, the breeding, management and feeding of the dairy herd, the production of milk, the operation of milking and the handling of milk, farm processes for the conversion of milk into dairy products such as butter or cheese, and the storage and marketing of milk and these products.

Secondly come the problems of the dealers and manufacturers, who collect milk, transport and distribute it to the retailers, and convert surplus milk into dairy-products by large-scale processes.

Thirdly there is the retail trade and the delivery of milk to the consumer.

Fourthly, we have the problems of the nutritive value of milk and its products in different forms, together with the medical and public health questions which are involved.

Moreover, to obtain a complete survey, most of these problems need studying from two or more different aspects—agricultural, chemical and physical, physiological, bacteriological, statistical, economic and financial.

#### *What is the proper line of division in the work of Dairy and other Research Institutions ?*

3. The wide range of dairy problems leads inevitably to overlapping between dairy research and other studies. The breeding of a dairy herd concerns not only the dairy farmer but also the geneticist, and the feeding of the herd concerns the worker in general animal nutrition ; the secretion of milk is of interest to the physiologist, and its composition to the physicist and chemist ; the

structure, action and effect on the cow of milking machines may be classed among the problems of agricultural machinery; the manufacture, handling, transport and storage of butter, cheese and casein, and the utilization of their by-products, may be studied by the chemist and chemical engineer; the nutritive value of milk brings in the physician and the medical officer of health; finally, marketing, distribution and retail sale are problems for the economist. Since research in all these directions is already subsidized by public funds and its demands are continually increasing, the need for both underlying principles and practical rules in the distribution of grants is clear.

4. At first it may well seem hopeless to discover any general principles which can guide us in a problem of such complexity, but I think three statements will hardly be disputed.

(1) Pioneer work on fundamental scientific problems is an affair of the individual, usually working on a small laboratory scale. It cannot be done to order, and must arise naturally from existing knowledge in the course of other work. Its initiation can only be subsidized indirectly by means of grants given, either without conditions or ostensibly for other purposes, to Universities, Colleges or Research Institutes. Hence arises the best argument for spreading grants over a large geographical area in different Institutions instead of aiming at greater immediate efficiency by concentration; we cannot tell where genius, rare as it is, will be found, and must cast wide our net to multiply the chances of securing for mankind the priceless services of its possessor. When brilliant pioneer work has been begun, it is then abundantly worth while to subsidize freely the man who is doing it, either by a direct grant or by moving him to the appropriate Institution.

In such work no question of overlapping arises. If the unlikely thing should happen, and two men break into a new field simultaneously, there will usually be plenty of room for both, and in any case there is great advantage in having new ground surveyed from two points of view.

(2) It is when pioneer work has been done, and it is sought to confirm it, and to investigate how far its results extend and with what modifications, and also in widening the range of other existing knowledge, that co-operative team work in research

becomes necessary. In these more routine investigations, where sometimes elaborate and costly large-scale experiments or statistical enquiries are needed, it is desirable to prevent overlapping so far as may be, and it is here that the present problem of demarcation arises.

(3) It is impossible and undesirable always to prevent the same problem from being examined in two or more Institutes; the line of division should be drawn more as between different aspects than different subjects. Dairying is a specific industry, and Dairy Institutes should regard all routine or large-scale problems from that point of view. The direct line of their work should be to follow the processes of dairying from the growth of fodder through the activities of the cow to the consumption of milk and its products, and other more general questions should only be examined in so far as they affect this main line of enquiry. Thus general agriculturalists deal with (say) the influence of the treatment of grass land on its quality for all purposes, but the dairy worker is concerned only with the effect of that treatment on milk-production. The Animal Nutrition Institutes deal with the problem of nutrition in all animals and in all conditions; the Dairy Institutes should regard the cow's food as the raw material of milk. The veterinary pathologist studies all animal diseases; the dairyman only those that affect the cow as a source of milk.

5. If the general principles underlying these three statements be accepted, they lead to fairly clear practical conclusions as ideals to be aimed at, though financial limitations will naturally control what can be done.

In the first place, no problem which concerns dairying can be ruled out as unsuitable for a Dairy Research Institute. If funds be available, it can make good use of a farm large enough to grow the food for, and otherwise support, a herd of cows sufficient in number to serve as a sound basis of investigation. It may rightly investigate breeding problems as they affect milk-yields, and the physiology of lactation in and with reference to the cow. It can study bovine tuberculosis and other diseases, especially as they affect the milk of cows and the danger of human infection. Then there are many problems in which no overlapping with other Research Institutes is probable—the handling, transport and distribution of milk, the



manufacture of milk-products, and the utilization of by-products obtained in the process. From the harrowing and manuring of a pasture to the disposal of surplus whey, the whole of the agricultural, nutritional, genetic, physiological, physical, chemical and economic problems which underlie the industry are fit subjects of enquiry in Dairy Research Institutes, provided that either fundamental scientific principles are being elucidated by a pioneer, or large-scale routine work is regarded from the appropriate dairying point of view.

6. But, when we come to the practical problem of getting the best value for the expenditure of limited national funds, we have to ask which of these many problems are already being subsidized elsewhere, whether it is better to help work already going on or how far simultaneous study from the different and more specific point of view of the Dairy Institute will yield additional information of sufficient value to pay for the cost of duplication.

It is impossible and certainly undesirable to prevent the workers in a Dairy Research Institute from considering any problem, and getting what light on it they can in the course of their other enquiries, but I think, while funds are limited, no grant should be made to Dairy Institutes for definite investigations on certain problems better provided for elsewhere. The problems I am inclined first to rule out as unsuitable for specifically dairy grants are the following :

(1) Agricultural problems such as the treatment of grass land and the cultivation of arable fodder crops, better studied in Agricultural Institutes and Colleges ;

(2) Problems of bovine disease, where the services of a veterinary pathologist are needed, who would find his natural place in a Veterinary College or Institute of Animal Pathology.

A second group of problems, comprising genetics, nutrition, and the physiology of lactation, need, I think, examination both from the general point of view in Physiological Laboratories, and in Institutes for Genetics and Nutrition as well as from the special point of view natural to Dairy Institutes. Grants for general research into genetics, nutrition and lactation should be given to the former Institutes and Physiological Laboratories, while grants for special enquiries into cattle breeding for milk yield, into nutrition as affecting milk production, and into the process of lactation in the cow, may quite rightly, I think, be given simultaneously to Dairy and to other Institutes. In this group, too, I should place

the problems of marketing and distribution. They naturally fall to the share of Institutes for Research in Agricultural Economics and to the Economic Organizers, but Dairy Research Institutes can better tackle certain practical problems—such, for instance, as the wholesale and retail sale of clean milk—and for such definite problems, grants, if necessary, would, in my view, be justified.

Problems in a third group practically concern dairy research only. Among them we have the physical and chemical nature of milk and the physiological factors which affect its composition; the handling and storage of milk; the making of butter and cheese and their ripening; the utilization of whey and any other by-products. Here no question of overlapping arises, and the making or refusal of a grant depends merely on the importance or triviality of the particular problem and on the amount of funds available.

## CHAPTER II.

### WORK RECENTLY COMPLETED OR NOW BEING DONE IN DAIRY RESEARCH.

7. To obtain an adequate appreciation of the present state and tendencies in Dairy Research, it is necessary not only to consider the work actually going on, but to trace the course of those recently completed investigations which have led up to the present position. I shall therefore attempt to give abstracts under different headings of the enquiries which seem to me the most important, both of those already published and those which are now being carried on.

#### *Cattle Food.*

8. Among the agricultural researches into cattle food recently published or now proceeding in the various countries of the world are many of interest to the dairy industry. Firstly, let us take into consideration work on the improvement of pastures. Grassland farming is of more importance in these islands than in almost any other place, and, in consequence, most of the work on grass is British.

Modern investigation of pastures and pasture grasses began in the West of Scotland Agricultural College at the end of last century. It was followed by the well-known experiments on phosphatic manures at Cockle Park and the later revelation of the importance of wild white clover. Work on the composition and improvement of pastures is now going on in many places.

One of the outstanding results is the discovery by Woodman of the special nutritive value of young grass and other plants, and its further investigation by Woodman and his colleagues.<sup>1</sup> They have shown that grass, cut at intervals of not more than three weeks, contains large amounts of digestible proteins—so much, indeed, that for equal weights of dry material, its nutritive value approximates to that of concentrated food-stuffs like linseed cake. The value of young grass has also been demonstrated in Canada by Shutt and others.<sup>1</sup> The detailed results do not always agree with those obtained at Cambridge, and further work under varied conditions is desirable.

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<sup>1</sup> *Jour. Agric. Science*; 16, 205; 17, 209; 18, 266; 18, 411; 19, 236.

Frequent cutting or intense grazing diminishes the total yield of grass, and hence stimulation of its growth by nitrogen fertilizers is found necessary. The practical problems involved in this system of intensive manuring and grazing are being studied at Seale Hayne College,<sup>1</sup> by Messrs. Nitram, and also by many agriculturists, among whom Sir Ernest Debenham and Mr. Brunton may be mentioned.<sup>2</sup>

9. The special problems of arable land dairying have been investigated by the Economics section of the Cambridge School of Agriculture and at Oxford by Prewett, who describes a system of mixed milk and grain production on a farm in the East Midlands, which gave good financial results.<sup>3</sup>

10. The importance of a balanced supply of mineral constituents in pastures has been demonstrated at the Rowett Institute, and Dr. Orr has summarized our knowledge of the subject.<sup>4</sup> If the pasture is short of minerals, or if they are ill-balanced, the drain involved in giving milk may result in removing some essential component of a cow's body, and diminution in milk or actual disease may follow. Dr. Orr finds that the poverty of some pastures is due to the want of one or more special ingredients, and concludes that, with the knowledge at hand or likely soon to be available, the productivity of the grazing lands of the world can be doubled.

11. The utility of various indigenous and imported species of grasses and clovers, and the methods of breeding and selection necessary to produce pedigree strains, have been worked out at the Welsh and Scottish Plant Breeding Stations, and similar work on arable fodder crops has been done at Cambridge. The importance of thorough and deep harrowing of permanent grassland has been demonstrated by accident and by other forms of practical experience, and by systematic experiments carried out by the Royal Agricultural Society and others.

Lucerne, owing to its high content of protein and minerals, is a valuable crop for a dairy farm. New varieties are being introduced and the work on the inoculation of soil carried out at Rothamsted

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<sup>1</sup> *Jour. Min. of Agric.*, 1929.

<sup>2</sup> *Jour. of the Farmers' Club*; February, 1928.

<sup>3</sup> Oxford Agric. Economics Research Institute; 1929.

<sup>4</sup> *The Composition of Pastures*; E.M.B. publications, No. 18.

for the Royal Agricultural Society, has enabled many farmers to grow lucerne where it failed before. Over 4,000 acres were sown with inoculated seed in 1930, and a much larger area in 1931.

Although these researches have direct bearing on the problems of the dairy farmer, they affect also the grazier and the sheep-owner. Hence they are primarily the concern of Agricultural Colleges and Institutes for Animal Nutrition, though their special influence on milk-production and on the quality of milk may sometimes and rightly form part of the programme of a Dairy Research Institute. For instance, the vitamin content of the milk from pasture-fed cows is apparently higher than that of stall-fed cows. Hence milk from pastures is of greater dietetic value. It seems also to be better for cheese-making and other processes of manufacture. On the other hand, ensilage made in tower silos has been shown by the West of Scotland Agricultural College to give a soft, white, watery butter of inferior keeping properties. Again, following the work of Woodman on the nutrient value of young grass, Sanders has examined at Cambridge the effect of different foods on milk-yields, and finds, as might be expected, that young grass, whether fresh or dried, causes an increase. Such problems may well be investigated as an essential part of dairy research.

12. Modern nutritional work is based on fundamental researches now many years old. The distinction between food needed for maintenance and that used in the production of meat or milk was first drawn by Kühn in 1887; Kellner developed the "starch-equivalent" method of assessing nutritive values in 1905, and Armsby that of "net energy value," commonly used in America, and now based on new figures obtained a few years ago. So far we deal with total energy only, but, early in this century, Fischer, Abderhalden and others showed that the various proteins in food have specific properties of their own, dependent on the amides or amino-acids which form their constituents, and that, if the feeding is to be satisfactory, whatever proteins are needed in the body of the animal must be supplied by constituents of the food. Between 1906 and 1912, Hopkins discovered the necessity of "accessory food factors," now called "vitamins," while requirements in mineral salts have more lately been studied, especially by American investigators and by Orr and his colleagues at Aberdeen. The problem of feeding is now known to be far more complicated than the early experimenters on energy values realized, and much of the knowledge acquired by

practical farmers by slow experience has been justified and explained scientifically. It may fairly be claimed that this stage is now past, and that nutritional science, in its turn, can give information of use to the practical stock-owner, in making his methods of feeding both cheaper and more effective by a scientific system of rationing.

13. The application of scientific methods of rationing is more successful in the feeding of dairy cows than in the feeding of any other live stock, chiefly because the daily output of the milch cow can be measured accurately and easily, so that the combined needs for maintenance and production can be assessed exactly. Hence the importance of this nutritional work to the dairy industry.

The Kellner standards usually employed in this country provide for a maintenance ration of 6 lb. of starch equivalent per 1,000 lb. live weight, including 0.6 lb. of digestible protein for each gallon of milk produced.<sup>1</sup> It also appears that for each gallon of milk,  $4\frac{1}{2}$  gallons of water must on the average be supplied.<sup>2</sup>

Recent work, especially in America, shows that the problem is far more complex than is contemplated by the above named standards.<sup>3</sup> Not only must the proteins be appropriate, and adequate amounts of vitamins and mineral salts be obtainable, but consideration must be given to the circumstances of life, to the temperature, to the condition of the animal, to its personal idiosyncrasies, etc. The special values of different foods have been examined by Thomas, Mitchell and others, who assign definite "biological values" to the various proteins.<sup>4</sup> Surveys of the data available have been made by Mackintosh and by Halnan.<sup>5</sup> From much recent work, chiefly in America, it seems probable that on the average some reduction of the standards will be found to be possible, thus cheapening the cost of food. While the over-riding importance of good management and handling of stock comes out from all these investigations, it is clear that the recent advances in our knowledge of nutrition must be of great benefit to the dairy farmer, and should be encouraged in every way, if possible both in Dairy Research Institutes and in those for the more general study of animal nutrition.

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<sup>1</sup> Agricultural Research in 1928 ; p. 120.

<sup>2</sup> Fuller ; *New Hampshire Techn. Bulletin* ; June, 1928.

<sup>3</sup> Forbes and others ; *Jour. Agric. Research* ; 37, 253.

<sup>4</sup> Mitchell ; *Bull. Nat. Res. Council (U.S.A.)*, No. 55, 1926.

<sup>5</sup> World's Dairy Congress, 1928 ; p. 19. *Journ. Dairy Research* ; 1, 3.

The subject is still not exhausted, especially as concerns the special problems of young stock. Here the importance of colostrum for newly-born calves has been shown by several investigators, especially at Leeds and at Missouri, and possible substitutes investigated.<sup>1</sup>

The mineral metabolism of dairy cows and the mineral contents of the concentrates used in milk production have been studied at the Rowett Institute. The contents of such concentrates have been found to be often defective, leading to a drain on the mineral contents of the cow's body, and a diminution of the milk-yield. The most important of the minerals are iodine, calcium and phosphorus. At the Rowett Institute too, the effect of sunlight has been studied, and also that of artificial radiation and ultra-violet light. Beneficial results have been obtained.

14. Systematic work on the management and feeding of dairy herds has been carried on in the Scandinavian countries by co-operative feeding experiments, and in Great Britain, more especially at the West of Scotland College and at Shinfield, where the practical bearing of recent discoveries is being examined. The benefit of restricting the more bulky and fibrous foods and giving cows chiefly concentrates has been advocated by Mr. Boutflower,<sup>2</sup> and a new system of open air dairying by Mr. Hosier.

A survey of 100 farms supplying milk to Aberdeen, made by Imper,<sup>3</sup> shows that valuable information about the conditions necessary for financial success in dairying can be obtained by the comparison of farms by the survey method. The average length of the milking life of cows has recently been examined, especially at University College, Bangor, and the West of Scotland Agricultural College, and found to be about four years. If this period could be increased, costs of production would be lowered.<sup>4</sup>

15. The cost of production of "ordinary" farm milk has been studied among other places at the South Eastern Agricultural

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<sup>1</sup> Leeds Bulletin 146. Ragsdale and Brady; *Journ. Dairy Science*, vi, 137.

<sup>2</sup> World's Dairy Congress, 1928; p. 15. But see on the other hand McCandlish; *Scottish Farmer*, Aug. and Sept., 1928.

<sup>3</sup> *Scottish Journ. of Agriculture*; January, 1929.

<sup>4</sup> *Welsh Journ. of Agriculture*, January, 1929; *Journ. of Agricultural Science*, April, 1929.

College.<sup>1</sup> It was found that 60 per cent. of the cost was assignable to food and 20 per cent. to direct labour, the balance being represented by depreciation, distribution and sundries. For the years 1923-25, food cost from 8*d.* to 17*d.* a gallon, and labour 2·35*d.* to 6·47*d.*, showing the wide divergence which exists between different farms. In later reports, describing five years' investigations, the conditions necessary for financial success are shown to depend not only on the yield per cow but on economy in feeding and labour, and on good management generally, both of the milking herd and of the young stock. The cost of rearing calves till they enter the dairy herd as heifers ranged from £21 to £42 per head—another indication of the wide differences in the skill of management.

It is important to compare the cost of "ordinary" milk with the best that is now obtainable. Dr. Stenhouse Williams estimates that the additional cost of clean milk from tested herds free from tubercle, as compared with average farm milk, is about 3*d.* per gallon, including a slight extra margin for the farmer. This is confirmed by results obtained by Liversage at Oxford.<sup>2</sup> Somewhat higher figures, about 4*d.* per gallon, are indicated by experiments at the University College of North Wales.<sup>3</sup> It is probable that the necessary higher price can more easily be obtained by farmers when they are within easy reach of large towns. The production of this milk should clearly be encouraged, both on the score of public health and because it is less likely to be faced with effective foreign competition. As the standard of quality of milk rises, foreign milk and milk products of unknown cleanliness might well be excluded altogether.

Some practical farmers believe that the total yield of milk and the cost of milk production might be lowered by increasing the intervals between calving.<sup>4</sup> This point might well be investigated.

#### *Physiology including Genetics.*

16. The problems of genetics affect not only dairy farmers. Indeed, they are of fundamental scientific interest; and, on the applied side, have a bearing on human sociology as well as on the production of domestic animals. Nevertheless, where breeding concerns the yield of milk, it becomes a problem of direct concern to the dairy

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<sup>1</sup> Wyllie; Wye pamphlets, esp. No. 7, 1929.

<sup>2</sup> Agricultural Research in 1926, p. 62.

<sup>3</sup> *Ibid.*, p. 37.

<sup>4</sup> Burkitt; *World's Dairy Congress*, 1928; p. 87.



industry. Most dairy farmers breed from their higher yielding cows, and pedigree stock-owners in the past have enormously improved our flocks and herds. A mass of hitherto unco-ordinated information is possessed by practical farmers, and data exist in the records of Breed Societies. Yet the problem of the inheritance of high milking qualities is still far from reaching a complete solution. Indeed, with the most important of English breeds—the Dairy Shorthorn—the quality of calves when they enter the dairy herd seems still largely a matter of chance.

This is less evident in breeds like the Friesian, where the whole breed, including the bulls, come for many generations from high yielding stock. But, with breeds less long established as milkers, even a bull with a high yielding dam does not necessarily get high yielding cows. This is why milk-recording has not made greater progress. It helps to weed out the bad cows from a herd, but has done less than was hoped to enable dairy farmers to increase their average yields by selective breeding.<sup>1</sup>

Indeed, progressive farmers now generally feel that the only sure method of breeding is to watch the milk yields of a bull's daughters when they come into the herd, and only to continue to use bulls which are thus proved successful. This opinion has been strengthened by the statistical examination of milk records in Denmark, which go to show that the best indication of the breeding value of a bull is the extent to which the milk yields of his daughters exceed that of their dam.<sup>2</sup> The same result was emphasized in 1917 by Pearl in the United States. But to wait for information in this way may mean long delay and much waste in keeping animals and their progeny afterwards to be discarded. It is only possible to the breeder of valuable pedigree stock.

Experiments on heredity in cattle are slow work, and it is probable that the clue to success may be found by using smaller animals of quicker maturity. For instance, Mr. Hammond is investigating at Cambridge the inheritance of high milk yields in rabbits. He finds that the factors are so numerous and so complex that inheritance follows Galtonian rather than Mendelian laws. But, by inbreeding, definite results have been obtained. To secure uniform results it is

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<sup>1</sup> For summary see *Agricultural Research in 1928*, p. 44.

<sup>2</sup> Frederikson; *Danish Milk Recording Societies and their influence on Cattle Breeding*.

not enough to mate a high-milking female with a male having a high-milking mother. It is necessary to cross this male with its dam. The progeny will certainly be high-milking females and males that transmit high-milking powers. On the other hand, in breeding with their sires, the females soon produce harmful recessive factors which only appear with the other method after repeated in-crosses. This work confirms the empirical knowledge of some dairy cattle breeders, but it is very desirable that the knowledge possessed by practical men should be collated, and that it should be confirmed and if possible amplified. Such work might well be shared between Dairy and Genetic Institutes.

17. Other physiological problems are also being investigated. Experiments carried out in America<sup>1</sup> have shown the importance of a correct interpretation of the variations in composition of the milk obtained at the beginning and end of milking. But the wider aspects of the physiology of milk secretion are still far from being fully understood. Indeed the chemical reactions by which the fat, protein and sugar in the milk are synthesized are entirely unknown. Investigations have hitherto been limited to attempts to identify the constituents in the blood from which they are derived.<sup>2</sup> The most promising method seems to be the analysis of the milk and of the blood before and after passing the mammary glands.<sup>3</sup>

At the Animal Breeding Institute at Edinburgh, experiments on hormones are throwing light on the problems of fertility and its inheritance, on senescence, on sex reversal in fowls, etc. At Cambridge, the physiology of breeding is being studied with special reference to the problem of fertility. The artificial insemination of many cows by the semen of a single high class bull may gradually, when technique has been perfected, improve the quality of all dairy herds.

#### *Pathology.*

18. The diseases of dairy stock cause an immense loss every year, and some of them, especially tuberculosis, are dangerous to mankind. In 1925 an investigation carried out by the Medical Research Council showed that the sub-cutaneous injection test for tubercle in cattle

<sup>1</sup> Vols. IV and V; *Journ. Dairy Science*. See also Swett, Vol. X. *ibid.*

<sup>2</sup> Recent Advances in Dairy Science, N. C. Wright; *Agricultural Progress*, 1929.

<sup>3</sup> Meigs, *Physiol Rev.*, 2, 204, 1922.

was faulty in farm conditions, and established the value of the intradermal method.<sup>1</sup> Recently at the Cambridge Institute for Animal Pathology, the Calmette method of preventive inoculation has been studied and the technique improved by Stanley Griffith and Buxton. Difficulties arise from the fact that beasts when inoculated react to the tuberculin test. Nevertheless, by using strong doses of vaccine and injecting them intravenously, effective protection from the disease seems to have been obtained, and, from the work as a whole, there seem good prospects of useful results.

A tubercle-free herd has been built up from one originally infected, by Adeane, who removed the calves from their mothers at birth, and examined the precautions necessary for success in artificial feeding.<sup>2</sup>

In Canada the system of accredited herds was begun in 1919, and by 1929 there were 4,000 fully accredited herds and 2,000 more in process of becoming accredited.<sup>3</sup> In 1922 a plan for restricted areas was started. If two-thirds of the owners in an area sign a requisition, all herds in that area are tested, reactors slaughtered, and all entry of cattle controlled. There are now eight restricted areas in Canada containing 700,000 cattle.

In the United States a campaign for the total eradication of the disease was started in 1917.<sup>4</sup> Where a majority of cattle owners are favourable, an area is cleared of reactors by isolation or slaughter, the farmers being compensated; in 1926 over 17 million dollars were thus paid. In 1929 more than 11 million cattle were tested.

With the help of the Medical Research Council, the Hannah Institute is attempting to clear from tuberculous cows an area of several square miles in Ayrshire. The Scottish Department of Health is examining the retail milk supply and trying to trace the source of any infection discovered.

19. Johne's disease, which causes great monetary loss, has been investigated among others by Dunkin,<sup>5</sup> who has produced a successful diagnostic. By its means infected calves can be detected, fattened for slaughter, and thus the herd protected with little cost.

<sup>1</sup> Medical Research Council, Special Reports, No. 94, 1925, No. 122, 1928, and No. 152, 1931.

<sup>2</sup> Adeane and Gaskell; *Journ. of Hygiene*, April, 1928.

<sup>3</sup> Agricultural Research in 1929; pp. 163, 166.

<sup>4</sup> *Ibid.*

<sup>5</sup> Reports of the Medical Research Council, 1928-29, p. 43, and 1929-30, p. 32.

Mastitis is being investigated at the Royal Veterinary College at the expense of the Royal Agricultural Society.

The calcium content of the blood of dairy cattle has been investigated at Baltimore.<sup>1</sup> The blood of cows infected with milk fever has been shown at Reading to possess a content of calcium lower than normal, and experiments are proceeding on the effects of calcium chlorate and lactate as curative agents.

Contagious abortion has been shown to be due to a specific micro-organism, which is now known to be very widely distributed.<sup>2</sup> In the States the disease is being attacked on the clean-area plan, by means of the blood-agglutination test.

Some years ago foot-and-mouth disease was shown to be due to a filter-passing virus, and many of the difficulties in dealing with it are thus explained.<sup>3</sup> The virus cannot yet be grown freely outside a living animal, but the discovery of the possibility of its transmission to guinea pigs makes investigation considerably easier. Work is being done on the length of time the virus remains active within and without the body, on immunity and on inoculation.

20. Little work has yet been done on the effects of bovine disease on the quality of milk for cheese-making and other processes. These effects may explain some of the obscure difficulties of manufacture. Such problems are specially fitted for Dairy Institutes. The same remark applies to investigations into the carrying of pathogenic organisms by condensed and dried milk (see § 23 below).

#### *The Composition and Properties of Milk.*

21. Statistical studies of the factors controlling the yield and quality of milk have been made by Tocher, Cranfield and others, and also at Cambridge and at Reading by an examination of milk-records over a series of years. Other information will be found in the Report of the Dairy Congress, 1928. Some experiments involve chemical analysis of large numbers of samples of milk from various sources.

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<sup>1</sup> Journal of Dairy Science, 1930.

<sup>2</sup> Agricultural Research in 1925 (R.A.S.E.), p. 145 ; in 1927, p. 182 ; in 1929, p. 153.

<sup>3</sup> Fourth Progress Report of the Foot and Mouth Disease Research Committee ; Ministry of Agriculture, 1931. For an abstract see the various volumes of *Agricultural Research* in 1925 to 1929.

While such experiments give information about the substances obtained by the analysis of milk, they may give misleading results when used to indicate the composition of the milk in its natural state. Milk is a very complex system, containing many salts and organic compounds, as well as enzymes, etc., in chemical and ionic equilibrium. The addition of analytical reagents or the other processes of chemical analysis may upset that equilibrium and destroy some of the delicate compounds involved in it.<sup>1</sup> Hence physical methods such as the determination of the hydrogen ion concentration, the microscopic examination of fat globules, as well as measurements of freezing point, surface tension, viscosity, etc., must be combined with the methods of investigation characteristic of organic and bio-chemistry. Much work of this kind is going on in various countries, chiefly in bio-chemical laboratories.<sup>2</sup> It may have no immediate bearing on the dairy industry, but research on the fundamental nature of that industry's main product not only will certainly advance knowledge, but may at any moment revolutionize practice.

Meanwhile it is necessary to point out that the question of variation in the composition of milk has definite legal and administrative repercussions. Many Local Authorities wish minimum standards for the nutrient contents of milk to be enacted, while the problem of detecting its adulteration involves the criminal law. As I was asked to make a special report on this subject, I treat it in some detail.

The Sale of Milk Regulations, 1901, provide that a sample of milk containing less than 3 per cent. of fat or less than 8.5 per cent. of other solids is to be presumed for the purposes of the Food and Drugs (Adulteration) Acts not to be genuine until the contrary is proved. Thus a farmer who sells milk below these standards is liable to a criminal prosecution unless he can prove that he did *not* adulterate his milk. This proof often takes the form of an "appeal to the cow." Samples are taken at the time of milking, and, if they are below standard, the poor quality milk is accepted as genuine.

Since the regulations assume that milk below standard is adulterated until the contrary is proved, it is clearly important to know how far that assumption is justified. Does a knowledge of the contents of fat and other solids enable the analyst to state whether a

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<sup>1</sup> Fundamentals of Dairy Science, American Chemical Society, New York, 1928; pp. 22, 117, *et seq.*

<sup>2</sup> For references down to 1927 see Fundamentals of Dairy Science, *loc. cit.*

sample of milk is genuine or adulterated? Adulteration is often easy to discover when a foreign substance is added to a material, but genuine milk contains on the average about 87 per cent. of water, and the presence of a small additional amount may well be difficult to detect.

Variations in the composition of genuine milk are known to occur, and many measurements thereon have been made. The legal limits are substantially lower than the average percentage of fat (3·8) and of non-fatty solids (8·8) in genuine milk, but it is certain that a proportion of genuine milk falls below one or both limits. Thus a farmer quite innocent of adulteration may find himself liable to a criminal prosecution. On the other hand, the consumer is badly served in that he generally pays a uniform price irrespective of quality, and may be getting a milk just above the minimal standards but much below average value. Hence arises the desire of Local Authorities and others to see a general standardization of quality.

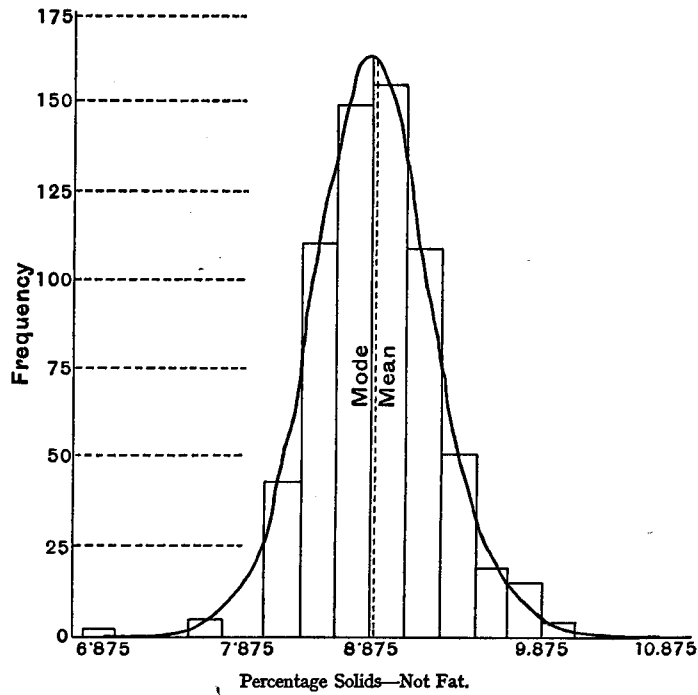
It is clearly important to know what percentage of samples of genuine milk fall below existing standards, and our present knowledge is summarized in a Memorandum on "Variations in the Composition of Milk"<sup>1</sup> and set forth at length in the papers there referred to. Especially valuable is the work of Dr. Tocher.<sup>2</sup> For the milk of 676 individual cows, collected at random over Scotland and sent to Aberdeen for analysis, Tocher found that 8·3 per cent. of the samples contained less than the standard amount of fat and 24·7 per cent. contained less than the standard amount of other solids.

When the milk of cows is mixed, the variations in composition are naturally less. Tocher found that, of the milk of a random group of five cows, something less than 1 per cent. was deficient in fat and about 6 per cent. deficient in non-fatty solids. Somewhat similar, though of course not identical, figures have been obtained by other observers.

The variations follow the well-known laws which describe the distribution of individual measurements round a mean value. The diagram which follows shows Tocher's results for the percentage of non-fatty solids in the milk of individual cows, the rectangular strips showing the number of samples falling within different percentages, the tallest strip, for instance, giving the number of samples (156) with

<sup>1</sup> Ministry of Agriculture and Fisheries, Miscellaneous Publications, No. 65.

<sup>2</sup> Variations in the Composition of Milk, by J. F. Tocher, D.Sc., F.I.C., H.M. Stationery Office, Edinburgh, 1925.



percentages of solids between 8.750 and 9.000. The smooth curve, drawn from these strips, represents the most probable distribution if the number of samples were very large. It will be seen that it is impossible to fix a practical limit below which no genuine milk falls, or to find a logical minimum for purposes of sale.

The other chemical and physical properties of milk show similar variations. Some of the graphs drawn from the observations are

less symmetrical, but the general results are the same—theoretically it is impossible to fix definite limits, and any practical limit, below which a negligibly small number would fall, must be fixed so low that the quality of much milk above it would be far below the average. To fix such low limits in the Regulations would tend to reduce the general quality of the milk supply.

The variability of different quantities may be expressed numerically by figures known as the standard deviation and the coefficient of variation.<sup>1</sup> Tocher gives the following table of the physical characters and chemical contents of milk, showing their arithmetic mean values, their standard deviations and their coefficients of variation.<sup>2</sup> The coefficients of variation give the most convenient measure of the variability of the different quantities.

<i>Character.</i>	<i>Mean.</i>	<i>S.D.</i>	<i>C.V.</i>
Freezing point 643 cows (own data) ..	·5442	·0153	2·81
Refractive Index (Value above R.I. For Water).	19·459	·8662	4·42
Specific Gravity (Mean excess in grams over 1,000 grms. of water).	31·528	1·5636	4·96
Percentage solids, not fat .. ..	8·804	·4422	5·02
Percentage ash .. ..	·700	·0505	7·21
Percentage lactose .. ..	4·535	·3712	8·01
Percentage total nitrogen .. ..	·508	·0621	12·22
Percentage casein nitrogen .. ..	·380	·0520	13·68
Percentage butter fat .. ..	3·953	·7810	19·76
Percentage albumen nitrogen .. ..	·116	·0232	20·00
Age (in years) .. ..	6·186	2·0905	33·79
Yield per milking (lb.) .. ..	13·919	5·0851	36·53
Yield of butter fat per milking (lb.)	0·546	0·2097	38·44
<sup>2</sup> Average yield per week (lb.) .. ..	186·095	33·7267	18·12
<sup>2</sup> Average yield per milking (lb.) .. ..	13·29	2·409	18·12
<sup>2</sup> Average percentage of butter fat for lactation period.	3·81	·274	7·19
Freezing point 111 cows (Monier-Williams).	·5362	·0091	1·69

<sup>1</sup> The standard variation is defined as the square root of the arithmetic mean of the squares of all deviations, the deviations being measured from the arithmetic mean of the observations. The coefficient of variation is defined as the standard deviation expressed as a percentage of the mean value of the observations.

<sup>2</sup> Tocher, *loc. cit.*, p. 49.

<sup>3</sup> Milk Records Association, 1920 data, 4,912 cows with completed lactation periods.



It will be seen that the physical characters—freezing point, refractive index of the serum, specific gravity—vary less than the chemical contents. Of these latter, the percentage of non-fatty solids varies least, while the percentage of butter-fat is very variable.

Another valuable series of experiments, made by Cranfield, Miss Griffiths and Ling,<sup>1</sup> on about 700 samples of mixed milk from 15 herds, show standard deviations which, while naturally somewhat less than those found by Tocher for the milk of individual cows, are in agreement with his general results.

Evidence has been adduced that certain relations between some of the chemical quantities are constant characters of genuine milk. In 1914, Mathieu and Ferré found that a number dependent on the lactose and the chlorine seemed to be nearly constant. Droop Richmond says that Veith's ratio between the contents of lactose, protein and ash is very accurately 13 : 9 : 2; but Tocher's figures for individual cows indicate that the mean value of the ratio of lactose to protein is 1.455 with a coefficient of variation of 16.0, and the ratio of protein to ash 4.635 with a coefficient of 10.9. Thus it seems that with Tocher's samples, Veith's ratio is no more constant than some of the individual chemical constituents of milk, though it is possible that better results might be obtained with milk which was all quite fresh.

But of the physical properties there is one which deserves further consideration. In the process of the secretion of milk from blood, it is probable that the most important controlling factors, as in all processes of secretion, are the osmotic pressures of the two liquids, and it is probable that a very constant relation holds between them. Moreover, the osmotic pressure of blood is maintained very constant by delicate physiological mechanism. On theoretical grounds, therefore, we should expect that the osmotic pressure of milk, and the depression of its freezing point compared with that of water, by which the osmotic pressure can be measured most simply, should be nearly constant.

Tocher's measurements of freezing point gave a variation curve which is unsymmetrical, falling rapidly to a negligible height on the left, but dropping very gradually to the right.<sup>2</sup> The almost vertical fall on the left looks promising for the use of freezing point as a criterion of purity or adulteration. Moreover, Tocher's results

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<sup>1</sup> Journal of Agricultural Science, XVIII, I, pp. 62 and 72, 1927.

<sup>2</sup> *Loc. cit.*, pp. 36 and 41.

show the very significant fact that the freezing point, unlike the other characters of milk, remains constant throughout the whole period of lactation.<sup>1</sup> But Tocher's samples of milk were collected from many places far from Aberdeen, and the delay in examination meant that some of these samples of milk were becoming sour, that is, the lactose had been partially converted into lactic acid, the number of effective molecules increased and the osmotic pressure increased also. Other papers on the subject by R. L. Andrew<sup>2</sup> and by Parker and Spackman<sup>3</sup> show constancy when the milk is fresh. A discussion on freezing point methods took place at the World's Dairy Congress in 1928.

In this connection, it is important and interesting to note that, in Holland, the depression of the freezing point has been adopted as a criterion of purity, any milk giving a value of the depression less than  $0.53^{\circ}\text{C}$ ., that is with a freezing point above  $-0.53^{\circ}\text{C}$ ., being assumed to be adulterated with water.<sup>4</sup> It is stated that the freezing point of genuine milk only ranges from  $-0.54^{\circ}$  to  $-0.57^{\circ}\text{C}$ .<sup>5</sup> This cryoscopic method is also used in New Zealand.

For the general confidence of both producer and consumer, a trustworthy criterion of purity or adulteration is greatly to be desired, and the cryoscopic method seems to detect added water with certainty. But it is unlikely to be successful in detecting the addition of separated milk. This point should be investigated.

Let us now leave the specific problem of finding a criterion of adulteration, and return to the general consideration of the variations in the composition of milk, and first in regard to the contents of butter-fat and of the total non-fatty solids.

On what do these variations depend? It is well known that the milk of Jersey and Guernsey cows is rich in butter-fat, and the milk of Friesians poor, so that one factor is breed. With all cows, morning milk is poorer than evening milk, probably chiefly owing to the longer interval before the morning milking. The first fraction of milk drawn from the cow in any one milking is poorer and the last

<sup>1</sup> *Loc. cit.*, p. 74.

<sup>2</sup> *Analyst*, April, 1929, p. 210.

<sup>3</sup> *Ibid.*, p. 217.

<sup>4</sup> *The Analyst*, May, 1929, p. 267.

<sup>5</sup> It may be noted that the freezing point of mammalian blood lies between  $-0.54^{\circ}$  and  $-0.60^{\circ}\text{C}$ . *Principles of Human Physiology*, by E. H. Starling, 4th ed., 1928, p. 733.

fraction richer than the bulk of the milk. As the period of the cow's lactation runs on, the quality of the milk falls to a minimum and then rises again. Some cows persistently give milk below the average, or even below the minimum allowable. Finally, most important, from the administrative point of view, the quality of a cow's milk may vary, and vary considerably, from day to day.<sup>1</sup> Thus "the appeal to the cow" may give a quite misleading verdict. Many investigations have been made on the influence of these different factors, and elaborate studies of the correlations between them will be found in Tocher's book.

Many experiments have been made on the vitamin contents of milk and marked variations in different samples discovered. These variations depend largely on the diet of the cows. Average milk contains Vitamin A, the fat-soluble growth factor, and, to a less degree and less uniformly, Vitamin B, the water-soluble anti-neuritic factor and Vitamin C, the anti-scorbutic factor.

The potency of milk can be increased by adding vitamin-bearing constituents to the diet. In particular, winter milk is less potent than summer milk, stall-fed fodder being less rich in the different vitamins than the young grasses of summer pasture. Experiments on pasteurized, sterilized, condensed, boiled and dried milk have hitherto led to somewhat conflicting results.

This work on vitamins is of great importance for the health of our population: the vitamin value of food-stuffs should regularly be assessed. The results for milk should be watched closely by the dairy industry. A summary of the work done with references will be found in a Report on the Present State of Knowledge of Accessory Food Factors (Vitamins), published by the Medical Research Council, under whose auspices many of the experiments have been carried out<sup>2</sup>.

22. The dietetic value of milk is very great. Not only is it the cheapest source of high-grade proteins, but, when fed with other foods in right proportions, it has a specific influence beyond its calorimetric value, especially on growing children and young animals. This latter effect has been demonstrated for pigs, calves and poultry. Children into whose diet a pint of raw or pasteurized milk a day has been inserted in place of some calorimetric equivalent, grow

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<sup>1</sup> *Loc. cit.*, Misc. Pubns., No. 65, p. 18.

<sup>2</sup> Special Report No. 38, 1924.

both in height and weight much faster than those without it. This has been shown by the careful work of Corry Mann on boys in a Home Colony near London.<sup>1</sup> On a basic ration, adequate calorimetrically, the average yearly growth in weight was 3.85 lbs. and in height 1.84 inches. Boys receiving also a pint of pasteurized milk a day put on 6.98 lbs. and grew by 2.63 inches. The effect of additional food of other kinds was much less. Similar results were shown by the experiments of Orr on Scottish school children.<sup>2</sup> Separated milk seemed to have as great an effect as whole milk in stimulating growth, though of course its food value is less. Another experiment, made in Scotland during 1930, again showed the value both of raw and of pasteurized milk.<sup>3</sup>

23. The consumption of condensed and dried milk is going up fast, partly owing to its convenience, partly owing to its relative cheapness, and partly owing to the idea that it is safe from infection of disease. But experiments have shown that tubercle bacilli may survive condensing or drying, though in less virulent form.<sup>4</sup> Again, Muggia has shown<sup>5</sup> that *streptococcus pyogenes* can remain alive and virulent in commercial milk powder for five months.

The nutritive value of dried milk has been examined in America, especially by Sharman and Campbell,<sup>6</sup> who found that a mixed diet of ground wheat and whole milk powder kept rats thriving for many generations. Skim milk powder was definitely less effective.

24. Present methods of pasteurizing milk were summarized at the World's Dairy Congress in 1928 by Orla-Jensen, who advocates heating it to 68° C. for five minutes where this is possible, instead of the usual half hour at 63° C.<sup>7</sup> Perhaps further evidence is desirable.

As far as experiments have shown, pasteurized milk is of the same food value for adults as raw milk, save that some observers have found that vitamin C is destroyed. This vitamin is, however, easily replaced by adding minute quantities of orange or turnip juice. For children under six years of age, some hold that raw milk possesses

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<sup>1</sup> Medical Research Council. Special Report No. 105, 1926.

<sup>2</sup> World's Dairy Congress, 1928; pp. 510, 517, 543, 778.

<sup>3</sup> Milk Consumption and Growth. Department of Health for Scotland; Edinburgh, 1930.

<sup>4</sup> The Prevention of Human Tuberculosis of Bovine Origin, by W. G. Savage.

<sup>5</sup> *Boll. Sestione Italiana*, April, 1929.

<sup>6</sup> *Journ. Biol. Chemistry*; 60, 5, 1924.

<sup>7</sup> See Report of Congress, p. 107.

a definite advantage. But it should be noted that Corry Mann, who advocates low temperature pasteurization, states that for over three years milk so treated has been given to children under two with good results, and that the addition of orange juice caused no increase in growth or improvement in nutrition.<sup>1</sup> It is desirable that further experiments should be made to clear up these apparent discrepancies.<sup>2</sup>

25. Work at the Rowett Institute has shown that pasteurizing causes physical and chemical changes in milk, which made calves fed on pasteurized milk to thrive less well than those fed on raw milk. Less calcium, phosphorus and nitrogen are absorbed when heated milk is used, the calcium being rendered less soluble. Experiments on rats are also being carried out at Shinfield. Rats fed on sterilized milk—that is milk heated for some time to 100° C.—make little growth, soon age and cease to breed. With pasteurized milk, while the does do well, the bucks make much slower progress. This experiment is in its early stages, but promises interesting results. Little, if anything, has been done to examine the special nutritive value for children of dried and condensed milk as compared with raw milk. Experiments on this point are urgently needed. Also it is possible that the experiments which used pasteurized milk as human food were not delicate enough to test the differences between it and raw milk, and further investigation is desirable. Some hold that, for the present, unless milk is clean and free from infection, it had better be pasteurized, while others fear that a general adoption of pasteurization would set back the movement for clean and tubercle-free milk. Cream from ordinary commercial milk must it seems, be pasteurized to make its distribution possible without preservatives. But, whatever be the truth about these contentious questions, all efforts should be made to develop the movement for clean milk, which owes so much to Mr. Wilfred Buckley, to Dr. Stenhouse Williams and his colleagues at Reading, and to the workers at the Kilmarnock Dairy School.

26. A subject of some importance to the practical dairy farmer is the appearance of taints and bad flavours in milk and its products. Certain weeds, such as may-weed and wild onion or garlic, give taints to the milk of cows that eat them. Experiments on these

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<sup>1</sup> World's Dairy Congress, 1928, p. 132.

<sup>2</sup> *Journal of the Farmers' Club*, May, 1931.

taints have been carried out in America,<sup>1</sup> and also on the flavours due to silage made from maize and lucerne. For instance, it is found that if green lucerne is being grazed, cows should be removed from it at least four to five hours before milking. It is not easy to control weeds on grass land, though it is well to know how taints are acquired, but taints due to arable crops can at all events be eliminated, and more work on them may be desirable. The action of metals used in dairy utensils in causing taints was discussed by Hunziker<sup>2</sup> at the World's Dairy Congress in 1928.

*The Microbiology of Milk.*

27. The bacteriology of milk has for many years produced an enormous volume of literature; indeed the favourable medium for bacterial growth which milk offers, and the importance of tracing and preventing the many possible sources of infection by milk-borne diseases, have directed perhaps more attention to this aspect of dairy research than to any other. As regards recent work, references to numerous papers will be found in the first volumes of the *Journal of Dairy Research*.

Many problems of dairy research involve bacteriological investigation, and thus bacteriology implicitly appears in several parts of this report. For this reason, and also because we are chiefly concerned with the practical application of science, bacteriology need only be considered under the present heading as a question of technique. A similar restriction clearly appeared at the Dairy Congress in 1928.<sup>3</sup>

The classification of milk according to its bacteriological contents involves an estimation of the quality of milk *either* for consumption as liquid *or* for use in the manufacture of butter or cheese. The methods appropriate to these two problems may be different. In England, the establishment of high-grade and certified milk requires very great purity, and nothing but actual bacterial counts are delicate enough as tests to classify the milk. But, in the North of Europe, where standards are at present not so high and much of the milk goes in the manufacture of dairy products, general use is made of the reductase test, which takes the time required to decolourize

<sup>1</sup> For abstract see *Agricultural Research* in 1926, p. 52.

<sup>2</sup> Report of Congress, 1928, p. 136; but see also Stansfield, p. 153. See also *Journ. of Dairy Science*, March, 1929; May, 1929.

<sup>3</sup> World's Dairy Congress, 1928; p. 654.

a definite solution of methylene blue as a measure of the purity of the milk, and enables analysts with little trouble to classify milk in four grades. Combined with the fermentation test it shows whether milk is suitable for cheese-making. All our certified and Grade A milk is high up in Class I, and so cannot be classified in this way, but the test might be useful for other, more rough and ready purposes.

*Dairy Products.*

28. The problems which underlie the manufacture of primary dairy products, especially butter and cheese, are being examined at Shinfield and in New Zealand. The trouble in cheese known as openness is being investigated at the Dairy Research Institute at Palmerston North, and the work will be extended in conjunction with Shinfield by the help of the grant recently made. Again, red spot in cheese and oiliness in butter have been studied at Shinfield with some success. Red spot has been shown to be due to a form of infection, and oiliness to the action of metallic catalysts in suitable environment. The specific enquiries on these faults have led to more general work on the ripening of cheese and the quality and preservation of butter, which must be regarded as the fundamental problem of those, the most important, dairy products. These investigations will probably for long form part of the staple work at one or more Dairy Institutes.

29. An increasing amount of milk is being condensed and dried. In the United States in 1926 more than 91 million pounds of dried skim milk and more than 10 million pounds of dried whole milk were produced.<sup>1</sup> Milk is also dried in large quantities in Australia, New Zealand, Canada and Holland. The qualities depend on the method of manufacture in ways not yet fully worked out,<sup>2</sup> and the uses include not only the reconstitution of milk, but the improvement of bread, etc.

30. The residue from cheese-vats, whey, is used on farms for pig-feeding. Cheese factories usually have large volumes of surplus whey during the summer: much more at times than they can use or sell as pig-food. The difficulties which arose in disposing of this

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<sup>1</sup> World's Dairy Congress, 1923, p. 366.

<sup>2</sup> *Ibid.*, pp. 370, 380.

surplus during and just after the War led the Ministry of Agriculture and the Royal Agricultural Society to investigate the manufacture of lactose as a method of using superfluous whey, the work being carried out by Dr. L. Harding.<sup>1</sup> The result was the establishment in England and New Zealand, of factories now under the control of a Company—Whey Products, Limited—which produces lactose and residues made into feeding stuffs. This Company has been and is continually carrying on research on the many problems which arise in the utilization of whey.

31. A survey of the surplus milk and milk-residues of Scotland has been made by Mr. A. Macneilage.<sup>2</sup> He estimates that about 4½ million gallons of whey are wasted annually. In 1918 the Ministry of Agriculture estimated the corresponding waste in England as 40 million gallons, but, since few complaints are now received about whey effluents, it is probable that the volume has become less.

#### *Dairy Machinery.*

32. The most important recent work on dairy machinery seems to consist of investigations on milking machines. The Ministry's scheme for the testing of agricultural machinery has already involved tests on these machines. Such tests take months to complete, since, to examine the effects on the cow, it is necessary to carry on the work through a complete lactation.

Many of the difficulties found with milking machines are due to inadequate cleansing, and the Dairy Institute at Shinfield has shown that the only way to get satisfactory results with certainty is to sterilize the apparatus with steam. They have also summarized the qualities necessary in a milking machine, and state that those qualities are to be found in present models.<sup>3</sup> Similar results are given by Scottish observers,<sup>4</sup> and by those in other countries as collected by the International Institute of Agriculture.<sup>5</sup>

It remains to examine the relative advantages of hand and machine milking. In Scotland it was found that when wages are high a milking machine is worth installing with a 40 cow herd, but when wages are low it is not likely to pay unless at least 60 cows are milked.

<sup>1</sup> Ministry of Agriculture, Research Monograph No. 5; 1925. Journal R.A.S.E., Vol. 83, p. 73; 1922.

<sup>2</sup> Bulln. No. 1, Hannah Dairy Research Inst.

<sup>3</sup> Mattick, *The Dairyman*, May, 1929.

<sup>4</sup> *Scot. Journ. of Agriculture*; Jan. 7, 1930.

<sup>5</sup> *International Review of Agriculture*; March, 1929.



*Economic and Marketing Problems.*

33. Marketing and similar economic problems have only lately become part of the subject of dairy research. Much information can be found in the Report of Lord Linlithgow's Committee; Forrester has made a study of the fluid milk market in England and Wales<sup>1</sup>; and Prewett has investigated the marketing of milk, in Wiltshire, Somerset, and the City of Bristol.<sup>2</sup> Prewett finds that, owing to effective combination, the wholesalers are in a stronger economic position than the retailers. Further enquiry into the history of the milk-slump in the autumn of 1930 is urgently needed. As far as my experience goes, the combination of wholesalers did not prevent different action among them. The large numbers of milk-producers and their individualistic psychology make collective action difficult, but some co-operation, voluntary or enforced, seems necessary if prosperity is to return to the dairy farmer.

The survey of the retail marketing of cheese in London, carried out by the Empire Marketing Board in 1928, gave valuable information, which should be useful if cheese-makers were organized for sales.

34. In England milk is usually sold by volume, even when bought for making cheese. This clearly results in under-payment of the farmer who produces milk rich in fat and casein. In some countries payment is made in terms of butter-fat. An investigation carried out in New Zealand<sup>3</sup> shows that, owing to want of proportionality between fat and casein, this results in over-payment for fat-rich milk. It is accordingly suggested that payment should be made on both fat and casein.

In devising schemes for the "rationalization" of the dairy industry, and for "orderly marketing," the experience of foreign countries, especially the United States (see § 50 below), and of New Zealand should be closely studied.<sup>4</sup> New Zealand factories, many of them co-operative, are large, some dealing with the produce of 5,000 cows, and they reward efficiency by paying according to the amount of

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<sup>1</sup> The Fluid Milk Market in England and Wales; Min. of Agric., Econ. Series No. 16 (1927).

<sup>2</sup> A Survey of Milk Marketing; Oxford, 1928.

<sup>3</sup> Veale; New Zealand Department of Scientific and Industrial Research; *Bull.*, 9, 1929.

<sup>4</sup> Jenks; Scot. Journ. Agric. Act, 1929; abstract in Agricultural Research in 1929; p. 65.

butter-fat in the milk. They buy the whole output, and thus relieve the farmers of marketing worries. On the farms, machinery is much used, and hired labour reduced to a minimum. An average dairy farm of 200 acres milks between 30 and 40 cows, and the average total manual labour, including that of the farmer and his family, is 2.2 men. This may be compared with the results of the survey of a milk-producing area in South Devon, where the average size of farm is 128 acres, the number of milking cows, 10 per farm, and the labour strength 3.2. Probably these farms produce other agricultural commodities besides milk, and are not strictly comparable with those in New Zealand. A similar study in other dairy counties, such as Dorset or Cheshire, seems desirable. Nevertheless, it is clear that New Zealand methods should not be overlooked.

A summary of the methods used in different countries for the handling, transport and retailing of milk was given by Lichtenberger to the World's Dairy Congress in 1928.<sup>1</sup>

35. The higher grades of milk are as yet most remunerative in special circumstances, such as proximity to large towns and retail markets, but it is to be hoped that grading will become more general, both with milk itself and with other dairy products. The dealers could probably do more than any other people to improve the general standard of "ordinary" farm milk. The Midland Counties Dairy, Birmingham, pays a bonus for low bacterial counts, absence of *B. coli*, keeping quality and contents of fat.<sup>2</sup> The improvement in cleanliness during the five years that the system has been in operation is very marked.

In most American and Canadian cities the by-laws prohibit the sale of milk except in sealed containers, and require pasteurization of all milk except certain specified high grades. In London, provided the milk is up to the minimum requirements of fat and other solids, it can be sold in as unhygienic a way as the retailer likes and the customer will stand. The best dealers would welcome support from the public authorities.<sup>3</sup>

The custom of grading also seems to be making some progress among cheese-makers, and it is interesting to note the system of grading adopted in Holland, where control stations have been established by the industry, and approved cheeses are stamped with Government

<sup>1</sup> See Report of Congress, p. 100.

<sup>2</sup> *Ibid.*, p. 323.

<sup>3</sup> World's Dairy Congress, 1928, p. 363.

marks,<sup>1</sup> showing the minimum contents of fat. Cheese and butter for export must bear these marks. The grading of butter and cheese has also been established in many other countries—The United States, New Zealand, Canada, The Irish Free State, Denmark, etc.<sup>2</sup>

36. The outstanding feature of the milk trade is the low consumption of liquid milk in England compared with that in America and in some European countries. Taking first the figures of production for England and Wales in 1925, the yearly sales of liquid milk off farms were estimated at 818 million gallons, while 70 millions were used in farm households. This indicates a total of about 23 gallons per head of the population. But it includes milk sold to factories, much of which is converted into cheese. If the problem is approached from the consumer's side, estimates of about 15 gallons a head have been made in certain towns.<sup>3</sup> This may be somewhat lower than the consumption in rural areas.

The actual yearly consumption in the United States is given as 46 gallons a head.<sup>4</sup> In Switzerland it is 83 gallons; in Sweden 68 gallons; in Denmark 57 gallons. Only in France and Germany are the estimates as low as in England. Thus it is clear that there is a wide margin for market expansion, and great need for further propaganda. In America, this has been very successful in increasing the consumption of milk.<sup>5</sup>

The work of the National Milk Publicity Council is, of course, familiar to the Empire Marketing Board, which has contributed to the cost, especially in paying for an advertising campaign in 1928. It is unfortunate that the scheme of a general levy on sales has fallen through, and that the consequent financial stringency has curtailed the Council's activities. But a permanent Joint Milk Committee, representing the producers and the dealers, has been set up, and is appealing for voluntary contributions. The Publicity Council is also developing the sale of milk in schools, and I am told that at present over 500,000 children are paying for milk each day to an amount which means a consumption of five million gallons a year. With additional income, the Council could extend this most useful work in schools, factories and elsewhere.

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<sup>1</sup> World's Dairy Congress, 1928, p. 172.

<sup>2</sup> *Ibid.*, p. 424.

<sup>3</sup> The Fluid Milk Market, R. B. Forrester; pp. 1, 2, 103.

<sup>4</sup> *Ibid.*, p. 131.

<sup>5</sup> World's Dairy Congress, 1928, p. 567.

## CHAPTER III.

### THE FUTURE OF DAIRY RESEARCH.

37. I must now deal with the third section in my terms of reference, and consider "what extensions are contemplated or desirable, and what are the most important scientific or practical problems to which attention should be directed."

38. Two preliminary and most important cautions are necessary. It is of course possible to state what seem to an observer at any given moment the directions in which research is most likely to obtain important results in the immediate future. But it is probable, indeed almost certain, that, over any considerable time, such a prophecy will prove to have been wrong. The path which research opens into the unknown cannot be traced far ahead. At any point a new and unforeseen prospect may open out, and a sharp turn in direction become necessary. Thus I can answer only subject to reservation the Board's question—What are the most important scientific or practical problems to which attention should be directed? I can say what seem to me to be the most promising lines of enquiry at this moment, but my opinion would, I hope, be quite different after the lapse of time. It is essential to keep an open mind, and to be ready at any moment to revise one's opinions.

39. The second caution I wish to make is as follows. Our rapidly growing knowledge of the underlying sciences, and of the practical methods best adapted to secure their application to dairying, should have a beneficial effect on the milk industry. It will certainly increase the yield of milk and diminish the costs of production, but its influence on profits involves elements of doubt. It will increase profits only if demand grows at least as fast as supply, and a growing demand will depend on an improvement in marketing and in the organization of propaganda. Unless demand can be stimulated as prices are lowered, the effect of improvement in the theory and practice of dairying may be to increase the over-production from which the industry is already suffering at present prices. Hence, to preserve the necessary balance, the Empire Marketing Board should bear in mind the desirability of helping marketing.

An increase in the English demand for dairy produce is important for the producer not only at home but also in the Overseas Dominions. It is necessary, therefore, to emphasize the fact that the recommendations which I make in the following pages are to be understood as subject to the proviso that this balance between the encouragement of production and of marketing is maintained.

*Cattle Food.*

I. *The Growth of Fodder.* (See Cap. ii. §§ 7-11.)

40. The researches being carried on at Aberystwyth, Cambridge and elsewhere on the selection, genetics and growth of different species and strains of fodder crops, especially of grasses and clovers, seem to me of fundamental importance and worthy of all necessary financial support. The work is not being done at Dairy Institutes, but is none the less important for dairying. The same remarks apply to the work going on upon the treatment of grass-land to get the best results of frequent cutting and intensive grazing, the advantages of which have been shown by Woodman and others. The methods of preserving young grass, whether by artificial drying or by conversion into ensilage, need, and should receive, further investigation.

Other questions important from the practical point of view which in my opinion need further enquiry are: (1) the effect of farm-yard manure on the fertility of pastures; (2) the differences between the milk of pasture-fed and of stall-fed cows, for instance in its content of vitamins, and especially in its quality for manufacturing cheese and butter; (3) the mineral composition of the soil and the herbage of dairy pastures, and its effect on the manufacturing qualities of milk.

The information which has accumulated lately on the beneficial effect of vigorous harrowing on grass-land should be followed up. Further and more carefully planned scientific experiments on this point are desirable, and efforts should be made to bring the facts already known to the attention of grassland farmers.

41. The depression in arable farming has led to the conversion of large areas of plough-land into meadow and pasture. Where the process has been well done, and the climate and soil are favourable to grass, no regrets need be felt. It is probably the best way of meeting the depression in cereal prices. But much East Anglian land will not carry good permanent grass, fields are often large and unfenced, and water is sometimes not procurable. Hence the process

of converting arable to grass-land has limits. Moreover, the sowing or "tumbling" down of ploughland to inferior grass, and its indiscriminate use for dairying, are calculated to depress the milk industry without giving much financial return to the farmer. Hence I think it important from the point of view of dairying to encourage any promising alternative method, whereby cultivation can be cheapened and arable land kept under the plough. Mr. Orwin has emphasized the success which has attended some of those who, leaving the familiar rotations, have specialized in corn-growing.<sup>1</sup> Perhaps he has not adequately described the achievements of skilful farmers who, in the same hard times, have made older methods pay. But certainly further experiments in this and other directions are desirable. Again, some progressive farmers are alternating four years corn-growing with four years of temporary grass leys, on which bullocks and grass-land sheep are fed. This method of alternation is used in Scotland. Scientific investigation of its adaptability to English conditions is beginning at the Cambridge School of Agriculture, and should, I think, be extended in scale there or elsewhere, first as an experiment, and then, if successful, as a demonstration. Directly, this is an attempt to meet the agricultural and economic problem of the remunerative use of East Anglian land, but indirectly, as preventing an ill-advised increase in milk-production, it may be of very great use to the dairying industry.

Further information is needed before these possible new methods are extensively adopted by arable farmers. They are not proposed as a solution of the present difficult problems due to the crisis in corn-growing. But if the new methods prove a success other problems will arise. The change from present methods of arable cultivation, will involve considerable expenditure for fencing, water supply and grass seeds. If the depression still continues, and it is thought right to help arable farmers over a time of transition at the expense of public funds, a grant in aid of this necessary capital expenditure would be free from some of the objections which have been urged against certain other forms of subsidy.

## 2. *Nutrition.* (See Cap. ii, §§ 12-15.)

42. In spite of the general opinion of "practical men" that the food of cows influences the percentage of fat in milk, and in spite of results confirming this idea given by Hansen,<sup>2</sup> it seems that other

<sup>1</sup> *The Future of Farming*; Oxford, 1930.

<sup>2</sup> *World's Dairy Congress, 1928*; p. 199.

properly controlled experiments show that ordinary variations in food cause very little effect.<sup>1</sup> Even diminishing the food till it verges on a starvation ration, while it decreases the quantity, is stated hardly to affect the fat contents of milk. Sanders has shown that, as might be expected, one kind of food—young grass—is specially efficacious in increasing the yield of milk, so that the change in food is responsible for some or all of the flush of milk in spring. This high yield can be maintained by dried young grass. Young grass is now, or soon will be, available in large quantities in the form of ensilage and of dried cake, and more experiments on its influence on the quantity and quality of milk should be made as quickly as possible. Here is another problem eminently suitable for one or more Dairy Institutes to tackle. It is of great importance to the Overseas Dominions as well as to Great Britain. Meanwhile, studies on nutrition must form part of the regular work of Dairy Research Institutes, and funds should be found for metabolism houses and apparatus, where, as at the Hannah Institute, they are needed for the authorized plan of work.

The general problem of the influence of variations in food on the quantity and composition of milk, at the moment needs more knowledge of the fundamental principles underlying both nutrition and milk secretion. As an example of the most promising kind of enquiry, we may take the work of Cary and Meigs, who have attempted to follow the alterations in the composition of blood and milk due to drastic changes in the diet of the cow.<sup>2</sup> They conclude tentatively that the important factors are alterations in the quantity and quality of the amino-acid mixture circulating in the blood.

Besides such laboratory experiments as these on basic problems, there is also room for a statistical examination of the existing data. This enquiry is dealt with in Section 49 below, as part of a larger problem. Its results will probably point the way in which the most useful laboratory work on nutrition can be done, or new statistical work planned.

*Physiology including Genetics.* (See Cap. ii, §§ 16–17.)

43. The general problems of genetics are now widely and extensively studied in special institutes and by private research workers in Universities and elsewhere. The work is voluminous, and, while

<sup>1</sup> Variations in the Composition of Milk; Min. of Agric. Misc. Publ. No. 65, p. 12.

<sup>2</sup> Carey; *Jour. Agricultural Research*; 29, 603, 1924.

some of it will certainly prove eventually useful to the stockbreeder, it is difficult to single out many particular points as worth special encouragement for dairying purposes.

But of course one problem directly concerns the dairy farmer—the study of the inheritance of milk yields—and every skilful dairy farmer knows that there is still much to learn before the effect on milk yield of any given mating can be predicted, or even the probabilities of any given result be stated.

Here the experiments of Mr. Hammond on the inheritance of milk-yielding qualities in rabbits<sup>1</sup> seem to point the way to a possible road of advance. The male offspring of a high-milking female, when crossed back on his dam, produces high milking stock, and this process can be continued till harmful recessive factors appear. These factors become evident sooner if the females be inbred with their sires; it seems better to restrict inbreeding to crosses between the males and their dams.

Methods of breeding somewhat like these have been used with cattle by some farmers, and doubtless there is much practical knowledge which should be collected and collated. But also it is clear that experiments planned scientifically and carried out under scientific control, should be initiated. Something is being attempted at Edinburgh, Shinfield and Cambridge, and being planned with Ayrshire cattle at the Hannah Institute, but these experiments are restricted by lack of funds. It is most important to investigate whether the results which Mr. Hammond has obtained with rabbits hold good also with dairy cattle. Help in this direction would almost certainly repay its cost.

44. Again, the Cambridge experiments on the physiology of reproduction (see (ii), § 17) are of great promise and deserve all support.

45. The whole field of the physiology of milk-secretion is eminently fitted for examination in Dairy Research Institutes, and gives scope for the useful collaboration of physiologists, chemists and statisticians. Two instances will be given as examples of the work the dairy physiologists might do in this part of their subject.

In the first place the mechanics and physics of the subject need investigation. When a cow's udder is milked out and begins to

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<sup>1</sup> See above, § 16.



refill, the rate of secretion is quick at first and falls off as the hydrostatic pressure in the udder rises. The limit to the rate of secretion may be due either to the secretory system or to the duct system, and may be quite different in first-calf heifers and in older cows. But no information seems available.

Examination of these problems, including the changes in the quality of the milk and the construction of accurate curves showing the fall in the rate of secretion as the pressure rises, could hardly fail to give information useful in the theory of milk-production, and in the practical problem of deciding how often and at what hours heifers and cows should be milked.

Next, one biochemical problem seems of fundamental importance : the connection between the proteins in the food, in the blood of the cow, and in the milk she secretes. Work on these lines is already being carried out by the staff of the Hannah Institute, and should be continued and extended when its new buildings are finished and in use.

These two lines of enquiry are given both for their own intrinsic importance, and as instances of the kind of direct physiological investigation needed. But many of the other problems which comprise dairy research have a physiological bearing. Every Dairy Institute should have a trained physiologist on its staff, and all problems dealt with by the Institute should be examined from the physiological point of view, even though they are more directly concerned with other parts of the subject.

*Pathology.* (See Cap. ii, §§ 18–20.)

46. Both the Ministry and the Board are, of course, advised from other sources on the subject of animal pathology, including the diseases of dairy cattle. But, during my enquiry, I have inevitably been brought into touch with some of the work going on, and I will state briefly what I think future policy should be.

47. The attempt being made at the expense of the Medical Research Council to clear an area near the Hannah Institute from tuberculosis seems to me worthy of all encouragement, and adequate funds to carry on the work should be supplied. But, in view of the possibility that a successful method of inoculation may be worked out, I do not think it worth while at present to try to clear other

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<sup>1</sup> See § 42 above.

areas, still less to adopt this method on the large scale in an attempt to free the country of tuberculosis.

At present, I think the Medical Research Council should be supported by the Ministry of Agriculture and the Empire Marketing Board in its efforts to enable Dr. Stanley Griffith and Professor Buxton to carry on their work. If conclusive success is obtained then in (say) two years time it should be possible to use inoculation on a wide-spread scale. The system of clean areas and accredited herds will then become unnecessary. But, until the complete success of inoculation is assured, the Ayrshire experiment should be continued. It may be necessary to revert to that method should inoculation fail.

48. Efforts should be made to get into use the results of Dunkin on Johne's disease, and, in general, to call the attention of farmers to work on other diseases as it reaches the practical stage.

Of the other recent researches on pathological subjects mentioned in §§ 19 and 20 of this Report, I need here return only to the question of the effect of bovine disease on the quality of milk, both for consumption as a liquid and for use in manufacture. This problem naturally arises from the normal work of a Dairy Research Institute, and in the course of statistical enquiries such as those dealt with in § 49 below; funds should be available to investigate it when occasion arises.

*The Composition and Properties of Milk.* (See Cap. ii, §§ 21-26.)

49. Our present knowledge of the variations in the composition and properties of milk was considered fully by an Inter-Departmental Committee appointed 18th August, 1927. The Committee came to the conclusion that our knowledge of the variations and their causes is insufficient, and thought that further information was needed on the following points:—

- (a) What percentage of cows persistently give milk below the limits of the Sale of Milk Regulations.
- (b) Day to day variations in the milk of individual cows, and herds of various sizes.
- (c) The extent to which milk is affected by unusual or disturbing conditions (e.g., strange milkers, warble-fly, climatic variations, sudden changes of food).

(d) Relationship between breed and average composition of milk for a lactation period.

(e) The effect of food on quality of milk, for instance the feeding of specific oils in excess, or ill-balanced rations and the period for which the effect operates.

(f) The effect of watering in winter, i.e., watering intermittently versus water laid on to each stall.

(g) Correlation of yield and composition of milk.

The Committee recommended (1) that Dr. Tocher should be asked to undertake statistical examination of existing data, and (2) that new information should be obtained by a scheme of investigation which, in its final form, involved the examination of the milk (mixed in churns) of about 250 herds for about a year.

As I was asked to report specially on this scheme, I have considered it fully and from many points of view. Doubtless it would give valuable new information, and enable us to estimate, more accurately than we can yet do, the influence of the various factors on which the composition of milk depends. From the practical aspect, it might help in any movement for the general improvement in the quality of the milk supply, by showing which factors were important and which could be ignored. Although even now theory is in advance of practice, and there is plenty of room for improvement in the light of knowledge already available, from this point of view the proposed investigation might be justified.

Again, it might, and doubtless would, increase the accuracy of our estimates of the mean values of the different characters of milk, and of the variations from those means which were to be expected in different conditions. It might supply a more authoritative basis for advice on legal and administrative problems. But it is almost certain that the general results of older work would be confirmed. The exact shape of the variation curves, the exact values of the coefficients of variation, might be modified, but the same difficulty in fixing minimum standards of fat and of non-fatty solids would remain.

My enquiry has inevitably led to the question which underlay the appointment of the Inter-Departmental Committee—the question whether the present Sale of Milk Regulations are right in principle. It is clearly desirable to find some method of detecting adulteration with ease and certainty, so that criminal prosecutions may be

instituted in clear cases. But even so, much milk which is not adulterated with water is very poor in quality, and the consumer is not protected from this deficiency by the criminal law; genuine milk is legal even if very poor, and at present the consumer usually pays for it the full price. In large towns, where most of the milk is bulked, the quality may be fairly uniform, but even then it is often considerably below the average for all milk.

In some countries, the dealers pay for milk according to its contents of butter-fat. The determinations are usually made by the purchaser, and this plan has sometimes led to dissatisfaction. Possibly some method of joint or independent control might be instituted for milk sold by farmers to dealers or to milk factories. Another arrangement might perhaps be devised on the lines of the present system whereby milk certified as tuberculin-tested is sold at an increased price. The difference in composition between morning and evening milk presents a difficulty. But, if the difficulty could be overcome, that fraction of the whole milk supply which is already guaranteed free from tubercle bacilli, might also be guaranteed as above a certain standard as regards its contents of nutrient material. I think the possibilities of giving some financial inducement to supply milk of good quality, either in these or other ways, should be explored.

I must now return to the problem of the possibility of legislative sanction for minimum standards below which milk should not be sold. This seems to have been the most important practical question which the Committee hoped to answer by the investigation which they planned. It seems almost certain that the answer, when obtained, would merely confirm to a higher degree of accuracy general results well-known at present, and show no logical line at which a minimum standard could be fixed. But, if minimum standards are wanted, and the known practical difficulties—such as the difference between morning and evening milk—can be overcome, there seems no reason why sanction should not be given. If any standard were fixed too high, a decrease in supply or an increase in price would soon correct it.<sup>1</sup> If it were fixed too low, presumably consumers would complain. Doubtless the results of the proposed enquiry would enable more accurate advice to be given on the best values for the standards, but I think advice quite good enough for

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<sup>1</sup> An increase in the retail price of fresh milk has the disadvantage that it tends to favour the consumption of dried and condensed milk.

practical purposes could be given on present data. We know well enough what is rich milk and what is poor milk.

To sum up the results of this section of my Report, I recommend :

(1) That of the scheme of investigation put forward by the Inter-Departmental Committee, the statistical enquiry on existing data be carried out as recommended, but that the rest of the scheme be held in abeyance for the time ;

(2) That meanwhile information be sought from Holland, New Zealand and the United States on the freezing point method of detecting the adulteration of milk by water ;

(3) That, if the information so obtained be thought inadequate as a basis for legislation or administrative action, an experimental investigation of limited scope on the freezing points of milk be planned and carried out ;<sup>1</sup>

(4) That, when the results of this enquiry (and investigation) are available, further consideration be given to the whole subject ;

(5) That authoritative opinion be sought on the best method of securing financial benefit to the producers of milk with a high content of nutrient material.

50. These recommendations were made in an Interim Report, dated March, 1930. I now wish to add the following supplementary remarks.

Firstly, I should like to point out that hitherto the many enquiries that have been made on variations in the composition of milk have, for the most part, been carried out by chemists, and naturally enough chiefly from the chemical point of view. The physiological aspect of the enquiry has been less in evidence. But the problem is essentially a physiological one, and in any future investigations I think that physiologists and statisticians should co-operate with chemists.

Secondly, I find indications that a very large number of data are embedded in the literature of the subject, and I think an exhaustive survey would enable those who carried it out to compile a mass of information from which most useful statistical results might be

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<sup>1</sup> Since this Report was written, the questions of the cryoscopic method and of a standard apparatus for its use have been taken up by a Sub-Committee of the Dairy Research Committee of the Empire Marketing Board.

obtained. For instance, Gower has put together the facts published by several observers concerning the relation of milk yield and butter-fat yield to the age of the cows of different breeds.<sup>1</sup> His table summarizing the results shows that the milk-yield rises on the average from 0·673 at 1·75 years old to a maximum taken as 1·000 at 8·25 years, and then falls with increasing rapidity to 0·900 at 13·25 years. Similarly the butter-fat rises from 0·658 to 1·000 and then falls to 0·855. Among the results quoted are those of Hammond and Sanders, who have investigated the relation between age and milk-yields by examining the records of milk-recording societies, and have worked out a correction for age which allows milk records to be standardized.<sup>2</sup>

Doubtless other problems could be attacked by similar methods. The statistical enquiry entrusted by the Inter-Departmental Committee to Dr. Tocher seems only to cover a limited number of data obtained by certain specified Institutions and individual observers.<sup>3</sup> It does not, apparently, touch other sources of information such as the books of milk-recording Societies. Although such Societies in general only record the weights of milk given by each cow, some have fuller details. Mr. Hammond tells me that the Bromsgrove Milk Recording Society has data for the percentage of fat, as have some of the Breed Societies. Therefore I recommend that, if funds allow, a physiologist and a statistician be jointly commissioned to search the records which are available in the books of these Societies and in the general literature of the subject.

In my Interim Report, I ventured to differ on another point from the Inter-Departmental Committee, and stated my view that, if the demand from Local Authorities for the fixing of minimum standards continued, there was no reason why sanction should not be given without further investigation of variations in the composition of milk. Further enquiry and consideration have left me with the same opinion. In the 48 United States of America, Dr. Eckles says that as far as he knows there is not one State that does not require a definite standard, which seems to be nearly always 8·5 per cent. for non-fatty solids, and to range from 3·00 to 3·50 for the contents of fat.<sup>4</sup>

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<sup>1</sup> World's Dairy Congress, 1928, p. 204.

<sup>2</sup> *Journ. Agric. Science*, Vols. 13 (1923), 17 (1927) and 18 (1928).

<sup>3</sup> Report of the Inter-Departmental Committee, Appendix B.

<sup>4</sup> World's Dairy Congress, 1928; pp. 739, 772. See also Forrester, *The Fluid Milk Market*; Min. of Agric. Econ. Series, No. 16, p. 127.

Another important point—in the United States the question of adulteration is not raised. Even if milk deficient in fat or other solids is genuine milk straight from the cow, its sale is illegal. Dr. Eckles also says that the practice of buying milk on a fat basis is practically universal, so that there is no inducement to adulterate milk. In other countries also milk is bought by quality; reference may specially be made to New Zealand (see § 34 above).

I think the principles underlying the American practice are better than the use of the criminal law on which this country relies. It will of course be necessary to retain the power of prosecution in proved cases of fraud, but, if methods of wholesale purchase and retail sale can be devised which roughly adjust the price to the contents of fat and other solids (see § 34), it is safe to say that adulteration would be rare or unknown. Standards of safety and cleanliness as disclosed by bacterial contents should be imposed, and in my opinion those should be the only absolute national standards, below which milk should be unsaleable. Local Authorities or consumers might impose minimum standards for fat and other solids, if they wish to do so, but I think it more important that a new system of payment should be worked out, in consultation with representatives of milk producers and milk dealers, so that purchasers should pay for what they really want—the nutrient contents of the milk they buy. Perhaps many of the larger milk-farmers would test the qualities and variability of the milk of their own cows, and guarantee the percentage contents, different figures being given, if necessary, for morning and evening milk.

If it proves possible to persuade the trade to adopt payment for milk by quality, criminal prosecutions for adulteration will become rare. Measurements of fat contents will be very frequent for purposes of payment, and, as at present, any abnormally low figure would suggest further enquiry. The removal of cream or the addition of water would not be worth while, pecuniarily, but if the latter action is suspected, I still think, as stated in my Interim Report, that the cryoscopic method is worth examination as a method of detection. Since the date of that Report, I have found another study on the freezing-point method, carried out by A. L. Andrew.<sup>1</sup> As the result of some thousands of observations extending over 17 years, Andrew finds the method to be quite satisfactory and to give an accurate estimate of the percentage of water added. Again, I have discussed

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<sup>1</sup> *Jour. Soc. Chem. Ind.*, Mar. 1929.

the matter with Mr. Nevill Wright, the Scientific Representative in London of the New Zealand Government. He informs me that the freezing-point method has been in use for many years in New Zealand with complete success.

Most samples of fresh milk have a freezing-point between  $-0.54^{\circ}$  and  $-0.55^{\circ}$  C., with an extreme range of  $-0.52^{\circ}$  to  $-0.57^{\circ}$ , beyond which cases are of the utmost rarity, and usually indicate disease in the cows. In Holland, any sample with a freezing-point above  $-0.53^{\circ}$  is assumed to be adulterated with water. If genuine milk from the suspected source can be obtained for comparison and the suspected sample is fresh, the evidence goes to show that a freezing-point measurement would be quite conclusive. The chief difficulty seems to be the increase in the depression of the freezing-point with the growth of lactic acid as the milk becomes stale, measurements as low as  $-0.7$  C. having been recorded 24 hours after milking. It seems probable, however, that a correction for acidity could be worked out, and more information on this point is desirable. Mr. Wright tells me that in New Zealand a sample of the suspected milk is taken and further lactic decomposition stopped by the addition of 0.5 cc. of a 5 per cent. alcoholic solution of mercuric chloride to a 200 cc. bottle of milk. When the alcohol has evaporated, the bottles are sealed and labelled "Poison" before being sent to the laboratory.

The cryoscopic method needs skilful manipulation and careful observation, since measurements to an accuracy of  $0.001^{\circ}$  C. have to be made. Hanley has obtained good results by using the easier refractometer method, and it may be worth further enquiry.<sup>1</sup> But its theoretical basis seems less sound than that underlying the measurement of freezing points.

In concluding this part of my subject, I wish to repeat that the problem of detecting adulteration will in all probability become less and less important as payment for milk on a basis of quality becomes more and more common. Secondly, I think that the enquiry proposed by the Inter-Departmental Committee may be worth carrying out at a later date, but I advise that further preliminary investigations into existing data should first be made. They might show that an expensive enquiry was unnecessary, and, at any rate, would lead to a better formulation of the many and complex physical, chemical, physiological and statistical problems which underlie the subject

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<sup>1</sup> World's Dairy Congress, 1928 ; p. 744.



than is possible at present, and thus make the enquiry when carried out more fruitful in results.

51. The experiments on the dietetic value of milk described in §§ 22-25 above, have yielded useful information. But, as there explained, many questions remain unanswered. It is uncertain which constituent of milk produces the marked stimulating effect on growth in children and young animals. Further experiments on whole milk, raw and pasteurized, on skim milk and whey, and on all these products both condensed and dried, seem desirable to clear up disputed points. Experiments are needed both on animals in the laboratory and statistically on large numbers of children.

Indications have been obtained (see § 23) that certain pathogenic organisms in milk survive the process of condensing and drying. In view of the rapidly increasing consumption of these products, it is important that an authoritative answer should be available to this question, and I advise that new experiments thereon be arranged. I understand that Dr. Norman Wright is planning some such work at the Hannah Research Institute.

*Microbiology of Milk.* (See Cap. ii, § 27.)

52. From the point of view of practical dairying, as stated in Cap. ii, § 27 of this Report, the study of the micro-organisms found in milk must be chiefly directed towards determining the quality of milk, firstly for consumption as liquid, and secondly for use in the manufacture of cheese, butter and other products. The papers and discussions at the World's Dairy Congress in 1928 showed clearly that the methods appropriate for the testing of milk for the one purpose are not necessarily suitable for the other. They also showed considerable divergence of views and methods in different countries. Professor Van Oijen, of Utrecht, stated at the Congress that conditions, and therefore the best technique, differed in different countries, and that "systematical inquiries adapted to different circumstances in different countries are very urgent."

In the study of general dairy bacteriology it is unnecessary to specify definite problems, since they are so numerous and underlie so many investigations directed to elucidating other matters. The position is the same as in physiology. Every Dairy Research Institute should have a competent bacteriologist, for he will find plenty of useful work to be done. And this applies not to the study of milk alone, but also to that of its products, especially

butter and cheese, the quality and ripening of which depend on micro-organisms. The qualities depend indeed on the other properties of the milk as well, and here is, I think, a wide field for enquiry. How do changes in milk affect the quality of the products made from it? For instance, is the wide-spread belief that prime cheese can only be made from the milk of a single herd justified, and if so, what is the explanation? Perhaps something may be done to simplify technique, for instance, to examine samples of milk for cheese-making, the reductase and fermentation tests may prove useful.<sup>1</sup> Again, though high-grade milk can only be classified by careful and laborious bacterial counts, if a minimum standard, below which no milk might be sold, were enforced, these simpler tests might be found to be adequate.

*Dairy Products.* (See Cap. ii. §§ 28-31.)

53. The problems which, at the present time, I think most important as regards Dairy Products may be summarized as follows.

(1) The work on red spot in cheese and on oiliness in butter, carried out at Shinfield, has now merged into the general problem of the ripening and keeping of dairy produce. For this work I recommended grants, both for the continuance of the present work and also for the building and maintenance of a low temperature station.

(2) The influence of the nature and initial treatment of milk on the products made from it should be further investigated. It was proposed that the Hannah Institute should carry out this enquiry in conjunction with the Scottish Milk Agency at Stewarton. I understand that some delay has occurred in the preliminaries, and that nothing has yet been done. But I am of the opinion that many manufacturing problems await scientific examination, and that they would best be attacked by some system of collaboration between factory and laboratory such as that planned.

(3) The utilization of by-products, chiefly skim-milk and whey, is of importance. Not much is yet known about the physics of spray drying, and I recommend that help be given to the work being done at the Royal Technical College, Glasgow, in conjunction with the Hannah Institute. At the Technical

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<sup>1</sup> See above, § 27.

College, also, experiments on the use of dried whey in baking have been planned, and advantage should certainly be taken of the facilities for such work which can be found there probably better than in any other available place. Work on by-products might well be supervised by a special Committee, in order to keep all those interested in touch with each other.

The position about starters seems to be unsatisfactory, and some system of standardization desirable. I understand, however, that the question is under consideration by the Dairy Research Committee, who are waiting for further information about work already done before making recommendations.

It is important to develop new uses for milk-products. In America ice-cream is regarded as a food as well as a confection, and, in summer at all events, something might be done to advertise that view in England. Much information is available about machinery and trading methods, and might usefully be put together.<sup>1</sup>

The by-products of butter and cheese making consist chiefly of separated milk and whey. Butter is only made in Great Britain in comparatively inaccessible regions, and cream production is a somewhat specialized trade. The separated milk in either case is mostly used for rearing calves. With the present superfluity of liquid milk, the extension of butter making and/or the sale of cream may be worth consideration, especially during spring and summer when the flush of milk comes. More cream might with advantage be used with fruit or converted into ice-cream, and, to use up the residues, the trade in veal, so general on the Continent, might be much more fully developed in England than it is at present.

From the Imperial point of view, it is of prime importance to study the effect of temperature on butter and cheese, during storage and transport, and, for this reason, the construction of a Low Temperature building at Shinfield was recommended in the Interim Report which I submitted to the Board in March, 1930, and I here repeat that recommendation.

*Dairy Machinery.* (See Cap. ii, § 32.)

54. The subject of Dairy Machinery is now being dealt with by two Departmental Committees of the Ministry of Agriculture, one of which controls the testing of Agricultural Machinery, and the

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<sup>1</sup> World's Dairy Congress, 1928; pp. 382, 391, 407.

other, newly established, is charged with advisory functions, with the help of representatives of farmers and of implement manufacturers. The first Report of the Testing Committee, describing five years' work, has just been published. In considering the needs of the National Institute for Research in Dairying at Shinfield and the Institute for Research in Agricultural Engineering at Oxford, the requirements of space, plant, and funds for their important testing work should not be forgotten. With that exception, the question of machinery is perhaps better left with these two Committees.

*Economic and Marketing Problems.* (See Cap. ii, §§ 33-36.)

55. The chief economic difficulty which faces dairy-farmers is the downward tendency of prices. This is doubtless partly due to the fall in the general price-level, and so must be correlated with the general economic depression of the world. But, whatever be the ultimate causes, there is growing over-production of milk in England in relation to the present demand at existing prices.

56. The figures given for the consumption of milk in different countries (see § 36 above) show that it is not at all hopeless to attempt to increase the demand. The conditions necessary for success are, I think, well set out by Mr. Forrester.<sup>1</sup> The public has to be informed of the great improvement in the quality even of "ordinary" milk of late years, and also of the great benefits of milk as diet, especially for children and young people. The activities of the National Milk Publicity Council are well known to the Empire Marketing Board, which has generously supported them in the past. The failure of the scheme for a systematic levy on the sales of milk is unfortunate, and, it is to be hoped, only temporary. I am told that a plan for additional publicity at a cost of £50,000 has been worked out, and can be put into operation as soon as funds are available. In spite of the recent financial set-back, the Council is, in my opinion, doing good work, worthy of all the support which can be given.

57. A necessary accompaniment to the campaign for increasing the demand is the work of improving the quality of the supply. Much has been done in recent years, by the institution of graded milk, clean milk competitions, etc. It is of great importance to raise the average standard of "ordinary" farm milk, as well as to encourage the production of comparatively small volumes of special grades. Mr. Forrester advises that the quality of ordinary market

<sup>1</sup> The Fluid Milk Market; pp. 118-124.

milk should be tested by the investigation of samples in a number of different areas, in both winter and summer conditions. Any improvement in the quality of average milk must, in the long run, be beneficial to the producer as well as to the consumer.

There is no doubt that the system of bottling, introduced into London by United Dairies, has done much to improve the milk supply. Sir E. Debenham and probably others are experimenting with cardboard non-returnable containers. These can be retailed by grocers at their usual margin of about 15 per cent., much less than that expected by retail dairy shops. If this system prove feasible and were adopted on a large scale, it might cheapen milk to the consumer at no cost to the producer.

58. Besides the present general over-production of milk, there is a seasonal problem which needs study. Even if the yearly supply were adjusted to the demand, yet, owing to the flush of new grass in May and June, there would be surplus milk in those months. A reduced and probably unremunerative price is payable for this milk under present arrangements between producers and dealers, but few farmers are willing to face cheese-making or similar methods of using up their own surplus. They should be encouraged to do so. The custom of selling the whole of a farmer's output for the complete year leaves the producer too much in the hands of the dealer.

It is possible that a development in the trade in veal might help to solve this problem. Many farmers regard calves somewhat in the light of unwelcome little strangers, and sell them at a day old for what they will fetch. Higher proportionate prices are obtainable for calves two or three months old, and the keeping of calves for this time fits in well with the consumption of surplus milk—indeed it is an almost invariable custom in Continental dairying countries and is not unknown in some English counties.

But the plan of letting the cows suckle their calves may lead to waste. Either several calves should be put on one cow, or the cows milked out and the calves bucket fed. Skim-milk can be used, mixed with some whole milk. Thus veal production goes well with the production of the cream needed for fruit at the same time as the surplus milk appears. As said above, the amount of cream used in England, either as such or as ice cream, is small compared with that consumed in some other countries, so that the trade in cream should be susceptible of development.

I think the economics and finance of this way of using surplus milk to produce cream and veal should be studied by one of the Economic Institutes, and, if it seems likely to be remunerative, efforts should be made (1) to get dairy farmers to adopt it, and (2) simultaneously to develop the markets for veal and cream in various forms.

59. It will be remembered that, at the beginning of this Chapter of my Report, I pointed out the necessity of widening the demand for milk and its products as the supply is increased by improved technical methods. Thus I lay great stress on this final appeal for the adequate consideration of and help to Economic and Marketing Investigations. Most of the definite applications for grants which have been referred to me by the Empire Marketing Board have come from Dairy Research Institutes, which are normally and naturally concerned with the technical problems of production. I have had to study the problems of marketing without the stimulus of such applications. But, I am convinced that more can be done for the Dairy Industry both in this country and in the Overseas Dominions by taking measures to expand the English market for milk and its products than by one-sided efforts to improve, and therefore necessarily to increase, production. The chief difficulties of the dairyman, like those of other farmers, are to-day economic and not technical.

## CONCLUSION AND RECOMMENDATIONS.

60. I must now attempt to summarize the substance of this Report, to clear up any outstanding points, and to repeat what seem to me the more important of my recommendations.

61. The division of work between Dairy Institutes and those concerned with Nutrition and Genetics should separate different aspects of subjects rather than different subjects themselves. Nutritional and Genetic Institutes should deal with feeding and reproduction as general problems, using work on special animals to elucidate general phenomena. Dairy Institutes will often study the same problems, but from the particular point of view of the milch cow and the Dairy Industry. No recommendation can be given to segregate different subjects, but if the above principle be borne in mind, it will, I think, prove possible to prevent wasteful overlapping.

Nevertheless, exceptions will arise, and may be justified abundantly by success. No one would wish to interfere with a brilliant performance. After all, men are more important than places or plant, and, when the right man has found a useful line of enquiry, every possible support should be given to him.

62. All Research Institutes should be encouraged to investigate the fundamental problems of pure science as well as the practical problems which arise therefrom. Indeed, practical advance may soon stop if pure research be starved. Yet it is impossible to lay down a programme for fundamental research. Individual workers must follow their own lights, with such additional illumination as the Directors of their Institutes and others their leaders may have to give. This fact makes difficult the apportionment of public funds. I think the only safe guide is to aim at the general efficiency of each Institute, at the adequacy of its Staff, and the possession of at least the minimum equipment necessary. Each Institute should have a basic income, large enough to support its normal work, both in theoretical and practical subjects. In the particular case with which I am concerned, each Dairy Institute should have on its Staff those able to deal with its problems from the agricultural, the physical, the chemical, the physiological, the bacteriological, and the statistical

point of view. A reasonable amount of research in the pure sciences which underlie dairying should be expected from each Institute, but no attempt should be made to control the direction this research should take, though consultation and co-operation between Institutes, both Dairy and other, will naturally go on, and should be encouraged.

As a general rule, only when adequate support has been provided to secure basic efficiency, should grants for special purposes be given. And here discrimination between Institutes may be exercised. To this point I shall return.

63. One of the difficulties in scientific work since the War is the cost of publication. Practically no scientific journals are self-supporting, and their usefulness is not always measured by the number of the subscribers. The new Journal of Dairy Research has, I understand, been subsidized by the Empire Marketing Board, so that it can carry on till next year. I am told that it has proved very useful to those engaged in Dairy Research, and could be even more useful if funds allowed it to accept more of the articles offered. I hope arrangements may be made to enable it to survive, if possible in a somewhat enlarged form.

64. Passing from general considerations to specific points, I will summarize the directions in which I think immediate progress in Dairy Research may be expected and should be supported by public funds.

(1) The improvement of pastures by work on plant genetics, on frequent cutting and intensive grazing, and on the cultivation of grass-land; also (for its indirect action in preventing over-production of milk) the development of new methods of arable farming (§§ 8-11, 40, 41).

(2) The effect of variation in cattle food, especially of dried young grass, on milk, and the effect of variation in the composition of milk on its products (§§ 14, 40, 42).

(3) The inheritance of high milk-yielding characters, information being sought both from existing records and by carrying out new investigations (§§ 16, 43).

(4) The physiology of milk secretion (§§ 17, 45).

(5) The inoculation of cattle against tuberculosis (§§ 18, 47).

(6) Investigations on the variation in the composition of milk, in the first place by a search of the literature by a physiologist



and a statistician, leading perhaps to further large-scale experiments (§§ 21, 49).

(7) Carefully planned and efficiently controlled experiments on the nutritive value of milk in various forms and of its products and by-products, to extend present work and to clear up discrepancies. (§§ 22, 51).

(8) The survival of pathogenic organisms when milk is condensed and dried (§§ 23, 51).

(9) The study of the process of ripening of dairy products and the effect of storage in controlled conditions of temperature and humidity (§§ 28-30, 52).

(10) The more intensive study of the economics of the dairy industry : (a) an account of the history of the milk trade during the slump in the autumn of 1930 ; (b) a survey of the present quality of " ordinary " milk, and periodical surveys in future ; (c) increased propaganda for the consumption of more milk ; (d) a study of the economic possibilities of increased trade in cream and veal, and, if the result is favourable, a campaign to make it known ; (e) an enquiry into the possibility of payment for milk by quality—cleanliness and contents of solids (§§ 15, 33-36, 50, 55-59).

65. Some of the work which I hope soon to see carried out must be done outside Institutes for Research in Dairying. The rest will naturally be shared between Shinfield and the Hannah Institute in Great Britain and the various Dairy Research Institutes in the Dominions Overseas as those Institutes are founded.

The Overseas Institutes will naturally be concerned primarily with problems of special interest to their own countries, but, as they become firmly established, it should be possible to assign to them more fundamental problems, in combination, or by agreement as to demarcation, with the Home Institutes. A beginning has already been made in co-operation between the National Institute at Shinfield and that in New Zealand, and it is essential that close touch should be maintained with all overseas work.

As regards the Home Institutes, it may be useful if I indicate how I think immediate problems should be apportioned. At the present time I should assign to the National Institute at Shinfield :

(i) all problems concerning the storage of milk and the ripening and storage of butter and cheese, since the low temperature

station will enable the observers to control both temperature and humidity ;

(ii) All examination and testing of dairy machinery, whether for the Ministry or otherwise.

I should assign to the Hannah Institute :

(i) Problems concerned with large-scale manufacturing processes of butter and cheese-making, especially if the co-operation with the Scottish Milk Agency is brought about ;

(ii) All work on by-products such as whey, which can best be carried on at the Royal Technical College, Glasgow.

This leaves to both Institutes problems concerned with physiology, including both the feeding and breeding of dairy cows. But it has been represented to me that Shinfield deals with Shorthorns and Guernseys, and with these only in accordance with farming practice in the South of England, whereas the Hannah Institute is concerned with Ayrshires as kept in Scotland. This is true, and does make a case for the duplication of some feeding and breeding work. Indeed, there is much to be said for duplicating work when the problems are complex. To take one instance—the study of the inheritance of high milking qualities in dairy cattle, in the light of modern scientific knowledge of heredity, is of such capital importance for the dairy farmer that I definitely think it is desirable that it should be undertaken in two or more Institutes and with two or more breeds. It must be several years before clear results are obtained, and new points are sure to arise in the course of the work at different places which will lead the observers into somewhat different paths. Moreover, consultation with practical breeders should be continuous, and cover a wide range geographically. Few investigations among those in sight are of such great importance as this one, and it will be found that specific questions can often be assigned to one Institute or the other by mutual arrangement at the time when the problems arise.

Both Shinfield and the Hannah Institute are carrying on and planning work on the physiology of milk-secretion. Dr. Norman Wright and Mr. Peskett have discussed these questions together, and provisionally agreed on lines of demarcation. Mr. Peskett will study at Shinfield the secretion of minerals and fats, and their relation to total solids, whereas Dr. Wright will investigate at the Hannah Institute lactose secretion and the important problem (see § 45 above) of the relation between the proteins in the blood

and those in the milk. The mechanical and physical factors in lactation will be reserved for future enquiry, when it is proposed that a joint course or agreed distribution of work should be arranged. Here again the results may differ in the different breeds of cow. The subject is complex, and there is plenty of room for two enquiries, especially if worked in collaboration.

66. Similar close relations are desirable between Dairy Institutes and those devoted to Nutrition and Genetics. It is most important that collaboration should be encouraged among all those engaged on problems of interest to the Dairy Industry, whether they are working in Dairy Research Institutes or elsewhere. Close touch should be maintained with such bodies as the Medical Research Council working at allied problems. I think that the present constitution of the Dairy Research Committee of the Empire Marketing Board might usefully be enlarged, with a view to promoting this closer co-operation.

67. In conclusion I must express my thanks to all those many people with whom I have discussed the subject for the help they have given me so ungrudgingly. It is impossible to name them all, but I must refer particularly to Mr. Dale and Mr. Blackshaw of the Ministry of Agriculture, to Sir Robert Greig and his colleagues, including the Directors of the Scottish Research Institutes, to Sir Walter Fletcher of the Medical Research Council, to Dr. Stenhouse Williams and those others working at Shinfield, to Dr. Norman Wright and the Staff of the Hannah Institute, and to Mr. Hammond of the Animal Nutrition Institute at Cambridge.

W. C. D. DAMPIER-WHETHAM.

Hilfield Manor,  
Dorset.

5th January, 1931.

Revised, Cambridge, October, 1931.

W. C. D. DAMPIER.

E.M.B.45.

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# TRANSPORT AND STORAGE OF BANANAS WITH SPECIAL REFERENCE TO CHILLING

By

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NOVEMBER, 1931

LONDON :

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

To be purchased directly from H.M. STATIONERY OFFICE at the following addresses :

Adastral House, Kingsway, London, W.C.2 ; 120, George Street, Edinburgh ;

York Street, Manchester ; 1, St. Andrew's Crescent, Cardiff ;

15, Donegall Square West, Belfast ;

or through any Bookseller.

1931.

Price 1s. 6d. Net.

70-221-45.

J374:77:8A

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## PREFACE.

**I**N this Report, Dr. Wardlaw and Dr. McGuire, the two Banana Research Officers of the Imperial College of Tropical Agriculture, complete a valuable trilogy which deals with matters of scientific and practical interest affecting an important item of our trade with the West Indies. Their previous investigations into the behaviour and diseases of the banana in storage and transport (a report of which has been issued as E.M.B. 36) led them to place considerable emphasis on the use of rapid cooling processes. They considered that the extension of this practice would act as a preventive measure in the control of banana diseases, and possible preventive measures are all too few.

This recommendation, which had a great deal to be said for it from the scientific point of view, was far from easy to translate into terms of actual commercial practice. All cooling processes have their risks and it seems to be a general rule that the more rapid the process the greater is the peril of damage to the product. It was felt in trade circles that more should be known about the effect of these rapid processes on the fruit before an attempt was made to adopt it generally. It was feared that some deleterious effects might result from "chilling" and might lead to wastage and loss. It was, therefore, decided that Dr. Wardlaw and Dr. McGuire should undertake a further detailed investigation into the transport and storage of bananas with special reference to chilling.

The present Report, which embodies the outcome of these later researches, contains a great deal of information which cannot, I think, fail to be of interest and value to all who have to transport and store bananas. Indeed, everyone who is engaged on work of an analogous character, whether scientific or economic, will owe these two gentlemen a debt of gratitude.

I have pleasure in expressing my appreciation of the importance of their work.

T. DRUMMOND SHIELDS,  
*Chairman of the Research Grants Committee.*

Empire Marketing Board.  
*August, 1931.*

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Low Temperature Station,  
5th February, 1931.

The Empire Marketing Board.

Gentlemen,

It is our pleasure to submit a Report on the behaviour and diseases of the banana in storage and transport, with special reference to chilling.

In our previous Report we recommended rapid cooling as an important preventive measure in the control of banana diseases, and in view of the impression current in the Trade that chill effects would result from such a procedure, further detailed investigation seemed imperative. We have been able to confirm our previous recommendations and at the same time to define more accurately the nature and limits of chilling.

We have the honour to be,  
Gentlemen,

Yours respectfully,

CLAUDE W. WARDLAW, *Pathologist.*

LAURENCE P. McGUIRE, *Physiologist.*

## 1.—RETROSPECT.

RESEARCHES at the Low Temperature Station, Imperial College of Tropical Agriculture, Trinidad, are directed chiefly to the major problems of the Banana Industry, namely, the need for a substitute for the Gros Michel, and the prevention of wastage in cargoes.

In an earlier communication (1), attention was drawn to the promising possibility of the Cavendish (Trinidad Governor) as a substitute, while by correlating temperature and fungal growth it was advocated, *inter alia*, that the interval between reaping and commencement of refrigeration be shortened to the utmost and that the cargo be cooled to 53° F. as expeditiously as possible, by delivering air at that temperature.

While main-stalk rot is a considerable source of wastage in banana cargoes, another important source of depreciation is "chilling," through fear of which the Trade has for many years been prejudiced against rapid cooling. Our research then, of which the following is an account, was directed to determining the limits of chilling.

## 2.—WHAT IS CHILLING ?

Chilling is an unhealthy condition induced by exposure during storage and transport to unsuitably low temperatures, and in this respect is not unlike the premature physiological break-down of Bramley seedling apples stored at temperatures below 36° F. It is perhaps difficult to recognise externally in green bananas, though it has previously been identified in a general way by an increased development of brown streaks in the sub-epidermal tissues (2). A more detailed microscopic examination shows this characteristic colouration to be definitely associated with the mucilage ducts. The latter are channels which arise by the end-to-end union of a longitudinal series of parenchymatous cells, and correspond to the latex-vessels in other plants (3). These ducts often occur associated with vascular strands, but they are also distributed generally throughout the cortical tissues. Isolated cells, giving similar staining reactions,

(1) Wardlaw, C. W., and McGuire, L. P : The Behaviour and Diseases of the Banana in Storage and Transport. Empire Marketing Board, Report No. 36.

(2) Barker, J. : Wastage in Imported Fruit : Its Nature, Extent and Prevention. Dept. of Sc. and Ind. Res. Food Investigation, Special Report No. 38. H.M.S.O., 1930.

(3) Skutch, A. F. : Anatomy of Leaf of Banana, *Musa Sapientum* L. Var. Hort. Gros Michel. Bot. Gaz. LXXXIV, No. 4, 1927.

also occur here and there. According to Wittmack (1) their contents in *Musa ensete* are rich in potassium chloride, potassium oxalate and tannins. As a rule, these ducts are transparent and colourless, or, in normally ripened fruit, of a slight yellow colour only. In chilled fruit, on the other hand, their contents become modified, accompanied by the characteristic change of colour to a dark brown.

During ripening, chilling is easily recognised by several abnormalities :—

- (i) Delayed ripening (and in bad cases, complete failure to ripen).
- (ii) The hardening of the central placenta—more pronounced in the Cavendish than in the Gros Michel.
- (iii) The assumption of a dull yellow colour instead of a healthy bright one.
- (iv) In the Gros Michel as ripening proceeds, the dull yellow is replaced entirely by a dull russet colour, which later darkens and is rendered more unsightly by the presence of black blotches and patches which are soft to the feel. Sometimes the fruit shows a characteristic dark brown mottling, apparently associated with desiccation of tissues. In places one finds large sunken patches, and on cutting open, the tissue is found to be entirely broken down. It should be noted, however, that this russetting of the whole bunch has not been noticed in the Cavendish, even when kept for 50 days at 52° F. (*vide* Senescence Studies later). In point of fact, up to the present we have found it difficult to recognise chilling in this variety, as fruit picked at an immature stage shows, on ripening, hardness of centre, dullness of colour, a tendency to browning (not typical Gros Michel russetting)—characteristics which at an earlier stage had been tentatively regarded as chill effects. When definite chilling was established in the Cavendish, it was readily recognised during ripening at 70° F. by the assumption of a dull, sooty, ashen colour.
- (v) In both varieties, the complete loss of banana flavour or the presence of a strange “cold-storage flavour.”
- (vi) (a) “Green-ripeness”  
(b) “Hard-ripeness” } These are referred to later.

While chilling, except in severe cases, seldom causes total loss, the resultant poor-flavoured, unattractive product commands low prices in the market.

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(1) Wittmack, L.: *Musa ensete*. Ein Beitrag zur Kenntniss der Bananen. *Linnaea* 35, 1867.

### 3.—SENESCENCE STUDIES.

In our storage studies, in which we have endeavoured to repeat trade conditions, the fruit has usually been kept for a period of from 15 to 24 days in cold storage at 52°–55° F., after which it was transferred to the ripening room at the higher temperature of 70° F. In the course of these senescence studies, however, a departure from the usual routine was made, in that the fruit was not transferred to the ripening room but left indefinitely at cold storage temperatures, by way of determining (1) the retarding action of cold temperatures on the ripening enzyme (or enzymes), (2) the storage expectancy at those temperatures, and (3) the adverse effects, if any, of long storage at those temperatures.

#### *Senescence Study No. 1 at 53° F.*

In the first of these senescence studies, four vigorous Cavendish bunches of good count which were not quite "¾-full" were kept at 53° F. On the thirtieth day the fingers were commencing to yellow, though finger-tips and finger-stalks remained absolutely green. Four days later this fruit, while not having quite reached table-ripeness, was extraordinarily attractive in appearance, the greenness of both the main-stalk and the hand cushion presenting a striking contrast to the bright yellow fingers. This temperature is evidently not sufficiently low to inhibit the functioning of the ripening enzyme (or enzymes); saccharification was proceeding at a faster rate than respiration, with consequent accumulation of sugars and increased deposition of pigment. With certain varieties which fail to ripen regularly under ordinary banana conditions, this may prove a solution, though the increased costs would probably render this impracticable. On the thirty-eighth day there was still no sign of senescence and decline, but there was, however, a slight hardness in the centre, which was more pronounced in the less mature bunches. After two days in the ripening room this hardness-of-centre diminished appreciably, though the fruit tended to break "hard." This is not surprising after 40 days' storage, during which the fruit had been subjected to a good deal of desiccation. In earlier storage trials at this temperature, the tendency to hardness-of-centre had frequently been noted in immature Cavendish bunches, and should, therefore, not necessarily be regarded as the result of long storage at 53° F.

A second senescence study was carried out at 52° F., and a third at 52.5° F. The more important developments are set out in concise

diary form as an Appendix, but the salient features may be summarised as follows :—

(1) The studies conducted at 53° F., 52·5° F. and 52° F. respectively, with fruit representing a gradation in maturity, depict in an interesting way the length of storage life before the onset of senescence and decline for the different temperatures of storage.

(2) As the cooling of the small consignments used was necessarily very rapid, they show in a striking way that the onset of chilling is a result of the cumulative effect of duration of exposure to the low temperature, and (2) further show the numerous ways in which chilling, whether slight or serious, may manifest itself, and, therefore, provide excellent criteria for the chilling experiments described later.

(3) They emphasise the importance of the time factor in wastage of fruit and main-stalks which have become contaminated with the various rot organisms. For the purpose of short storage of 14–17 days, temperatures in the neighbourhood of 52·5° F. have been sufficiently low to retard fungal growth so as to give no trouble in ripening and handling ; in these longer trials, on the other hand, fungal growth was a decided factor in shortening the storage expectancy.

#### 4.—PRELIMINARY RAPID COOLING EXPERIMENTS.

In an earlier paper, we expressed the view that our comparative freedom from main-stalk rot was largely due to the rapidity with which we were able to cool down our smaller consignments—a practice against which the trade, however, seems prejudiced through fear of chilling. It was felt, therefore, that precise information, defining the limits of chill and the duration of exposure inimical, was of primary practical importance. To these ends we have aimed at the more and more rapid cooling of consignments to progressively lower temperatures.

The fruit was obtained from various sources in the island, on account of the great scarcity owing to a very dry season ; latterly, however, our Gros Michel was mostly derived from one source and

our Cavendish from three. As is to be expected under the circumstances, the fruit was not of standardised plantation uniformity; for each storage trial we have endeavoured to obtain two hundred standard bunches, or as near that figure as possible, making up the balance, for the sake of introducing the complex of bulk, with bunches which would normally have been rejected by the Trade. These do not appear in the figures in items 8-13 in Table I, which are expressed as percentages of the original number of "count" bunches.

It is perhaps to be regretted that facilities were not available for the weighing of our consignments as they arrived by lorry. The College Department of Sugar Technology, to whom we express our thanks, kindly consented to our making use of their sugar-cane weigh-bridge; unfortunately, the time involved, the extra cost, and particularly the increase of mechanical damage in the extra operations of loading on to small carts, etc., precluded its use\*.

As a general rule during a storage trial, the ratio, volume of fruit : volume of circulating air was approximately 1 : 2. This is considerably lower than that obtaining in the holds of banana boats, and has contributed materially to rapid cooling and to low concentrations of carbon dioxide in the storage atmosphere. We have thus found it necessary to "blow out" only once daily for five minutes at 6 p.m., while the atmosphere was sampled at 8 a.m., 11.30 a.m. and 3.30 p.m. daily, and analysed by means of a Haldane Gas Analysis Apparatus.

The relative humidity of storage chambers and ripening room was approximately 85-90 per cent. and ripening was conducted at 70° F. Furthermore, throughout the experiments the fans delivering air over the brine pipes were worked at maximum. The usual procedure of cutting and vasing carefully immediately prior to commencement of refrigeration and of frequent inspections and mycological examinations, especially during ripening, were continued, and developments noted.

For the purpose of simplifying the description of results, the details of the storage trials are tabulated below (Table I).

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\* According to E. Holmes (Banana Cultivation in the Canaries, Trop. Agric. VII, No. 12, 1930), the average weight of exportable Cavendish bunches is 44 lb.

TABLE I.

	<i>Bulk trial 5.</i>	<i>Bulk trial 6.</i>	<i>Bulk trial 7.</i>
1. Temperature of brine at commencement of loading .. .. .	31° F.	47° F.	34° F.
2. Temperature of store at completion of loading .. .. .	62° F.	58° F.	56° F.
3. Temperature of store after fruit has been cooled down .. .. .	52° F.	52° F.	52.5° F.
4. Time in hours before air temperature was 53° F.:			
(a) delivery .. .. .	2½	1	1
(b) return .. .. .	7½	7½	1½
5. Time in hours before air temperature was 52.5° F.:			
(a) delivery .. .. .	—	—	2½
(b) return .. .. .	—	—	13½
6. Time in hours before air temperature was 52° F.:			
(a) delivery .. .. .	4	1½	—
(b) return .. .. .	14	12	—
7. Number of days in cold storage ..	10	14	24
8. Percentage of "ship-ripes" .. .. .	—	—	—
9. Percentage of total rejects .. .. .	—	—	—
10. Percentage of attractive "ripes" by sixth day .. .. .	27%	50%	89%
11. Percentage of attractive "ripes" by tenth day .. .. .	100%	96%	98%
12. Percentage which failed to ripen ..	—	—	—
13. Percentage chilled slightly .. .. .	—	4%	2%

The following are the more important facts emerging from the above trials:—

(1) The slight chilling observed in Nos. 6 and 7 raises the question as to whether the cumulative effect of duration of exposure to the temperature of storage rather than the rapid cooling down to that temperature, is responsible for the chill. For instance, after exposure of 24 days to 52.5° F. (No. 7) and of 14 days to 52° F. (No. 6), slight chilling effects were observed, but not so after 10 days at 52° F. (No. 5), in which cooling was but slightly less rapid than in No. 6. It is significant that bunches of Gros Michel which were left at 52° F. for a further five days, making fifteen days in all, showed characteristic chill effects. This will be discussed below in the next series of experiments.

(2) The chill effects were found in the Gros Michel only, and not in the Cavendish, corroborating the results found in the senescence studies. It will be recalled in our earlier paper, that in Bulk Trials 3 and 4 of Cavendish, after quick cooling and exposure of 21 and 22 days respectively to 52° F., the fruit ripened normally and attractively.

(3) Quite apart from this advantage of cold resistance, the Cavendish has stood ordinary Gros Michel uncrated conditions remarkably well. Vigorous bunches of good count consistently ripened attractively, indicating the importance of favourable pre-storage nutritional factors on the well-being in storage and subsequent ripening. It would be interesting indeed to study, in very much larger consignments, the storage behaviour of the Cavendish grown under uniform plantation conditions and intensive cultivation.

(4) In No. 5 trial, a number of bunches of Silk Fig, a variety of small bunch habit and small count, were introduced, chiefly to make up bulk. When thoroughly ripe, this variety has a pleasant sub-acid flavour, and on that account it was thought might find favour in limited quantities as a curiosity in oversea markets. It has the peculiar characteristic of turning yellow at a stage of maturity very much earlier than that of any other variety experimented with at this Station. At this stage, while attractive in external appearance, it has a very astringent taste. A variety, up to which the public require special education, can hardly be recommended unless it possesses some outstanding qualification, such as external beauty, flavour and texture, or high food value.

(5) While one must necessarily be guarded in defining the precise stage of maturity of a bunch of comparatively unknown pre-storage history, it seems safe to say that our experience has been, particularly in the case of Gros Michel, that after storage at 52° F. of 14–17 days, ripening has been perceptibly retarded. This would involve extra costs to the ripening consignees. It was thought that a simple modification might ensure the beneficial effects of quick cooling without the complication of slower ripening. Its merits were tested out in Bulk Trial No. 8, the details of which, for the purposes of clarity of description, are tabulated below (Table II).



TABLE II.

	<i>Bulk trial 8.</i>
1. Temperature of brine at commencement of loading ..	38° F.
2. Temperature of store at completion of loading ..	64·6° F.
3. Temperature of store after fruit has been cooled down	52° F. for 4 days ; then 53·6° F.
4. Time in hours before air temperature was 52° F. :	
(a) delivery .. .. .	3½ hours.
(b) return .. .. .	18 "
5. Number of days in cold storage .. .. .	15
6. Percentage of "ship-ripes" .. .. .	Nil.
7. Percentage of "total rejects" .. .. .	Nil.
8. Percentage of attractive "ripes" by sixth day ..	40%
9. Percentage of attractive "ripes" by tenth day ..	90%*
10. Percentage which failed to ripen .. .. .	Nil.
11. Percentage chilled .. .. .	Nil.

Several points call for further consideration.

(1) There was definitely no chill, and ripening proceeded at normal rates.

(2) There was, however, a good deal of main-stalk rot. A consideration of the several possible contributing factors indicated that this was due to the rough treatment of the fruit by several new hands engaged in the loading operations. On arrival at the Station, numerous otherwise good bunches had perforce to be rejected on account of damage to the main-stalk.

The question of the banana as a substitute or auxiliary crop for some of the West Indian Islands has been engaging the attention of their Directors and Superintendents of Agriculture. A shipping company would require a guarantee of a definite quantity per ship before considering the venture, and it is realised that an extensive acreage would have to be planted up to ensure even 1,000 bunches per fortnight of fruit of precisely the same stage of maturity, and thus a certain amount of fruit, reaching picking maturity between the arrival of boats would have to be pre-cooled. What would be the effect of exposure to tropic temperatures during transference from the pre-cooling station to the ship's hold? In this experiment, the behaviour of fruit removed from storage after four days at 52° F., exposed to ordinary laboratory temperature (82° F.) for 2½ hours, and then transferred to 53·6° F., showed that the exposure *per se*

\* This consignment was on the immature side, as evidenced by the low percentage of "ripes" by the sixth day, especially considering temperature of storage. The remainder ripened by the twelfth day.

caused no abnormality, nor was there any appreciable difference from the point of view of main-stalk rot. This experiment was repeated with corroborative results; after the fruit had been stored for six days at 52° F. it was exposed to laboratory temperatures for five hours, after which it was stored for eighteen days at 53·6° F. and then ripened up normally. It must be remembered, however, that a small consignment, on being transferred to the cold chamber, would quickly assume the temperature of storage, which would retard respiratory and fungal activity. But the matter might be very different in the case of large consignments. With the use of insulated barges to the ship, expeditious handling to reduce to the minimum the exposure to tropic temperatures, and adequate refrigeration efficiency on the ships, the problem does not seem insoluble. The importance of the time factor in fungal wastage has been so marked, that fruit, to be reaped prior to one week of the boat's arrival, presuming a 14 days' voyage to the ripening room, should not be cooled for shipment but used for local consumption.\*

Running parallel with this experiment, but not referred to in the Table above, a number of bunches of both Gros Michel and Cavendish were stored at 53·6° F. from the commencement of the experiment, and at intervals of 16, 20 and 24 days were removed to the ripening room. These bunches showed no abnormality of ripening—this fact will be made use of in the next experiment.

#### 5.—DETAILED CHILL EXPERIMENTS.

The question of chill was studied in greater detail in the experiments which are now to be described.

##### *Bulk Trial 9.*

It has been shown that chilling effects have not been produced by:—

- (1) Cooling to 52° F., no matter how rapidly, provided temperature of air delivery is not below 52° F.;
- (2) exposure of fruit to 52° F. for 4 days and then to 53·6° F. for 11 days;
- (3) exposure of fruit to 53·6° F. for as long as 24 days.

In the absence of a factor or factors unknown, it follows logically that if fruit is attendant with characteristic chill effects after exposure

\* It is realised that such procedure is not current practice in the Industry. These observations, however, have been set down by way of replying to questions that have recently been forwarded to us from interested Islands.

to 52° F. for a period of X days (X days greater than 4) and then to 53·6° F. for 24-X days, such chilling must be attributed to the exposure to 52° F. for X days.

Accordingly, in this bulk trial, conducted at 52° F., three bunches of Cavendish and three of Gros Michel were removed each day and placed in a second storage chamber maintained at 53·6° F. for the remainder of the 24 days' period. Each bunch had been carefully labelled and given a serial number, and after transference to the ripening room, was examined at frequent intervals and observations noted. The details of the experiment are tabulated below (Table III).

TABLE III.

1.	Temperature of brine at commencement of loading ..	27° F.
2.	Temperature of store at completion of loading ..	60° F.
3.	Temperature of store after fruit has been cooled down	52° F. and 53·6° F. ( <i>vide text</i> ).
4.	Time in hours before air temperature was 53° F. :	
	(a) delivery .. .. .	3½
	(b) return .. .. .	8½
5.	Time in hours before air temperature was 52° F. :	
	(a) delivery .. .. .	4½
	(b) return .. .. .	16½
6.	Number of days in cold storage .. .. .	24
7.	Percentage of "ship-ripes" .. .. .	3% (just turning yellow).
8.	Percentage of total rejects .. .. .	Nil.
9.	Percentage of attractive "ripes" by sixth day ..	31%
10.	Percentage of further attractive "ripes" by tenth day	29%
11.	Percentage showing chill effects by sixth day :	
	(a) "Green-ripe" .. .. .	10%
	(b) "Hard-ripe" .. .. .	1%
	(c) Dull or pasty-coloured .. .. .	7%
	(d) Russet-coloured .. .. .	2%
	Total .. .. .	20%
12.	Percentage showing chill effects by twelfth day :	
	(a) "Green-ripe" .. .. .	4%
	(b) "Hard-ripe" .. .. .	Nil.
	(c) Dull or pasty-coloured .. .. .	7%
	(d) Russet-coloured .. .. .	2%
	Total .. .. .	13%
13.	Percentage showing further chill effects in their failure to ripen in 17 days .. .. .	4%

It will be noted :—

- (1) That the temperature of the brine was very low, 27° F.; and
- (2) that the cooling was very rapid, especially considering that this was a large consignment ;
- (3) the total percentage of bunches showing chill effects was 37 per cent., and this was manifested in several ways, e.g., failure to ripen, or ripening to a dull, pasty or russet colour, "green-ripeness" and "hard-ripeness." The first-named have been described under Senescence Studies, so our attention will be confined to the two mentioned last.

"*Green-ripeness*," as the name implies, is a condition in which the yellow colour is poorly developed, giving the impression of being but half-ripe, while the edible portion is quite as soft as, or even softer than, a normally ripe and even over-ripe banana. This has been popularly attributed by the Trade\* to too high a temperature of ripening during the summer time, but there is no doubt that a similar condition can be induced by chilling. For purposes of standardisation, our ripening throughout has been conducted at 70° F.

A less frequent chill effect is "*hard-ripeness*," in which, as the name implies, the fruit is fully coloured (sometimes slightly dull) as in a ripe fruit, but the flesh is absolutely as firm as in a green fruit. The chill effect we have referred to above as "dull or pasty colour," is quite distinct from this, in that the flesh is as soft as in a normally ripened banana, and, except in severe cases, is quite palatable.

This experiment confirms our earlier finding, namely, that the duration of exposure to 52° F., inimical to the Gros Michel, is approximately 14 days, when slight chilling is evident. As this exposure is increased, chill effects become more pronounced, until, in the case of many bunches which had been kept at 52° F. for the whole period of storage (i.e. 24 days), many showed obvious "green-ripening" and marked russetting.

While the great majority of Gros Michel, which were exposed for longer than 14 days to 52° F., showed chilling effects to varying degrees, nevertheless, many ripened attractively and as many as 13 per cent. of the bunches left for 24 days at 52° F. ripened to products of extremely pleasing appearance. *In every case these were vigorous bunches of high "count."* This emphasises the view expressed earlier that favourable pre-storage factors play an important part in the well-being of the fruit in storage and its resistance to cold. This is an important observation, and commends itself as a subject for more detailed study later.

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\* Barker, J., *Loc. cit.*

*Up to the present, the Cavendish has shown no definite chill effect at 52° F., despite the rapidity of cooling and the duration of exposure to that temperature.*

*Bulk Trial 10.*

The behaviour of Gros Michel and Cavendish at 52° F. has proved comparatively consistent, and it seems that our original recommendation of quick cooling to 53° F. allows of a considerable margin of safety, namely, 1° F. over a period of 14 days.

Bulk Trial 10 was to be conducted at 51° F., but unfortunately, owing to failure of the automatic electric thermostatic controls, temperatures fluctuated between 50°–51° F. The experiment was continued so that the harmful effects, if any, might be observed. In making any recommendation to the Trade, it is realised that a margin of safety is essential.

By way of assessing more accurately the effects of the lower temperature, the following procedure was adopted :—Each morning four comparable bunches of Gros Michel and of Cavendish were removed, divided into two representative consignments, and each bunch labelled and given a serial number. One lot was then stored at 53·6° F., while the other was transferred to the ripening room. Observations as to their behaviour were made at frequent intervals and compared. The details of the experiment are tabulated below (Table IV).

TABLE IV.

1.	Temperature of brine at commencement of loading	..	25° F.
2.	Temperature of store at completion of loading	..	64° F.
3.	Temperature of store after fruit has been cooled down	..	50° F.—51° F.
4.	Time in hours before air temperature was 53° F. :		
	(a) delivery	.. .. .	4
	(b) return	.. .. .	12½
5.	Time in hours before air temperature was 52° F. :		
	(a) delivery	.. .. .	4½
	(b) return	.. .. .	16½
6.	Time in hours before air temperature was 51° F. :		
	(a) delivery	.. .. .	5½
	(b) return	.. .. .	24½
7.	Number of days in cold storage	.. .. .	24 ( <i>vide text</i> ).
8.	Percentage of "ship-ripes"	.. .. .	Nil.
9.	Percentage of attractive "ripes"	.. .. .	34·5%
10.	Percentage showing chill effects :		
	(a) "Green-ripes"	.. .. .	8%
	(b) "Hard-ripes"	.. .. .	4%
	(c) Dull or pasty-coloured	.. .. .	20%
	(d) Russet-coloured	.. .. .	31%
	(e) Failed to ripen	.. .. .	2·5%
	Total	.. .. .	<u>65·5%</u>

For the first time we have induced chilling in the Trinidad Governor (Cavendish). In less severe cases the skin assumes a pasty, dull colour, and in more severe cases a brownish, sooty, ashen-grey, together with the almost complete loss of flavour. No russetting has so far been observed with this variety, but there has been an appreciable tendency to "hard-ripeness."

At the commencement of ripening, the consignment was characterised by comparative freedom from main-stalk rot, due, no doubt, to the low temperature of storage. In the comparatively slower rate of ripening subsequently in fruit which had been kept for most of the time at the lower temperature, main-stalk rot developed rapidly, and in many cases had already progressed into the cushion of the top hand before the fruit had ripened. On the grounds of (1) expenses to the jobber, (2) the additional opportunities afforded to the rot organism during the slower ripening, and (3) the narrow margin of safety, a temperature of 51° F. for transport is not recommended.

*Bulk Trial 11.*

This storage trial with Gros Michel and Cavendish was again conducted at 51° F. in No. 3 chamber, and, as before, rapid cooling was aimed at. At commencement of loading the temperature of the storage air was 51° F.

The rate of cooling down was as follows:—

	<i>Delivery.</i>	<i>Return.</i>
53° F. .. ..	After 4 hours.	After 12½ hours.
52° F. .. ..	" 4½ "	" 17 "
51° F. .. ..	" 7½ "	" 26 "

After a return temperature of 51° F. had been obtained, four bunches of Gros Michel and four of Cavendish were labelled and removed daily for 24 days from No. 3 chamber and divided into two lots: the first was immediately hung up in No. 1 chamber at 70° F., developments during ripening being noted at frequent short intervals ("x" series), while the second lot ("y" series) was transferred to No. 4 chamber, held at 53·6° F., for the remainder of the "voyage" period of 24 days, to be ripened subsequently.

In the "x" series the first occurrence of chill was noticed in fruit which had been subjected to nine days' exposure to 51° F. in the case of the Gros Michel and to 13 days' in the Cavendish variety. As the exposure increased the chill became more marked, all the chill effects mentioned above being in evidence. From the eighteenth day, it was

really unnecessary to hang up the Gros Michel bunches as there was a predominant russetting throughout the consignment. In the Cavendish, however, chilling was not so readily recognisable at this stage, but after a few days in the ripening room was evident in the smoky ashen-grey colouration. The "y" series gave confirmatory results and further substantiated the view that exposure of as much as 24 days to 53·6° F. was not harmful to both varieties.

#### 6.—TREATMENT OF MAIN-STALK ROT.

In all our storage trials, we have persisted with the vaseline treatment, and have found it efficacious, when properly applied. While the cut end is undoubtedly the main source of entry and protection at this point therefore advisable, it must be remembered that an easy entry for the rot organisms is also provided by breaks in the main-stalks, rupturing of the hand-cushions through careless handling, and skin punctures by animal agencies. In the ripening room, the cord by which the bunches are suspended causes a rupture of the stem, and provides an ingress for fungal organisms which progress upwards towards the vaselined end and downwards towards the first hand. Main-stalk rot has proved serious in the case of bunches which, through immaturity at harvesting or through chilling, ripened more slowly than normal.

As far as we have been able to ascertain, successful treatment of stems to prevent main-stalk rot must consist essentially of two operations :—

- (i) The cutting off of a small portion of the stalk, whereby organisms which become associated with the stem end in the interval between reaping and loading are removed ; and
- (ii) A suitable means of preventing re-infection, such as vaseline, sterilised tallow, etc.

The simple tying of grease-proof paper over the freshly-cut stem-end in a preliminary trial was found efficacious. The delay which would be occasioned in the loading operations by the tying process or the expense of a more rapid substitute—adhesive paper or tape, or elastic binders—not to mention the cost of grease-proof paper, precluded further experiment with a view to representing it to the Trade. Experimental bunches, which were completely enclosed in large brown paper bags immediately after reaping, and then shipped, were reported to have reached their destination in better condition, from the point of view of stalk rot, than naked fruit.

Vaseline is objected to on the grounds of smearing contact fruits, but we have not noticed this to any appreciable extent as only a thin coating was used. Since similar smearing materials would not find favour on the same account, various rapidly-drying sealing materials, such as acetone and collodion, two kinds of varnish, flour paste, gloy, etc., were experimented with. While for the first few days the treated stems appeared superior to the untreated ones, the desiccation process was invariably attended with the formation of deep fissures in the stem tissue, and later the rot organisms progressed downwards in the usual way.

#### 7.—MYCOLOGICAL OBSERVATIONS.

In an earlier paper\* some account was given of the activities of various fungi which play important parts in the production of main-stalk, finger-stalk and fruit rots, during storage trials. The collection of organisms isolated included *Thielaviopsis paradoxa* (De Seyres) Von Hohn., *Gloeosporium musarum*, Cke. and Masee, *Botryodiplodia theobromae*, Pat., and species of *Phomopsis*, *Nigrospora*, *Verticillium* and *Fusarium*. Two mycological aspects were investigated in some detail, namely, the rate of growth of the organisms at different temperatures, and their parasitic behaviour as determined by inoculation experiments. By correlating the results obtained with trade conditions of transport and storage, it was possible to submit recommendations for curtailing wastage in cargoes.

In these investigations it was demonstrated that while many of the organisms isolated grow rapidly at the normal air temperature (78°–82° F.), their growth rates at the cool temperature of transport (53°–55° F.) are very considerably reduced. The length of time that elapses between the reaping of fruit and cooling to 53° F., therefore, is of fundamental importance in determining the extent of infections. Thus, the recommendations submitted regarding main-stalk rot aim at eliminating infections from the cut ends of the main-stalk by a process of trimming and vaselining on the quay-side immediately before loading into the holds. If the latter are then rapidly cooled to 53° F., new infections can only become established at the lower temperature, so that during the relatively short voyage and subsequent brief period in the ripening room, the amount of disease developed is not extensive.

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\* Wardlaw, C. W., and McGuire, L. P., *Loc. cit.*



The time factor is important in determining the extent of infections at the higher temperatures, as indicated above. Even at the lower temperature of transport, however, fungal growth continues at a reduced rate, and in time existing infections become extended, and may ultimately be responsible for a considerable amount of wastage. On this point the long-storage trials described in previous sections have afforded ample corroboration.

*I. Extent of disease at the end of a long-storage trial (24 days at 52° F., then ripened for 6-8 days at 70° F.).*

In our earlier bulk storage trials, the amount of fruit disease in carefully handled consignments was of limited extent, most of the infections being definitely associated with bruises sustained in handling or with punctures and wounds caused by animal agencies. At the end of our longer storage trials, on the other hand, the amount of fungal infection was much more significant, and there was considerable wastage on account of finger-dropping, blemishing and rotting of the fruit, *Gloeosporium* being particularly conspicuous.

In some instances the amount of main-stalk rot was considerable, but as the vaseline treatment (*vide* previous work) had been carefully applied, it was not a limiting factor in handling the bunches.

In order to extend our information on the subject of fruit diseases, many isolations of fungi were made from diseased finger-stalks, finger-tips, spots, blemishes and bruises, at the end of a storage trial of 24 days at 52° F.\* The following organisms (Table V) were obtained.†

The examples of bruising and finger-stalk rot were of the types described in our previous work, but accentuated by the long period in storage. Further reference to these sources of wastage is, therefore, unnecessary. On the other hand, some of the spotting and finger-tip diseases not hitherto observed and of relatively frequent occurrence in the longer storage trials, call for more detailed consideration.

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\* We are much indebted to Mr. S. F. Ashby, of the Imperial Mycological Institute, for verifications and identifications.

† A few of the fungi mentioned in Table V did not occur during long-storage trials, but are recorded here for convenience. Other references are made to them in the text.

TABLE V.

Variety of Banana.	Finger-stalk Rot.	Blemishes and Bruises.	Spotting Diseases.	Finger-tip Rots.
Cavendish ..	Gloeosporium musarum ; Botryodiplodia theobromae ; Fusarium spp.	Gloeosporium musarum ; Pestalozzia fuscescens ; Eidemia sp. ; Fusarium spp.	Gloeosporium musarum ; Botryodiplodia theobromae.	Gloeosporium musarum (several strains) ; Botryodiplodia theobromae ; Verticillium sp. ; Fusarium spp.
Gros Michel ..	Gloeosporium musarum ; Botryodiplodia theobromae ; Fusarium spp.	Gloeosporium musarum ; Botryodiplodia theobromae ; Helminthosporium torulosum ; Fusarium spp. ; Penicillium glaucum ; Phomopsis sp.	Gloeosporium musarum ; Botryodiplodia theobromae ; Pestalozzia fuscescens ; Helminthosporium torulosum.	Gloeosporium musarum (several strains) ; Botryodiplodia theobromae ; Fusarium spp.
Lacatan ..	Gloeosporium musarum ; Botryodiplodia theobromae.	Gloeosporium musarum ; Botryodiplodia theobromae.	—	Gloeosporium musarum ; Botryodiplodia theobromae ; Helminthosporium torulosum.
Hybrid GM × B2	—	—	Gloeosporium musarum.	—

## II. Fruit Spotting Fungi.

### (a) On the hybrid GM × B2 (I.C.1).

The most outstanding example of a spotting disease occurred on this variety, and was first observed during a chilling experiment when fruit was being maintained at 52° F. for 24 days.

*Appearance.*—While fruit was still in the green stage, a large number of minute spots, like pin-pricks, particularly in the distal region of the finger, were observed. At an early stage they became brown and sunken, and were surrounded by a halo of slightly discoloured tissue. These small wounds appear to have been caused by some sucking insect or insects, and on sectioning, the affected cells were found to be collapsed, shrunken, and of a brown colour.\* At this stage no

\* We are indebted to Professor H. A. Ballou for supplying information to us regarding possible insect agencies concerned.

associated fungal hyphae could be observed. In the course of 10 to 20 days the blemishes spread, became sunken and of a dark brown colour, while the original centre remained conspicuous because of its lighter colour. The spots spread to a diameter of one centimetre or more, and coalesced here and there. The final result was to render the fruit decidedly unsightly (Fig. 1). In sections through the larger spots, fungal hyphae were invariably observed. Thus, while the initial injury is due to insects, the final unsightly appearance of the fruit is to be attributed to fungal activity. The general effect produced bears a close resemblance to fruit injured by fruit-spotting bugs, figured by Veitch and Simmonds.\* When pieces of tissue from 43 spots were cultured on a sterile synthetic medium, following the usual mycological procedure, 7 gave no organism, 3 gave a strain of *Gloeosporium musarum*, while 33 gave similar cultures of a species of *piricularia grisea*.

(b) *On the Gros Michel.*

Insect punctures very similar to those on the hybrid GM×B2, were also observed on the Gros Michel, and while a fairly conspicuous spotting developed on some fruit, as a whole the degree of blemishing was by no means comparable. *Helminthosporium torulosum*, *Gloeosporium musarum*, *Phomopsis* sp., and a fungus we have not yet identified, were isolated from such spots.

Occasional black circular spots, 1-1.5 cms. in diameter, also occurred on the Gros Michel, and on several occasions a species of *Pestalozzia* was isolated. Other spots yielded cultures of *Botryodiplodia theobromae*.

(c) *On the Cavendish Banana.*

Some isolated spots were occasionally observed on the Cavendish banana, and on investigation, cultures of *Gloeosporium musarum* and *Botryodiplodia theobromae* were isolated. Fruit from some areas was also markedly affected by sucking insects, but no extensive spotting comparable to that on the hybrid GM×B2 has yet been observed.

Inoculation experiments, using the methods described in our earlier paper, were carried out under typical storage conditions with *Pestalozzia* and *Helminthosporium*, by placing spores on the surface of injured and uninjured fingers of the Gros Michel and Cavendish

\* Veitch, R., and Simmonds, J. H. : Pests and Diseases of Queensland Fruits and Vegetables. Government Printer, Brisbane. 1929.

*To face page 27.*



**FIG. 1.** Three stages in the development of a spotting disease on the hybrid GM × B2 (I.C.1).

varieties. Negative results were obtained throughout with *Pestalozzia*, but *Helminthosporium*, when placed on scratches or stabs, produced dark localised blemishes on the skin, the underlying flesh being unaffected even at the end point of the experiment when the fruit had matured. This fungus was also applied to the distal ends of trade Gros Michel and Cavendish fruits which had been previously incised, but at the end of ten days at normal temperature (78°-82° F.) no effective penetration had taken place and typical "Black Tip" was not obtained. This lends confirmation to Ogilvie's finding that ripening of the fruit appears to inhibit further parasitic activity.\* Ashby,† who has given an account of this organism in its capacity as a leaf parasite causing Black Spot-Disease, found on some occasions that the young fruits were badly spotted but that no active rotting ensued.

### III. Finger-tip Diseases.

#### (1) General Account.

A number of finger-tip diseases have already been described by other investigators. These arise from infections of the perianth or style at the distal end of the finger, and by progressing along the fruit may cause a considerable amount of rotting. Even though the flesh may be but slightly attacked, such infections render the fruit decidedly unsightly and unsuitable for marketing.

The finger-tip diseases already described include :—

(i) "Black-tip Disease" of the Cavendish banana in Bermuda, caused by *Helminthosporium torulosum*, Syd. Ashby, Comb. Nov. (*Cercospora musarum*, Ashby). So far we have not observed this disease on the Cavendish in Trinidad, although the causative fungus has been isolated from spots and bruises on Gros Michel fruits, and also from a black-tip disease of immature Lacatan fruits.

(ii) "Cigar End," caused by *Verticillium sp.*; this disease is important in the Canary Islands, where a hand control is necessary. It has also been reported from the Gold Coast, the Azores, Panama and Queensland, and has been observed by us on the Cavendish banana (Governor) in Trinidad.

(iii) *Gloeosporium* tip-rot. A tip-rot of the plantain has been recorded from India.

\* Ogilvie, L. : "Black-tip," a Finger-tip Disease of the Chinese Banana in Bermuda. *Phytopath* XVIII, 1928.

† Ashby, S. F. : Banana Diseases in Jamaica. *Bull. Dept. Agric., Jamaica*, Vol. 2, No. 6, 1913.

During our storage trials, five tip-rots, to wit, a *Botryodiplodia* tip-rot, a *Gloeosporium* tip-rot, Cigar End, black-tip of the Lacatan, and a *Fusarium* tip-rot of the Gros Michel, have called for more detailed attention. These may now be dealt with briefly.

(2) *Botryodiplodia* Tip-rot.

In our earlier studies, *Botryodiplodia theobromae* (Pat.) was frequently isolated from severe cases of main-stalk rot and occasionally from diseased finger-tips and finger-stalks of several varieties. Inoculation experiments on wounded fingers and finger-stalks over short storage periods at 53° F., however, yielded minor blemishes only.

During long-storage trials, however, a finger-tip disease of the Gros Michel, Cavendish and Lacatan varieties was of frequent occurrence. In contrast to the usual localised disease which follows mechanical injury, this tip infection appears to originate in the decayed perianth or style, from which it spreads uniformly along the fruit, causing a progressive brownish-black discoloration of the skin. The disease, which becomes prominent as the fruit is approaching maturity in the ripening room, may sometimes affect two-thirds of the finger, the flesh being rendered soft and pulpy or even semi-liquid, with a sweetish odour, while the skin becomes soft and wrinkled. At this stage numerous small black pycnidia can be observed on the brown skin, and at some points the characteristic greyish-green mycelium of *Botryodiplodia* is also present. Even in relatively advanced stages of the disease, secondary organisms were little in evidence. Pure cultures of *Botryodiplodia theobromae* were consistently isolated from such tip-rots of the Gros Michel, Cavendish and Lacatan varieties.

Inoculation experiments, using the Cavendish and Gros Michel varieties, were carried out along the following lines.

Fruit was sterilised and placed in large desiccators as described in our previous report, and the fungus applied to both wounded and unwounded figures. Small incisions were also made at the distal (perianth) end of the fruit and inoculated. The containers were then kept for 2 days at 70° F., 13 days at 53·6° F., and 9 days at 70° F. (24 days in all). Localised blemishes were produced by the fungus where the fruit had been injured, but the characteristic tip-rot was not obtained during this normal storage period. The experiment was repeated, the containers being kept at room temperature (78°–82° F.) for 5 days, and thereafter transferred to 51° F. At the end of 14 days some of the fruits were badly affected with tip-rot and prematurely



FIG. 2. Three stages in the development of *Botryodiplodia* tip-rot of the Gros Michel, produced during an inoculation experiment.

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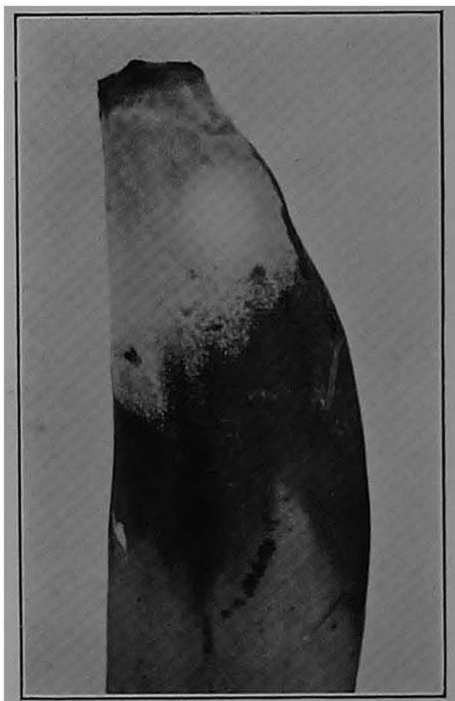


FIG. 3. *Botryodiplodia* tip-rot of the Gros Michel, produced after ten days at room temperature.



FIG. 4. *Botryodiplodia* infection of the Cavendish banana (see text).



FIG. 5. Three stages in the development of *Gloeosporium* tip-rot, obtained from an inoculation experiment.



ripened, while others only showed slight blemishing (Fig. 2). Such variable results indicate that pre-storage as well as other factors are important in determining the incidence of disease.

When fingers of the Gros Michel and Cavendish varieties were inoculated at incisions at the distal end and maintained at normal temperatures (78°–82° F.) for 10 days, important infections resulted in every case, and characteristic tip-rots were obtained. These were accompanied by an extensive exploitation of the flesh, which was reduced to the typical semi-liquid consistency. Fig. 3 shows a tip-rot of the Gros Michel produced by inoculation with *Botryodiplodia*, and Fig. 4 a Cavendish fruit rotted at the tip and still more extensively rotted at the stalk end, which had become accidentally inoculated by contact in the container. Such extensive infections have not been observed by us during the shorter storage trials.

### (3) *Gloeosporium* Tip-rot.

In previous storage trials, a strain of *Gloeosporium musarum* characterised by bright salmon-coloured acervuli (spore masses) was of frequent occurrence, infections on lateral bruises at the finger-tips being a usual feature of most consignments.

As maturity was being approached in the ripening room, after the long-storage trials described in Section 4, a finger-tip disease, apparently originating in the decayed perianth and spreading slowly backwards from the finger-tip for 2 cms. or more, was much in evidence on both the Cavendish and Gros Michel varieties. The affected tips became dark brown in colour, with a gradual transition through a watery-looking, greenish-brown margin, to the normal healthy yellow skin. At the same time the flesh within was slowly exploited, and after attack, consisted of moist disintegrated pulp, with a watery margin where deeper invasion was taking place. At a later stage the brownish-black region became covered with the acervuli (spore masses) of a strain of *Gloeosporium*. These were of a dark brick-red colour, in contrast to the more common strain of *Gloeosporium*, which sometimes became established secondarily at the extreme tip.\*

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\* A detailed account of the several strains of *Gloeosporium* isolated is not being attempted here; as this work is being carried out in co-operation with the Imperial Mycological Institute, Kew, cultures of *Gloeosporium* strains have been deposited there for fuller systematic investigation.

Inoculation experiments parallel to those described above for *Botryodiplodia*, were carried out, using the strain of *Gloeosporium* isolated from typical cases of tip-rot. In the first experiment covering the normal storage period, characteristic blemishes were obtained where spores had been applied to scratches and stabs on the skin. Only small blemishes, however, developed in the vicinity of the small inoculated incisions at the distal ends of the fingers, and the characteristic tip-rot was not produced. When inoculated and kept for 5 days at 78°-82° F., followed by 14 days at 51° F., some fingers showed tip-rots while others did not, again indicating the need for further investigation into pre-storage factors in relation to disease incidence. Fig. 5 shows three typical stages produced by artificial inoculation under the conditions described above.

When fingers of the Cavendish banana were inoculated at incisions at the distal end and kept at normal temperatures (78°-82° F.) for 10 days, typical finger-tip rots were invariably obtained, the distal end being affected over a distance of one inch, while the fruit was still in the greenish-yellow transition stage. The underlying flesh was much more extensively affected than was found when the disease developed under low temperature conditions. Fruits of the Gros Michel inoculated under similar conditions yielded similar but rather less extensive infections.

Dastur\* and Park† have also described a *Gloeosporium* tip-rot of the plantain in India. Dastur noted that with young fruits, the infection originated at the distal end through the perianth. In the *Botryodiplodia* and *Gloeosporium* tip-rots described here, the original seat of infection also appears to be the perianth, while pre-storage, time and temperature factors are clearly of importance in determining the incidence of active rotting of the finger-tips.

When pieces of withered perianths or styles from Gros Michel and Cavendish bananas were planted in plates of culture medium, a number of common fungi were readily obtained. It is the rule, however, that such fungi, though present in the perianth, do not give rise to significant infections during the usual short storage periods.

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\* Dastur, J. F.: Spraying for Ripe-Rot of the Plantain Fruit. Agric. Journ., India, Vol. XI, 1916.

† Park, M.: Tropical Agriculturist, LXXIV, p. 195. 1930.



FIG. 6. Black-tip disease of the Lacatan (*Helminthosporium torulosum*).

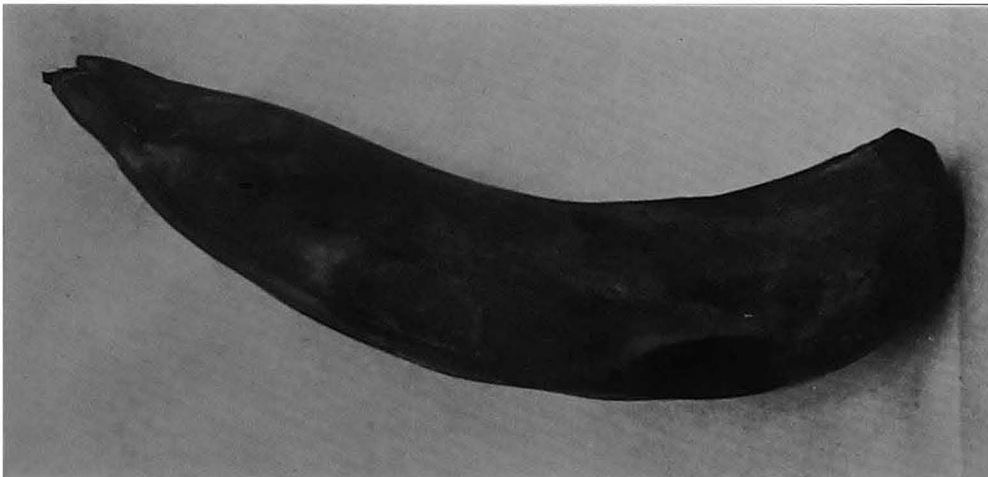


FIG. 7. *Gloeosporium* infections developed on a superficially sterilised fruit kept in an aseptic chamber (see text).

(4) *Cigar End.*

This is not a storage disease but one which occurs in the fields, the fruits being apparently most subject to infection in their more immature stages. Sometimes only a few fruits are affected, but at other times every finger in the bunch may show some degree of infection. Characteristic examples have been observed by us in Trinidad. The infection apparently originates in the perianth. From there it slowly spreads backwards along the finger, causing a shrinking and blackening of the skin, while the diseased region becomes covered with the powdery grey spores of *Verticillium*, which give the characteristic resemblance to a burnt cigar tip. The flesh within is slowly exploited by the fungus and is left in a dry, rotted condition. The disease made no further progress when fruit was taken into storage and kept under the usual trade conditions. From such material, cultures of *Verticillium* were consistently isolated.

(5) *Black-tip Diseases of the Lacatan.*

A "Black-tip" disease of the Cavendish banana has already been described from Bermuda, where it was demonstrated by inoculation experiments that the causal organism was *Helminthosporium torulosum* (Syd.) Ashby, comb. nov. (*Cercospora musarum*, Ashby). Ogilvie's description of the symptoms is as follows:—

"Under certain conditions a black discoloration becomes apparent just below the flower and progresses down the fruit. In about three weeks' time it may progress some two inches down from the tip. The diseased area is frequently irregular in outline, often affecting one side of the fruit more than another, and is bordered by a narrow grey or light yellow margin. An ill-defined zonation is frequently present."

A very similar tip infection of the Lacatan banana (Fig. 6) has occasionally been observed by us on immature fruit from the College plot.\* In older infections the blackened areas were frequently disrupted, apparently as the result of insect activity. Superficial scrapings, on microscopic examination, yielded spores of several fungi, including *Fusarium spp.*, *Acrothecium sp.*, and *Helminthosporium torulosum*, while the latter was also isolated from the innermost affected tissues. Further investigations are in progress.

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\* The first specimens were brought to our notice by Mr. R. T. Wigglesworth and Mr. W. F. Gwilliam, who observed them while studying the behaviour of the Lacatan as a field crop.

(6) *Fusarium Tip-rot.*

In some of the long-storage trials, a tip-rot of conspicuous appearance was occasionally observed in the Gros Michel. An early stage of the infection consisted in the development of a dark, watery-looking zone round the distal end of the finger. This discoloration spread slowly along the fruit over a distance of one to two inches, while in the older infected regions, as maturity was reached, the skin developed a dark, sooty appearance, more or less obscured by the development of a mat of pink mycelium of velvety texture. In the vicinity of the distal end, the flesh was reduced to a semi-liquid consistency by the invasion of fungal hyphae. Small samples taken from the junction of healthy and diseased tissue, when grown on culture media consistently yielded the same species of *Fusarium*. It remains to be determined by inoculation experiments the conditions under which the invasion of finger-tips by the organism takes place.

IV. *Latent Infections.*

Dastur noted that fruit may be infected by *Gloeosporium* long before it gets ripe, but that the fungus remains dormant until favourable conditions for attack arise. For example, fruit picked from half-grown bunches, when superficially sterilised by the usual methods, gave *Gloeosporium* pustules after incubation under aseptic conditions.

Some experiments were carried out by us along the following lines. Normal fruits of the Gros Michel and Cavendish varieties were thoroughly sterilised superficially by washing over carefully with a piece of cotton wool soaked in methylated spirits, followed by spraying and flaming, the sterilised fruits being immediately placed in suitable aseptic containers. This treatment caused a certain amount of blackening of the skin. After a few days, fungal hyphae commenced to appear at the distal ends and at points over the surface of the fruit, and at the end of 10 days at 78°-82° F., important *Gloeosporium* and *Botryodiplodia* infections were much in evidence, typical specimens of tip-rots, finger-stalk rot and disease spots being obtained. Fig. 7 shows a typical specimen affected at a number of different points by *Gloeosporium*.

All the diseases present at the end of a storage trial cannot be assigned to such latent infections. The latter, however, obviously constitute an important potential source of wastage and only require suitable temperatures to become manifest. Further, when they are present they cannot be combated by preventive measures based on

surface sterilisation, since it has been shown that they escape destruction when the usual experimental methods are carefully applied. On the other hand, when fruit is expeditiously cooled to 53° F. and quickly ripened at the end of the transport period, ripe fruit can be obtained before the damage due to latent infections becomes excessive. This was confirmed by doubly sterilising fruit as before and placing in 53° F. for 16 days followed by ripening at 70° F. Only minor infections were in evidence when maturity was reached.

#### *V. Summary.*

(1) A résumé is given of the several organisms associated with fruit rots under storage conditions.

(2) Pre-storage, time and temperature factors are of fundamental importance in determining the extent of wastage due to fungal activity in banana cargoes.

(3) Fungi established in punctures made by sucking insects may render fruit unsightly if the storage period is prolonged or if suitable temperatures are not maintained.

(4) Finger-tip rots originating in the perianth may cause considerable wastage. A number of these have been examined and reproduced by experimental inoculation.

(5) Latent or dormant infections, established while the fruit is still immature, may be responsible for extensive wastage if fruit is not expeditiously cooled and quickly ripened. Such diseases cannot be combated by superficial sterilisation of the fingers.

#### 8.—SUMMARY AND CONCLUDING OBSERVATIONS.

(1) In these investigations the object was to define the limits of chill, with a view to placing on a definite footing our previous recommendations of quick cooling as a preventive measure for main-stalk rot and other sources of fungal wastage in banana cargoes. The storage trials carried out at 51°–52° F. have shown that chilling is a cumulative effect of duration of exposure, and not the result of rapid cooling to such temperatures. In actual practice the banana is transported by the bigger companies at a temperature of approximately 53° F., to which temperature the cargo is reduced in the course of 4 to 5 days. More rapid cooling than this is popularly believed to involve risk of chilling, with concomitant failure to ripen regularly or ripening to a dull colour, but our researches have corroborated

strikingly our earlier recommendations that this temperature is definitely not inimical, no matter how quickly it is reached, provided delivery temperature of the air is not lower than 53° F. On the other hand, we have obtained chill effects (*vide* above) by:—

- (a) *Gros Michel*.
  - (i) Exposure of 14 days at 52° F.
  - (ii) Exposure of 9 days at 51° F.
- (b) *Cavendish*.
  - (i) Exposure of 13 days at 51° F.

(2) Since this work definitely aims at providing information for the Trade, our practice has been the more and more rapid cooling to progressively lower temperatures than those usually adopted, and we have now established, contrary to previous information, that *the rapid cooling to 53° F. within 12 hours may be practised without danger of chilling during the usual voyage of 16 to 20 days. This will bring in its train the advantages of retarded fungal activity, with consequent decrease in wastage.*

(3) While from the purely mycological standpoint the benefits of temperatures lower than 53° F. are evident, we do not recommend them, since in the resultant comparatively slower ripening, fungal activity is responsible for relatively extensive wastage.

(4) The number of ways in which chill effects manifest themselves include: (i) failure to ripen, (ii) poor colour, (iii) russetting, (iv) "green ripeness" and (v) "hard-ripeness."

(5) In the course of further bulk storage trials, the Cavendish, as exemplified by good specimens of the Trinidad "Governor," again commends itself as a possible substitute for the Gros Michel.

(6) In the course of both senescence and long-storage studies, the superiority of this variety in the matter of cold-endurance has been repeatedly observed—a qualification which should prove particularly advantageous on the longer journeys.

(7) *Pre-storage, nutritional, time and temperature factors are of fundamental importance in determining the extent of wastage due to fungal activity in banana cargoes. In particular, the longer storage trials at 52° F. and 51° F. stress the importance of the time factor in this connection.*

(8) Latent or dormant infections established while the fruit is still immature may be responsible for extensive wastage if fruit is not expeditiously cooled and quickly ripened. Such diseases cannot be combated by superficial sterilisation of the fingers, but may be minimised by suitable observation of temperature relations.

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The foregoing is an account of research work conducted by the Physiologist and Pathologist in collaboration at the Low Temperature Station, the Imperial College of Tropical Agriculture, Trinidad, B.W.I., and they again avail themselves of the opportunity of expressing their thanks to the Principal and Members of the Staff for their helpful co-operation.



## 9.—APPENDIX.

*A brief Record of Senescence Studies Nos. 2 and 3 (see Section 3).*

### *Senescence Study No. 2 at 52° F.*

For the purpose of this study at 52° F., excellent bunches of Gros Michel and Cavendish, from a small plot of alluvial soil, were selected, and every care taken to reduce to the minimum mechanical injury during transport to the cold storage chamber, as bruises, etc., invariably become associated with rot organisms, which militate against long storage life. On reaching the Station, the stems, which had been purposely cut very long, were freshly cut, vaselined, and the bunches hung up in the cold chamber, the rope being placed as high up as possible. The fruit was chosen in such a way as to represent a gradation in maturity from "light  $\frac{3}{4}$ -full" to "heavy full," with a view to noting the influence, if any, of maturity on resistance to chilling.

While the fruit was inspected at short intervals and minute developments noted, only the important stages are given here.

*Thirty-first day.*—In Gros Michel and Cavendish at this stage, matters were very similar, in that bruises had gradually turned brown, and in the more mature bunches the top hands had commenced to colour.

*Thirty-eighth day.*—Main-stalk rot has made considerable progress, emphasising the time factor. The bunches had been hung up so that the weight of the bunch would not unduly affect the bottom hands, especially when the fruit commenced to ripen and soften. The break of the stem, due to the cord by which they were hung, evidently provided an ingress for rot organisms. The affected bunches were re-cut and vaselined, and in several cases it was necessary to cut off the top hand and second hand before vaselining.

*Sixtieth day.*—The more mature bunches of Gros Michel, which had commenced to yellow, had now assumed a decidedly russet-brown colour, and though comparatively firm still showed, on sectioning, decided internal breakdown. The less mature bunches had commenced to turn yellow and main-stalk rot had progressed considerably.

Of the Cavendish, the more mature bunches had ripened up very attractively and the flavour was excellent, while the less mature, though still firm, had acquired a good colour.

*Seventy-fourth day.*—The Gros Michel were now a dark russet-brown and large black patches made their appearance most unsightly.

Several of the Cavendish have now reached the over-ripe stage, while the less mature have reached table-ripeness.

*Eighty-second day.*—The remaining Cavendish are now over-ripe. There seems little doubt that the Cavendish (Trinidad Governor) has lasted longest and best at this temperature and has much greater cold-resistance than the Gros Michel.

### *Senescence Study No. 3 at 52·5° F.*

In the third trial of this series, conducted at 52·5° F., the behaviour of fifteen bunches of Cavendish and fifteen of Gros Michel was studied, and as before, this fruit was chosen so as to represent a gradation in maturity.

*Twenty-fifth day.*—Up to the present there was no change in colour in the Cavendish, but in two Gros Michel the slightest change—the paling of the ground colour which

usually precedes the yellow colour—was noticeable. Main-stalk rot is now developing in some of the bunches, again drawing attention to the significance of the time factor on the extent of damage for which these rot organisms may be responsible.

*Thirtieth day.*—The bunches referred to were now turning yellow, and several more bunches of both Gros Michel and Cavendish have assumed the pale-green to pale-yellow colouring. In several bunches it was necessary to cut the main stalks again and vaseline.

*Thirty-fourth day.*—The yellow colour in the Gros Michel has grown perceptibly dull, while in the Cavendish the colour is intensifying and the bunches promise to become very attractive.

*Forty-fourth day.*—The chilling effect in Gros Michel is quite pronounced in the russet colouration, which has replaced the dull yellow. On breaking open there was no flow of sap, while the broken skin seemed decidedly desiccated. The colour-change in chilled fruit has been both characteristic and regular; first the ground colour grew pale and gradually became yellow, which commenced to grow dull and then later was replaced by a decided russet colour. This colour deepened till the fruit resembled a dull edition of the red-claret banana. In several of the immature bunches, individual fingers, which, owing to fungal invasion at the finger-stalk, have ripened prematurely, have assumed the russet colour, so that in the same hand we have one or more browned fingers amongst perfectly green, or green turning to yellow, fingers.

Several bunches of the Cavendish had by this time acquired good colouring. On cutting open there was a slight hardening of the centre, and the flavour, though somewhat different from fruit treated in the usual way, was not unpleasant. The Gros Michel and the Cavendish bunches were now transferred to the ripening room, to study the effect of a short period at ripening temperatures after the long storage in the cold.

*Fifty-first day.*—In the mature Gros Michel bunches, which were of a dark russet colour, large sunken black patches had developed, which were very soft and soggy to the touch. On cutting open, the underlying tissue was found to have entirely broken down. Externally, these patches were associated with *Gloeosporium*. Those which were not so badly affected had not acquired further russetting at the temperature of the ripening room, but those, on the other hand, which had not commenced to turn yellow before being transferred to the ripening room, had acquired dull, pasty colouration.

In the Cavendish, all traces of hardness in the centre and the "cold-storage flavour" referred to above had disappeared.

The fruit tended, however, to break hard, which was to be expected after this long storage, during which the fruit had undergone a certain amount of desiccation.

*Fifty-eighth day.*—In several Gros Michel bunches in which, at time of transfer to the ripening room, the top hands had commenced to yellow while bottom hands were still green, the top hands had now assumed the russet colour and the lower hands a dull, pasty yellow. The flavour in these bunches had entirely disappeared.

*Sixty-second day.*—The dull, pasty, yellow hands were not assuming the russet colour; in other words, it seemed that on removing from inimical temperatures, provided chilling had not been severe, the colour abnormalities of ripening did not continue as a matter of course.

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# AUSTRALIAN AND NEW ZEALAND FRUIT SHIPMENTS

REPORT OF AN INVESTIGATION BY THE ECONOMIC SECTION  
OF THE EMPIRE MARKETING BOARD INTO THE  
DETERIORATION IN TRANSIT OF IMPORTED  
AUSTRALIAN AND NEW ZEALAND  
FRUIT, 1927-30.



NOVEMBER, 1931

LONDON:

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:  
Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh;  
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff;  
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## AUSTRALIAN AND NEW ZEALAND FRUIT SHIPMENTS.

### I.—INTRODUCTION.

THE annual shipment of several million boxes of fruit from Australia and New Zealand through the Tropics to the European market some 12,000 miles distant is perhaps the most impressive achievement of the fruit industry and one of the major triumphs of refrigeration. When the inherent difficulties of the undertaking are considered, the condition in which most cargoes are landed is surprisingly good. At times, however, serious wastage develops, both during shipment and in the later stages of distribution and marketing.

Intensive research into the diseases of fruit which cause wastage has for some time been in progress at experimental stations in the main producing countries and a considerable body of data bearing on methods of control has been secured. Until recently, however, no systematic survey had been made of wastage as it occurs under commercial conditions and little exact knowledge was available of its nature, causes and economic significance. Early in 1927 the Board initiated such a survey, dealing with the principal Empire fruits imported into the United Kingdom. It was hoped in this way to secure quantitative data as to existing conditions and to define the problems in which further research was of greatest urgency. Special attention was directed towards methods of controlling wastage under commercial conditions, and in certain cases experimental shipments were arranged in co-operation with oversea Departments of Agriculture to test specific methods.

Throughout the survey close contact was maintained with the officers of the Cambridge Low Temperature Research Station of the Department of Scientific and Industrial Research, particularly in connection with the study of wastage in Covent Garden Market, initiated by the Department shortly before the Board's survey was begun.

A progress report (7)\* on the condition of Australian and New Zealand apples arriving during 1927 was published at the end of the first season's work. The present report includes the material of the earlier publication, together with further observations made during

\* Throughout this report, figures in brackets refer to the list of references on page 59.

the seasons 1928, 1929 and 1930. The method of procedure followed has been substantially the same as that described in previous reports (7, 8). Most of the work has been carried out at the docks as experience has shown that an extensive examination of imported fruit can be most conveniently undertaken at that point. The fruit is there concentrated into a comparatively small area and facilities for opening the packages are readily obtainable. After unloading, shipments were examined as thoroughly as possible before removal from the dock, notes being taken of the origin, quality and maturity of the fruit, the nature and extent of any wastage present and any further observations that appeared to be of interest. In addition, many ships were boarded during unloading and observations taken of the temperatures of the holds and the methods of stowage of the cargo.

The greater part of the survey was undertaken during the three seasons 1927-29 and was carried out mainly at London and Liverpool, though some cargoes were also examined at Glasgow, Southampton and Hull. In 1930 only a very limited dock examination was attempted.

It was recognised more and more strongly as the survey progressed that the wastage which had developed at the time of the dock examination by no means represented the total losses since there is often considerable further deterioration before the fruit reaches the consumer. Attempts were therefore made to extend the work to include a re-examination of fruit at the stores and warehouses of wholesale and retail merchants. In this way some idea was gained of the nature of the wastage developing in the later stages of marketing, but in view of the wide distribution of the fruit and of the difficulty of tracing individual consignments, it was not found possible to follow this method on a large enough scale to secure representative data.

Accordingly towards the end of the 1929 season a new method was tried which gave sufficiently promising results to warrant a more extensive trial in 1930. Cards were inserted in boxes of apples at the docks to be returned by retailers with particulars of the date of opening the box and the extent of wastage at that time. The results obtained by this method are summarised in Section VII, but must for the present be regarded as highly tentative in view of the limited sample on which they are based. It is hoped later to develop this side of the enquiry on a more comprehensive scale.

*The Importation of Australian and New Zealand Fruit.*

In recent years, shipments of apples from Australia have been alternately light and heavy, varying from about 1½ to 4 million boxes in different seasons. Of the four main apple exporting states, Victoria and South Australia have shipped appreciable quantities only in heavy crop years, while exports from Tasmania and Western Australia have been two to three times greater in such years than in "off" seasons. It is to be noted that during the survey period heavy crops have been harvested in Western Australia during seasons of light production in the other States. Shipments of apples from New Zealand have increased materially during recent years, and the alternation of bearing has been less marked than in Australia. High yields in New Zealand have coincided with heavy crop seasons in Tasmania, Victoria and South Australia during the period under review.

The quantities exported to Europe during the past four seasons are set out in Table I.

TABLE I.  
*Shipments of Australian and New Zealand Apples to Europe, 1927-1930. (Thousand boxes).*

	1927.		1928.		1929.		1930.	
	To U.K.	Total.	To U.K.	Total.	To U.K.	Total.	To U.K.	Total.
Tasmania .. ..	819	1,069	2,372	2,689	624	868	2,169	2,657
Victoria .. ..	7	7	548	798	2	2	634	869
Western Australia ..	200	372	14	141	170	604	46	323
South Australia ..	1	1	197	427	—	2	283	406
New South Wales ..	—	—	17	17	1	1	49	49
Total Australia ..	1,027	1,447	3,148	4,072	797	1,477	3,195*	4,318*
New Zealand ..	449	449	870	870	640	750	938	1,105
Total .. ..	1,476	1,898	4,018	4,942	1,437	2,227	4,133	5,423

The first consignments from both countries normally arrive towards the end of March or the beginning of April. New Zealand shipments usually continue until early August; while the last Australian shipments reach the market about the middle of July in

\* Including 14,000 boxes from Queensland.

light crop seasons, but are maintained for a further month in years when the crop is heavy. The number of varieties exported is very large, particularly in the case of Tasmania. A list of varieties of apples and pears examined during the survey is shown in Appendix I.

Consignments of pears from Australia and New Zealand have increased substantially during the past few seasons (Table II below). The Australian pear export season begins rather earlier than the apple season and fairly regular consignments reach the market until the middle of July; the New Zealand shipping season for pears coincides roughly with the apple season.

TABLE II.  
*Shipments of Australian and New Zealand Pears to Europe, 1927-1930.*  
(Thousand Boxes).

	1927.	1928.	1929.	1930.
<i>Shipments to U.K.</i>				
Tasmania .. .. .	68	77	98	91
Victoria .. .. .	1	73	38	139
Western Australia .. .. .	25	—	32	7
South Australia .. .. .	—	3	3	11
New South Wales .. .. .	—	12	10	6
Total Australia .. .. .	94	165	181	254
New Zealand .. .. .	22	53	47	43
<i>Shipments to U.K. and Continent.</i>				
Australia .. .. .	102	176	190	275
New Zealand .. .. .	22	53	54	56

*Packing and Grading.*

The majority of Australian apples are packed in "dump," bushel boxes made of eucalyptus hardwoods, while some choice varieties are occasionally packed in half-bushel boxes and trays of the same material. Red Jarrah and Karri wood is used in Western Australia and various white gum woods in the other States. These woods have the defect that they contain tannins and blacken badly when wetted with water which has been in contact with iron, such as drip from overhead grids. Opinions differ as to the suitability of the hardwood "dump" box and in recent years increasing quantities of Australian apples have been packed in "standard," bushel, pinewood

boxes of the type universally employed in New Zealand, British Columbia and the Western United States. A "dump" bushel case made of imported pinewood has also been fairly extensively employed in some Australian States. Considerable attention is being paid, however, to improving the appearance of the hardwood case by greater care in seasoning, by planing the timber, and by substituting printed labels for the rather rough stencilling formerly employed. Official encouragement is also being given to the use of a "standard" pattern case made of hardwood.

In all types of package the apples are wrapped in sulphite paper and wood-wool or corrugated card is used as protective packing material. Methods of packing apples are considered briefly in relation to bruising and fungal rotting in Section II below.

A variety of packages are used for Australian pears, including "dump" and "standard" bushel boxes, three-quarter bushel boxes, half-bushel boxes and flat trays which are sometimes shipped singly and sometimes nailed or wired together in bundles of two or three. New Zealand pears are also packed in flat trays wired into bundles.

The Australian grading regulations for apples and pears define three quality grades, Special, Standard and Plain, but the great majority of the fruit is in fact shipped under the Standard grade. All fruit is graded for size and the diameter of the contents is marked on the end of each case. New Zealand fruit is exported under the three quality grades, Extra Fancy, Fancy and Good, while the number of apples contained is marked on each box.

#### *Conditions of Shipment.*

The voyage to the United Kingdom occupies some five weeks and upwards, the time varying considerably with different vessels and routes, and refrigeration is therefore essential for the successful shipment of fruit. An account of modern methods of refrigerating practice in relation to the transport of fruit from Australia and New Zealand is to be found in publications of the Food Investigation Board (2,17), to which reference should be made for further particulars.

#### *Types of Wastage.*

Wastage in Australian and New Zealand apples shipped to the United Kingdom may be broadly divided into two main types—(i) wastage due to rotting by fungi and (ii) wastage resulting from various physiological diseases; i.e., diseases not connected with fungi, but caused by abnormal changes in the metabolism of the apple itself. Apples infested by insect pests appear to be fairly

effectively graded out before shipment, and although serious losses often occur in the orchards from such pests, comparatively little insect injury has been noted in imported apples during the present survey.

Wastage of apples resulting from fungal rotting is discussed below in Section II, the principal physiological diseases of apples are considered in Sections III-V, Section VI deals similarly with wastage in pears, and an enquiry into the development of wastage after unloading is briefly summarised in Section VII. Finally, the methods available for controlling the principal types of wastage are discussed and various suggestions made in earlier sections of the report summarised.

It should be noted here that the wastage data given below for Victorian, South Australian and Western Australian apples do not relate to the whole period of the survey because of the irregularity of shipments from these States (Table I). Apples from Tasmania and New Zealand were examined during each of the three seasons 1927-29 and it is thought that for these shipments the data are fairly representative.

## II.—FUNGAL DISEASES.

Observations in wholesale and retail markets make it abundantly evident that rotting by fungi is one of the most important causes of wastage in Australian and New Zealand apples, and is responsible for serious losses. Striking evidence of this nature has also been obtained in storage trials with imported Australian and New Zealand apples undertaken by the Food Investigation Board (1, 2). When the fruit first arrives on the British market, however, fungal rotting is seldom very extensive; its main development occurs during the later stages of marketing as the fruit ripens after removal from refrigeration.

### *Extent and Nature of Fungal Rotting on Unloading.*

The average extent of rotting observed in apples when discharged from the ship's hold is shown in Table III, which combines the results of the three seasons of the dock survey. It is seen that wastage was low in all varieties; few showed more than 2 per cent. of rotting, while in most cases the average was less than 1 per cent. The extent of rotting varied considerably, however, as between different shipments. No marked differences in susceptibility were apparent between fruit from the five producing areas, but on the whole wastage was rather less in New Zealand than in Tasmanian apples.

**TABLE III.**  
*Percentage of Fungal Rotting observed in Australian and New Zealand Apples at Dock Examinations, 1927-29.*

Variety.	Fungal Rotting (per cent.).				
	Tasmania* (1927-28-29).	Victoria (1928).	Western Australia (mainly 1927 and 1929).	South Australia (1928).	New Zealand (1927-28-29).
Alexander .. ..	1.2	—	—	—	—
Alfriston .. ..	0.4	—	—	—	—
Cleopatra .. ..	0.8	0.9	0.2	0.7	0.2
Cox's Orange Pippin	2.5	2.8	—	—	2.3
Crow Egg .. ..	0.1	—	—	—	—
Delicious .. ..	—	—	—	—	1.1
Dougherty .. ..	—	—	—	—	0.2
Duke of Clarence ..	2.2	—	—	—	—
Dunn's Seedling ..	0.6	0.7	0.5	—	0.2
French Crab .. ..	1.6	—	—	—	—
Granny Smith .. ..	—	—	0.4	—	—
Jonathan .. ..	0.7	1.2	0.5	0.7	0.5
King Pippin .. ..	1.3	—	—	—	—
London Pippin .. ..	1.8	2.6	—	—	1.0
Ribston Pippin .. ..	0.9	—	—	—	—
Rome Beauty .. ..	1.4	0.6	1.0	—	0.5
Scarlet Pearmain ..	1.5	—	—	—	—
Statesman .. ..	—	—	—	—	0.7
Stone Pippin .. ..	0.9	—	—	—	—
Sturmer Pippin ..	0.5	—	—	—	0.6
Tasman Pride .. ..	1.0	—	—	—	—
Worcester Pearmain	1.2	—	—	—	—

*Note.*—In the above and subsequent Tables a dash indicates that insufficient boxes were examined for an average to be taken. The samples upon which the wastage data are based are shown in Appendix II.

*\*Nomenclature of Tasmanian Apples.*—The following points may be noted in regard to certain Tasmanian varieties. In Table III and elsewhere, Five Crown Pippin apples are included with the synonymous London Pippin, Munro's Favourite with Dunn's Seedling, and New York Pippin with Cleopatra. King Pippin apples are often shipped as Adam's Pearmain, and the King Pippin apples referred to in the wastage tables included a proportion labelled in that way: the true Adam's Pearmain is sometimes shipped under its own name and sometimes as Dutch Mignonne. The variety exported as Scarlet Pearmain is often stated to be actually Scarlet Nonpareil, but the former name has been retained in this report as it appears to be in more general use among growers.

The observations described in this section have been mainly directed towards the extent and causes of wastage rather than to the organisms responsible for the injury, and no attempt has been made to compile an exhaustive list of the fungi occurring in Australian and New Zealand apple shipments. In general, the greater part of the wastage at the time of unloading was caused by the common fungi *Penicillium expansum* and, to a less extent, *Botrytis cinerea*. These fungi together probably accounted for fully 80 per cent. of the rotting observed at the dock examinations. As a rule, one or two rotted apples were found in a box, and extensive rotting was rare except in particularly ripe samples or secondary to internal breakdown. The latter instances have as far as possible been omitted from Table III and included in Table XI under breakdown. In boxes containing one or two decayed apples, the rots were most usually found at the sides or corners and appeared to have originated from case injuries. Bruises, stem punctures and similar wounds were the most general points of entry for fungi, but a smaller number of rots originating at the stem end, the calyx, lenticels and scab injuries were also observed. Core rots were fairly frequently noted in the Cleopatra and Delicious varieties.

It is evident from the high proportion of infection originating from mechanical injuries, both in hard and soft varieties, that rotting could be appreciably reduced if greater precautions were taken to handle the fruit carefully during harvesting, packing and transport. Considerable attention is now paid to this matter, but a large amount of bruising is still caused by rough handling.

There is also need for more careful packing to ensure that the fruit receives the maximum protection. Case bruising and subsequent rotting was often caused by too high a pack, no pronounced difference in this respect being noted as between the hardwood "dump" case and the soft-wood case. Slack boxes, probably sometimes due to shrinkage of the fruit after packing, were also frequently observed, more particularly in Australian apples. Further, many examples were noted where insufficient packing material had been included in the box to afford adequate protection to the fruit.

There appears to be a definite need for investigation\* to ascertain the methods of packing, types of box and packing materials which are most effective in preventing bruising.

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\* A brief account of a preliminary investigation into this aspect of wastage has recently been published in the Annual Report of the Food Investigation Board for 1930.



#### *Nature of Wastage Developing after Unloading.*

The above considerations refer mainly to wastage which is already present when the fruit is discharged from the ship's hold. Observations made by the Food Investigation Board on the development of wastage after unloading in imported New Zealand apples suggest that, in addition to fungal rotting following bruising, there is also in some varieties serious wastage from fungi which do not invade the fruit at mechanical injuries, but at the stem-end, calyx and lenticels. An analysis was made of the species of fungi causing wastage in samples of Cox's Orange Pippin, Jonathan and Sturmer Pippin apples, and in each variety a high proportion of the rotting proved to be due to one fungus. The conclusion was therefore drawn (1) that "since over 75 per cent. of this wastage is the result of infection at the stalk or calyx, and does not, so far as can be observed, follow wounding, care in handling will do little to control it; on the other hand, since it is caused by a single fungus in each case, control might be secured by cleanliness in the orchard, and spraying." It should be remembered, however, that these observations were made with specially selected experimental fruit handled as carefully as possible, and it is probable that with ordinary commercial fruit wastage from bruising would have been more important.

#### *Maturity and Fungal Rotting.*

Particulars were noted of the maturity of all apples examined during the dock survey by two independent methods of classification. The first was based on the gradual change in the colour of the unblushed portion of the skin from green to yellow, and apples were classified into five grades (briefly noted as *g*, *ggy*, *yg*, *yyg*, and *y*) according to the relative proportion of the two colours. The softening of the flesh with increasing ripeness formed the basis of the second method, apples being roughly classified into four groups ranging from hard to soft. Taken in combination, these methods gave a fairly definite indication of the maturity of any particular sample. The two changes are not always parallel, however, and this should be borne in mind in comparing different varieties; this matter is discussed later. On the whole, colour was found the more satisfactory classification and, for simplicity, fruit has been grouped only according to colour in the following tables.

The above system of classification was not adopted in the first few shipments examined in 1927, and in consequence the maturity data for that year are not complete. The figures given below therefore relate to the 1928 and 1929 seasons only.

Throughout the survey, fungal rotting has been closely associated with ripeness and, with rare exceptions, extensive rotting at the docks has been noted only in fruit which was fully mature when unloaded. This relationship is brought out clearly in Table IV, which shows the average percentage of rotting observed in apples classified in four maturity groups. The same results are shown graphically in Fig. 1.

TABLE IV.  
*Maturity and Fungal Rotting at Time of Unloading.*

Country of Origin.	Variety.	Fungal Rotting (per cent.) in Fruit Classified in Maturity Grade.			
		<i>g</i> and <i>ggy</i> .	<i>yg</i> .	<i>yyg</i> .	<i>y</i> .
Tasmania .. (1928 and 1929).	Cleopatra .. ..	0.5	0.3	1.1	1.9
	Cox's Orange Pippin	0.7	1.8	2.6	3.9
	French Crab*	1.3	2.4	—	—
	Jonathan .. ..	—	0.5	0.8	1.4
	Ribston Pippin ..	0.3	1.0	0.8	1.1
	Scarlet Pearmain ..	1.1	0.8	1.2	3.4
	Sturmer Pippin ..	0.4	0.4	0.8	1.9
Western Australia (1929).	Jonathan .. ..	0.0	0.1	0.5	—
Victoria .. .. (1928).	Jonathan .. ..	0.0	0.7	1.4	1.6
New Zealand .. (1928 and 1929).	Cox's Orange Pippin	0.0	0.0	0.1	1.8
	Delicious .. ..	—	0.1	0.3	3.2
	Jonathan .. ..	—	0.0	0.2	1.0
	Sturmer Pippin ..	0.0	0.2	0.4	0.8

\* Most of the French Crab apples examined were classified as *g* or *ggy*; in the former group no fungal rotting was observed, in the latter it amounted to 2.1 per cent.

The above table refers only to rotting at the time of unloading. The more extensive wastage developing during the later stages of marketing is also more serious in fruit which is in a "forward" condition on arrival. This is well illustrated by the following table from a recent report (1) of the Food Investigation Board, showing the development of rotting in two comparable boxes of New Zealand Cox's Orange Pippin apples: these boxes differed in maturity when unloaded on account of inequalities in the shipping temperature. It is seen that at all examinations wastage was considerably more serious in the riper fruit.

FUNGAL ROTTING IN RELATION TO MATURITY.

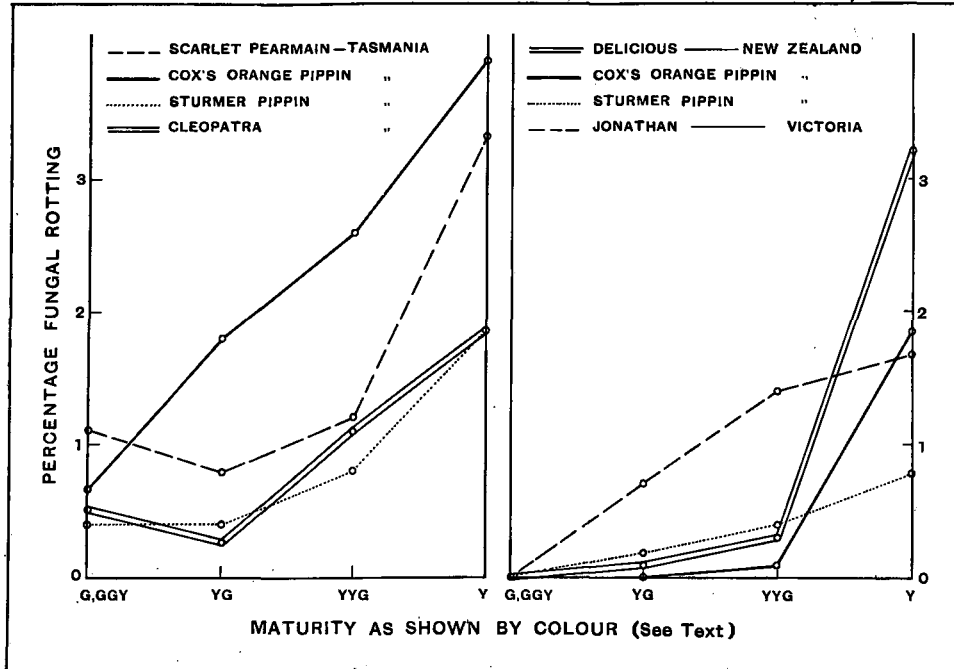


FIG. I.

To face page 14.

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TABLE V.  
*Fungal Rotting in Ripe and Unripe Apples Following Discharge from the Ship.*

Days after Discharge.	Fungal Rotting (per cent.).	
	Riper Sample.	Less Ripe Sample.
2	5.0	2.8
16	13.0	4.4
30	18.3	8.3

It is thus clearly of the greatest importance that fruit should not arrive in a fully ripe state: immaturity is naturally equally undesirable. In this connection, Table VI is of interest as giving some indication of existing conditions.

TABLE VI.  
*Percentage of Apples Classified in Each of Five Maturity (Colour) Grades, 1928 and 1929.*

Country of Origin.	Variety.	Season.	Percentage Apples Examined Classified as				
			<i>g</i>	<i>gg</i>	<i>yg</i>	<i>yyg</i>	<i>y</i>
Tasmania ..	Cleopatra .. ..	1928-29	5	8	33	36	18
	Cox's Orange Pippin	1928-29	2	8	35	27	28
	French Crab .. ..	1928-29	30	46	23	1	0
	Jonathan .. ..	1928-29	1	3	35	38	23
	Ribston Pippin ..	1928-29	8	17	26	21	28
	Scarlet Pearmain ..	1928-29	3	9	38	39	11
	Sturmer Pippin ..	1928-29	1	7	55	36	1
Western Australia	Cleopatra .. ..	1929	0	15	62	21	2
	Jonathan .. ..	1929	1	11	49	27	12
Victoria .. ..	Jonathan .. ..	1928	4	3	35	26	32
New Zealand ..	Cox's Orange Pippin	1928-29	0	10	38	26	26
	Delicious .. ..	1928-29	0	3	37	39	21
	Jonathan .. ..	1928-29	0	3	44	34	19
	Sturmer Pippin ..	1928-29	1	7	44	41	7

It is not possible to deduce from the above table an exact estimate of the proportion of apples which arrive in a state of ripeness rendering them liable to rapid decay. Different varieties reach this danger zone at various stages of the colour scale; moreover, colour without reference to firmness is not a wholly adequate index of maturity. It is, in any case, extremely difficult to forecast with any certainty the post-shipment behaviour of a consignment of apples since keeping quality is not merely a function of maturity, but depends on a large number of complex factors. As a rough indication, however, it may be taken that in all varieties fully yellow apples which show no trace of green on arrival are liable to deteriorate rapidly; while in some varieties, including Cox's Orange Pippin, Ribston Pippin and perhaps Jonathan, it is probable that apples in the group *yyg* are in many instances beyond the safe limit of maturity. In the case of the exceptionally green variety, French Crab, apples in the group *yg* often appear to be dangerously ripe.

It is thus fairly clear that a considerable proportion of the apples examined, particularly of the Cox's Orange Pippin, Ribston Pippin and Jonathan varieties, were in a ripe condition which rendered them liable to deteriorate rapidly. The data given below in Section VII make it clear that such deterioration does in fact frequently occur. It does not follow from these considerations, however, that earlier picking is generally desirable. Many instances were in fact observed of yellow and softening apples in which lack of flavour or slight shrivelling indicated that they had actually been picked somewhat immature and allowed to ripen before or during shipment.

Over-ripeness of apples on unloading may be mainly attributed to two causes—(i) unsuitable carrying temperatures and (ii) the shipment of fruit which is too ripe when loaded.

Considerable light is thrown on the influence of shipping temperatures in a recent report (2) of the Food Investigation Board describing a series of experimental shipments undertaken in co-operation with the New Zealand Department of Scientific and Industrial Research and with the Shipping Companies concerned. These experiments demonstrated clearly that over-ripeness in New Zealand apples often results from the existence of comparatively high temperature zones in refrigerated holds. There can be little doubt that similar causes are also operative in the case of Australian fruit and that relatively high carrying temperatures largely account

for the ripe and forward condition in which shipments from both countries not infrequently arrive. Methods of maintaining uniform temperatures in large masses of fruit are now being investigated at the new Ditton Experimental Station.

Over-ripeness at the time of loading may result from late picking or from delay between picking and shipment. The evidence in regard to this condition is mainly presumptive, resting on the frequent wide variation in maturity as between different "marks," and on the fact that consignments arriving towards the end of the shipping season of a variety are often very ripe and show more fungal rotting than the average. This latter tendency is more common in Australian shipments; in New Zealand a final date is fixed for the export of each variety. Having regard to the storage and shipping facilities available, it appears that the export season of Australian varieties is often unduly prolonged. Comparatively small consignments of the earlier varieties continue to arrive for some weeks after the main shipments have terminated and are frequently in an over-ripe and often more or less wasty condition. Further, in the heavy crop year of 1928, the export season was extended well into August and arrivals of apples towards the end of that period were generally in a "forward" condition and showed more rotting than the normal. For example, in the Cleopatra and Scarlet Pearmain varieties over 4 per cent. of fungal rotting was observed in the last five shipments, compared with an average of slightly over one per cent. for the whole season; while consignments of French Crab and Sturmer Pippin apples were only slightly less affected. It is reasonably certain that in all these cases post-shipment deterioration would be rapid.

#### *Scab.*

In addition to rot-producing fungi, considered above, some loss is occasioned by scab (black spot), a surface injury caused by the fungus *Venturia inaequalis*. Scab is fairly prevalent in Tasmanian apples and more rigorous control measures appear to be necessary in that State. In apples from New Zealand and the Australian mainland States, the disease is less common.

Apart from disfiguring affected apples, scab injuries occasionally provide a point of entry for rot-producing fungi, notably *Penicillium* and *Trichothecium*.

### *Summary.*

Fungal rotting is seldom extensive in Australian and New Zealand apples on arrival. In most varieties less than one per cent. of the fruit examined was affected and the average rarely rose above two per cent. The wastage is fairly uniformly distributed throughout the cargo and as a rule not more than one or two decayed apples are found in a box except in particularly ripe samples, or secondary to internal breakdown. During the later stages of marketing, however, there is often a rapid development of rotting.

Fungal rotting present at the time of unloading mainly originates at bruises, stem punctures and similar wounds, and there is need for more careful handling and packing to reduce this wastage. In some varieties the later development of rotting appears to be less closely associated with mechanical injury.

Data are given of the comparative ripeness on arrival of the more important varieties and of the average percentage of rotting observed in apples at different stages of maturity. Susceptibility to fungal rotting increases rapidly as the fruit ripens, and over-ripeness is the main cause of this type of wastage. Different shipments vary appreciably in this respect on arrival. Over-ripeness largely results from comparatively high carrying temperatures, and probably also from the shipment of fruit which is already too ripe when loaded. There is no evidence, however, to suggest that earlier harvesting is generally desirable: in some cases apples which are yellow and softening on arrival show indications of having been picked when somewhat immature.

### III.—BITTER PIT.

Bitter pit is annually responsible for heavy losses to Australian apple growers. New Zealand fruit is less seriously affected, but the disease is sometimes severe in the Cox's Orange Pippin variety. Affected apples develop small brown spots in the flesh, which most commonly occur near the surface when they show through the skin as circular, brown or greenish-brown depressions. The fruit is thus badly disfigured, and in extreme cases may be practically unsaleable.

Several theories have been advanced to account for the development of bitter pit, but none appears to be adequately supported by experimental evidence, and the exact cause of the disease is still obscure. The extensive literature of the subject has been reviewed in detail by Smith (18), and was briefly summarised in the earlier report on the present investigation (7). More recently, an important paper, mainly concerned with the influence of maturity on the development of pitting, has been published by Carne, Pittman and Elliott (5). These authors following earlier work by Mix (13), distinguish between bitter pit and certain other diseases involving localised browning of the flesh, for which the general term "cork" is proposed. Cork spots, which are sub-divided according to their appearance into four types, develop only on the tree. Bitter pit, on the other hand, is considered rarely to occur on the tree, primarily developing in storage. This classification is not discussed here, but to avoid confusion it should be noted that the disease encountered on the British market is definitely identical with the bitter pit of Carne and his co-workers, since apples showing "cork spots" will presumably have been graded out for the most part in the packing sheds.\*

#### *Susceptibility of Varieties.*

The comparative susceptibility of different varieties to bitter pit was considered in the earlier report in which a table was given showing the average percentage of pitting observed in 1927 in the more important Tasmanian, Western Australian and New Zealand varieties. Further work during the two following seasons has in general confirmed the first results obtained on the relative incidence of the disease as between different varieties. The average percentage of pitting observed during the whole survey is set out in Table VII. A certain amount of internal pitting will certainly have escaped notice, however, as it was impracticable to cut a large number of apples at the dock examinations; this should be borne in mind in considering all tables relating to bitter pit. It should be added that the figures quoted include slightly, as well as severely pitted apples, and that the former were not entirely unmarketable.

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\* Injuries resembling Carne's description of "blotchy cork" have, however, fairly frequently been observed in Tasmanian Sturmer Pippin apples, and more occasionally in Tasmanian Cleopatra apples.



**TABLE VII.**  
*Percentage of Bitter Pit observed in Australian and New Zealand Apples, at Dock Examinations, 1927-29.*

Variety.	Percentage Bitter Pit.				
	Tasmania (1927-28-29).	Victoria (1928).	Western Australia (mainly 1927 and 1929).	South Australia (1928).	New Zealand (1927-28-29).
Alexander .. ..	2.0	—	—	—	—
Alfriston .. ..	2.3	—	—	—	—
Cleopatra .. ..	7.1	9.2	11.3	1.7	0.9
Cox's Orange Pippin	15.4	8.9	—	—	4.8
Crow Egg .. ..	0.4	—	—	—	—
Delicious .. ..	—	—	—	—	0.6
Dougherty .. ..	—	—	—	—	0.4
Duke of Clarence ..	1.7	—	—	—	—
Dunn's Seedling ..	2.8	0.5	0.6	—	2.6
French Crab .. ..	2.8	—	—	—	—
Granny Smith .. ..	—	—	6.0	—	—
Jonathan .. ..	0.4	1.2	3.1	1.4	0.4
King Pippin .. ..	2.7	—	—	—	—
London Pippin .. ..	0.5	1.3	—	—	0.1
Ribston Pippin .. ..	11.5	—	—	—	—
Rome Beauty .. ..	0.3	0.3	2.4	—	Nil.
Scarlet Pearmain ..	1.3	—	—	—	—
Statesman .. ..	—	—	—	—	Nil.
Stone Pippin .. ..	3.9	—	—	—	—
Sturmer Pippin .. ..	4.8	—	—	—	0.5
Tasman Pride .. ..	1.5	—	—	—	—
Worcester Pearmain	1.2	—	—	—	—

The table is intended to indicate the relative incidence of disease as between different varieties rather than the average extent of loss which actually occurs. Pitting varies so considerably in different seasons (Table VIII below), that representative figures could only be secured in a survey extending over a long period.

It is seen that the Cox's Orange Pippin variety is extremely susceptible to bitter pit, and is, in fact, the only New Zealand apple seriously affected. Of the more important Australian varieties,

Ribston Pippin, Cleopatra and Sturmer Pippin also show extensive pitting; others, including Jonathan, Scarlet Pearmain, London Pippin and Rome Beauty are on the whole much less seriously affected. The incidence of the disease in the principal varieties exported now appears to be well established.

Caution should be observed in comparing the susceptibility of apples from different localities, since the severity of pitting varies in different seasons, and the data for the Australian mainland States relate only to the years in which a sufficiently heavy crop was harvested for export. New Zealand apples, however, definitely appear to be less subject to bitter pit than Australian apples.

*The extent of Pitting in different Seasons.*

A striking difference was noted in the incidence of bitter pit in Tasmanian apples during the three seasons of the dock survey, the disease having been very much more serious in the years 1927 and 1929 than in 1928. The average percentage of pitting observed in all samples of the more susceptible varieties examined in each season is given in Table VIII. The samples upon which this table is based (Appendix II) are of considerable size, and it is thought that the figures quoted represent the relative extent of pitting in the three seasons with fair accuracy. The same data are shown in more detailed form in Table X and in Figs. II and III below.

TABLE VIII.

*Average percentage of Bitter Pit observed in the more susceptible varieties of Tasmanian Apples in the three Seasons 1927-29.*

Variety.	Percentage of Bitter Pit.		
	1927.	1928.	1929.
Cleopatra .. .. .	10	2	7
Cox's Orange Pippin .. .. .	21	10	15
Ribston Pippin .. .. .	9	7	19
Sturmer Pippin .. .. .	9	1	5

It is seen that the seasonal fluctuation is particularly marked in the Cleopatra and Sturmer Pippin varieties, in which the percentage of affected apples was many times higher in 1927 and 1929 than in

1928. In the two other varieties the differences are less pronounced, but the distribution of pitting is definitely similar. Less susceptible varieties also showed seasonal differences; thus the percentage of pitting observed in Scarlet Pearmain apples in 1927 and 1929 was 1.4 and 2.0 per cent. respectively, compared with 0.8 per cent. in 1928. In the Jonathan variety the corresponding figures were 0.7 and 0.5 per cent. in 1927 and 1929, compared with 0.2 per cent. in 1928.

Considering the results as a whole, the difference in the extent of pitting as between the three seasons appears to be definitely established. It is suggested that this seasonal variation may be related to the size of the crop.

In 1928 when bitter pit was relatively inextensive, the Tasmanian apple crop was very large, and a total of 2,689,000 boxes was exported to Europe. In 1927 and 1929, on the other hand, light crops were harvested, and the total exports to Europe amounted only to 1,069,000 and 868,000 boxes respectively; these were the years of severe pitting. No systematic examination was attempted in 1930, when the crop was again heavy, but pitting does not appear to have been especially severe.\* Combining these results, it appears in general that the light crops were particularly susceptible to pitting, while the heavy crops were relatively immune.

No effective comparison may be made of the relative susceptibility to bitter pit in different seasons for apples from the Australian mainland States. Victoria and South Australia exported negligible quantities in 1927 and 1929, and data are available only for the 1928 season. Fair samples of Western Australian apples were examined in 1927 and 1929 when heavy crops were harvested, particularly in the latter season, but adequate data are lacking for 1928, when the crop was light and mainly shipped to continental Europe. In 1927 and 1929, the average amount of bitter pit observed was 18 and 8 per cent. respectively in Cleopatra, and 4 and 1 per cent. in Jonathan apples; these two varieties are shipped in greatest quantity. The sample of Cleopatra apples examined in 1927 was not large, however, and the significance of the high value quoted is uncertain. Data extending over three seasons are available for New

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\* The Tasmanian export in 1930 amounted to 2,657,000 boxes. From occasional examinations and from information supplied by officials and by members of the fruit trade, it appears that pitting was by no means as serious as in 1929, but no comparative figures are available.

Zealand, but in view of the low percentage of apples affected by bitter pit, effective comparison is impossible in all but Cox's Orange Pippin. In this variety considerably less pitting was observed in 1928 than in 1929 when the crop was light, an average of 1 per cent. and 9 per cent. respectively having been recorded in the two seasons;\* this is in agreement with the Tasmanian results.

Little investigation appears to have been carried out in regard to the influence of the size of the crop on susceptibility to pitting, but some relationship between the two has been noted. Thus from the replies to a questionnaire circulated to growers in all parts of Australia, McAlpine (12) states that there was general agreement that a light crop was most affected with the disease. Smith also in his review of the literature of bitter pit (18) states:—

“ There is a consensus of opinion that bitter pit is especially prone to occur in fruit from young trees, or from trees with light crops. It is clear, moreover, from experiment as well as experience, that the larger apples are more susceptible to bitter pit than smaller ones from the same tree. A young tree, a light crop and a large apple are, however, circumstances which usually accompany each other, and it has not been determined whether the age of the tree and the size of the crop have an effect when apples of the same size are compared.”

With reference to the point made in the last sentence, data given below in Table X indicate that differences in the average size of the apples were not responsible for the greater extent of pitting in the light crop years, since the increase in pitting is apparent in every size of fruit.

A third reference to the influence of yield on pit susceptibility is made by Carne (5) who states that there is a “generally accepted idea that small crops and consequent large fruits are very liable to bitter pit.” Carne, however, considers that this idea has reference to cork rather than true bitter pit. Finally, in America, investigations at the New Hampshire Experimental Station (3) are said to indicate that more serious pitting occurs in Baldwin apples during years of light bearing than when there is a heavy crop.

It may also be noted that in British Columbia a relationship has definitely been shown to exist between the susceptibility of Jonathan

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\* Very few boxes of Cox's Orange Pippin apples were examined in 1927, and no average can be taken for that year.

apples to breakdown and the size of the crop, fruit from lightly laden trees breaking down far more readily than fruit from trees bearing a full crop (14, 15). This fact has been verified year after year by storage experiments with fruit from individual trees and methods have now been evolved to ensure that fruit from trees bearing a light crop is harvested early, before it becomes liable to breakdown.

The size of the crop is naturally not the only possible explanation of the seasonal variation in pitting; climatic or other conditions may be the predisposing cause. It is suggested, however, that experiments in Australia into the influence of the yield on pit susceptibility might well lead to useful results.

*The Influence of Maturity on Bitter Pit.*

It has now been recognised for some years that the development of bitter pit in storage is particularly severe in fruit which is unripe at the time of picking. Attention was drawn to this relationship in 1926 by Smith (18) who published the results of storage experiments with Tasmanian Cox's Orange Pippin and Ribston Pippin apples and also quoted data previously obtained by Brooks and Fisher (4) in experiments with American Jonathan apples. Later investigations by Wickens and Carne (21) and by Carne, Pittman and Elliott (5) indicated very definitely that a similar relationship held with Western Australian Cleopatra apples.

The influence of the picking maturity on the development of bitter pit is clearly evident in Australian apples on arrival in the United Kingdom, and in all varieties the disease becomes less and less prevalent as the season advances. No relationship, however, has been observed between the maturity of the fruit on arrival and the degree to which it is pitted.

Reference was made in the preliminary report to the decline in pitting as the season advances and a diagram was included showing the percentage of affected apples in successive shipments of certain varieties. These figures, however, showed considerable fluctuations, the significance of which is discussed later, and in the present report it has been thought preferable to present the data in the form adopted in Table IX. This shows the average percentage of pitting observed in apples shipped at different periods of the season. The intervals have been chosen arbitrarily as giving a fairly uniform division of the boxes examined. The same data are reproduced in graphical form in Fig. II.

FIG. II.

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PERCENTAGE OF BITTER PIT OBSERVED DURING SUCCESSIVE PERIODS IN SHIPPING SEASON.

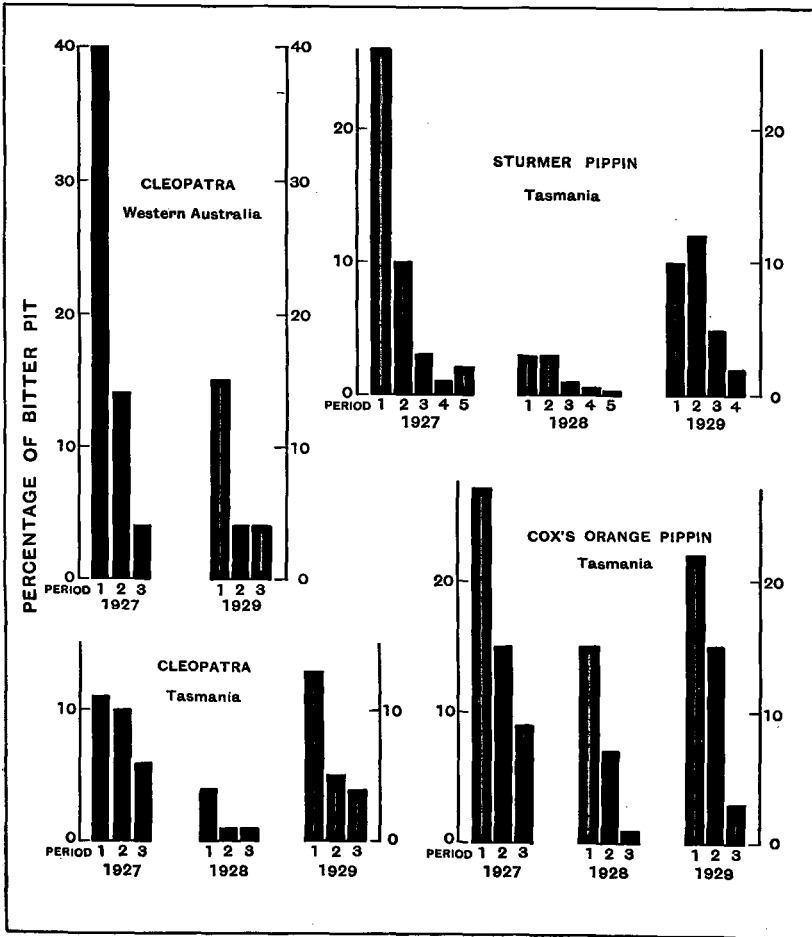


TABLE IX.

*Bitter Pit and Time of Shipment.*

(a) Cleopatra. Western Australia.

Season.	Bitter Pit (per cent.) in Apples Shipped.		
	Before 21st March.	21st-31st March.	After 31st March.
1927 .. ..	40	14	3
1929 .. ..	15	4	4

(b) Cleopatra. Tasmania.

Season.	Bitter Pit (per cent.) in Apples Shipped.			
	Before 16th March.	16th-31st March.	1st-16th April.	After 16th April.
1927 .. ..	11	10	6	—
1928 .. ..	—	4	1	1
1929 .. ..	—	13	5	4

(c) Cox's Orange Pippin. Tasmania.

Season.	Bitter Pit (per cent.) in Apples Shipped.		
	Before 10th March.	11th-25th March.	After 25th March.
1927 .. ..	27	15	9
1928 .. ..	15	7	1
1929 .. ..	22	15	3

(d) Ribston Pippin. Tasmania.

Season.	Bitter Pit (per cent.) in Apples Shipped.	
	Before 10th March.	After 10th March.
1927 .. ..	10	9
1928 .. ..	7	7
1929 .. ..	23	15

(e) Sturmer Pippin. Tasmania.

Season.	Bitter Pit (per cent.) in Apples Shipped.				
	Before 31st March.	1st-15th April.	16th-30th April.	1st-15th May.	After 15th May.
1927 .. ..	26	10	3	1.0	2.0
1928 .. ..	3	3	1	0.4	0.2
1929 .. ..	10	12	5	2.0	—

It is seen that in some instances the decline in bitter pit in the later shipments is very marked, notably in Tasmanian Cox's Orange Pippin and Sturmer Pippin apples in 1927, in Tasmanian Cleopatra and Ribston Pippin apples in 1928, and in Western Australian Cleopatra apples in 1927. It should further be noted that the actual decrease in the severity of pitting is even greater than the figures in Table IX would imply, since affected apples are, on the whole, less seriously disfigured in the later part of the season.

Taking the above data in conjunction with the experimental work already quoted, it appears to be definitely established that later picking reduces the development of bitter pit in some instances to negligible proportions. Where harvesting can be delayed without serious risk of over-ripeness or other forms of wastage, it therefore appears that this constitutes the most effective control measure at present available.



*Bitter Pit in Relation to Size.*

It is generally recognised in the fruit trade that bitter pit is more serious in large than in small apples. The data collected during the present survey amply confirm this view. The percentage of pitting observed in various size grades of several of the more susceptible varieties of apples is shown in Table X; these figures relate mainly to Tasmanian apples, for which the most complete information is available. No data are given for New Zealand apples on account of the low percentage of pitting observed and the different system of size grading employed.

TABLE X.  
*Percentage of Bitter Pit Observed in Apples of Different Size Grades.*

Variety.	Season.	Bitter Pit (per cent.) Observed in Apples of Size				
		2 inch.	2½ inch.	2¾ inch.	3 inch.	3 inch.
Cleopatra .. .. . (Western Australia)	1927	—	2.7	20.3	15.6	16.6
	1929	—	3.1	13.1	9.0	—
Cleopatra .. .. . (Tasmania) .. .. .	1927	—	3.4	11.8	8.8	14.9
	1928	—	0.6	1.3	3.7	1.2
	1929	—	4.0	10.1	16.3	—
Cox's Orange Pippin .. .. . (Tasmania)	1927	10.4	15.4	24.7	33.9	—
	1928	2.5	6.0	10.5	13.6	—
	1929	—	13.1	22.4	39.0	—
Ribston Pippin .. .. . (Tasmania)	1927	—	4.5	8.8	13.4	28.8
	1928	—	5.0	6.4	10.1	—
	1929	—	4.6	15.8	29.2	—
Sturmer Pippin .. .. . (Tasmania)	1927	None observed.	4.1	6.2	10.1	16.5
	1928	—	0.3	0.4	0.9	1.0
	1929	None observed.	2.6	5.0	6.7	11.3

The same data are reproduced in graphical form in Fig. III. It is seen that the curves shown vary in gradient, but in general tend to rise steeply, particularly in the case of Cox's Orange Pippin and

Ribston Pippin. Thus a comparatively small increase in size is accompanied by a marked increase in susceptibility to pitting. No suggestion can be advanced to account for the irregularity of the curves for the Cleopatra variety.

*Other Aspects.*

Certain other aspects of the incidence of bitter pit may be briefly mentioned. The variation in the extent of pitting on arrival in apples from different growers is extremely marked and is generally recognised by the Trade. On account of the irregularity of shipments from individual growers and the difficulty of sorting out particular samples at the London docks, it has not been possible, however, to ascertain by comparative observations over a long period if apples from certain growers or certain districts consistently show more pitting than the average. More conclusive data on this matter could probably be obtained by investigations in Australia.

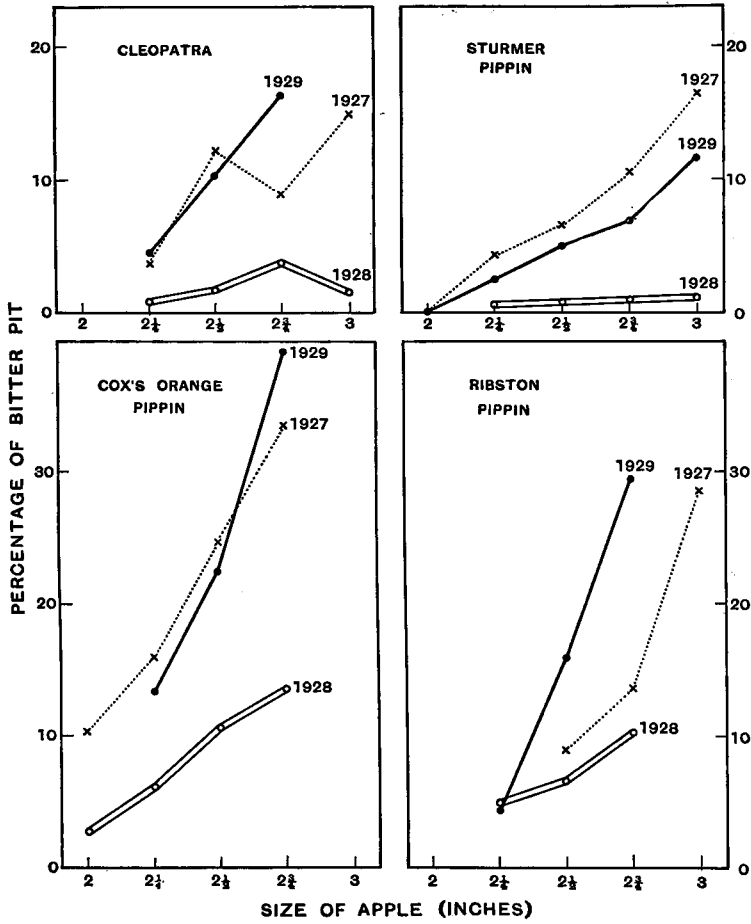
The incidence of pitting also appeared to vary appreciably as between different cargoes. Thus if the individual shipments were arranged in order of sailing, there were considerable fluctuations in the percentage of pitting observed, apart from the general decline as the season advanced. This tendency was especially marked in the Cleopatra variety. The actual figures are not given since their significance is uncertain in view of the comparatively small samples examined, but from investigations into the influence of storage temperatures on the development of pitting it seems probable that different conditions in ships' holds may well affect the incidence of the disease. Thus Carne and his co-workers in experiments undertaken in 1926 (18) and 1928 (5) found a much greater development of bitter pit in Western Australian Cleopatra apples in cold storage than at atmospheric temperature; in 1927, on the other hand, the reverse was the case (21). Less contradictory results have been obtained with Cox's Orange Pippin apples. Experiments by Smith (18) in Tasmania in 1926, indicated that a low storage temperature reduced the development of pitting in this variety and also in Ribston Pippin apples, and similar results with New Zealand Cox's Orange Pippin apples have recently been reported by Barker (2) and Tiller (20).

While it is clear from the above summary that no definite relationship can yet be established between storage temperatures and the development of bitter pit, it is evident that the influence of storage conditions is considerable. The amount of pitting in a cargo of apples on unloading must therefore be to a large extent dependent

FIG. III

To face page 28.

**BITTER PIT IN RELATION TO SIZE.**  
TASMANIAN APPLES. SEASONS 1927-29.



on the conditions obtaining in the ship's hold during the voyage. Further investigations in Australia on this aspect of the bitter pit problem are required and should include experiments on the influence not only of the storage temperature, but also of other factors such as humidity.

*Summary.*

Of the more important varieties of Australian apples, Cleopatra, Cox's Orange Pippin, Ribston Pippin and Sturmer Pippin often show extensive pitting on arrival in the United Kingdom. New Zealand apples are less seriously affected, but the disease is sometimes severe in the Cox's Orange Pippin variety. Data are given of the average percentage of pitting observed in different varieties of apples during the survey.

During the period of the survey, bitter pit was considerably more prevalent in seasons when the crop was light than in seasons when a heavy crop was harvested. If a definite relationship between yield and susceptibility to pitting is established by experiments in Australia, it appears that special precautions should be taken to harvest and handle fruit from lightly laden trees under the optimum conditions for controlling the disease.

In all varieties, the earliest shipments were much the most seriously affected, and where risk of over-ripeness is absent, losses from bitter pit could be materially reduced if the harvesting of susceptible varieties were not begun until somewhat later than is now customary.

Bitter pit is considerably more prevalent in large than in small apples.

There appeared to be an appreciable variation in the extent of pitting in different shipments, distinct from the general decline as the season advanced. This may be due to differences in the conditions in ships' holds, since storage conditions have been shown to have a marked influence on the development of the disease. Further investigation in Australia to define the optimum storage conditions for the control of the pitting are required.

#### IV.—INTERNAL BREAKDOWN.

The physiological decay of apples known as internal breakdown includes at least two distinct diseases, very similar in appearance, but produced by entirely different causal conditions. It is characterised by a mealiness and brown discolouration of the flesh ;

later the fruit usually becomes soft, is easily bruised, and assumes a dull, water-logged appearance. The disease is particularly liable to develop in apples previously affected by such injuries as bruising, bitter pit or water core. Apples suffering from breakdown are readily invaded by rot-producing fungi, and extensive secondary rotting frequently accompanies the disease.

One form, known as low temperature internal breakdown, has been shown (11, 19) to occur only when certain varieties of apples are held at too low a temperature, and may be prevented by storing at a temperature of not less than 38° F. It is in no way connected with freezing, and often develops at temperatures several degrees above freezing point. A second form has been called "Jonathan breakdown," since in some countries it occurs typically in that variety. Investigations in British Columbia (14, 15) have shown that it is closely correlated with the maturity of the fruit, and is only extensive in apples which have passed a certain stage of maturity when harvested. Its onset is retarded, but not prevented, by storage at low temperature.

The existence of these two types of breakdown has been clearly established, but it is possible that further investigation will reveal other forms produced by different causal conditions. Recent experimental shipments (2) and storage trials (20) have definitely shown that the low temperature type of breakdown occurs in New Zealand apples. There is also some indication that this form develops in Australian Jonathan apples (9), but further investigation is necessary before the causes and methods of controlling breakdown in Australian apples can be definitely established.

#### *The Extent of Internal Breakdown on Unloading.*

Like fungal rotting, internal breakdown is not remarkably extensive in Australian and New Zealand apples when first unloaded. Its main development occurs during the later stages of marketing, and it has been found that even apples which are sound on arrival not infrequently show severe breakdown a fortnight or three weeks later. This aspect of the disease is considered in Section VII below.

Serious breakdown does, however, sometimes occur at the docks : boxes showing 20 per cent. of affected apples are by no means uncommon, and cases are occasionally found in which the injury approaches 100 per cent. More often, however, only one or two affected apples occur in a box. The average percentage of breakdown observed during the whole period of the dock survey in the more

important varieties is shown in Table XI, and it is seen that, although the disease has been found in nearly all varieties, its incidence has been low, amounting in most instances to less than 1 per cent. Jonathan, Cox's Orange Pippin and Ribston Pippin were the varieties most seriously affected.

TABLE XI.  
Percentage of Internal Breakdown observed in Australian and New Zealand Apples at Dock Examinations, 1927-29.

Variety.	Percentage Internal Breakdown.				
	Tasmania (1927-28-29).	Victoria (1928).	Western Australia (mainly 1927 and 1929).	South Australia (1928).	New Zealand (1927-28-29).
Alexander .. ..	0.1	—	—	—	—
Alfriston .. ..	0.8	—	—	—	—
Cleopatra .. ..	0.1	0.3	0.1	Nil	Nil
Cox's Orange Pippin	2.1	—	—	—	0.4
Crow Egg .. ..	0.3	—	—	—	—
Delicious .. ..	—	—	—	—	0.7
Dougherty .. ..	—	—	—	—	0.1
Duke of Clarence..	0.1	—	—	—	—
Dunn's Seedling ..	0.8	0.1	Nil	—	Nil
French Crab .. ..	0.5	—	—	—	—
Granny Smith .. ..	—	—	0.1	—	—
Jonathan .. ..	1.8	2.3	3.3	1.0	0.4
King Pippin .. ..	0.7	—	—	—	—
London Pippin .. ..	0.3	1.3	—	—	0.1
Ribston Pippin .. ..	1.1	—	—	—	—
Rome Beauty .. ..	0.4	0.3	0.4	—	Nil
Scarlet Pearmain ..	0.4	—	—	—	Nil
Statesman .. ..	—	—	—	—	Nil
Stone Pippin .. ..	Nil	—	—	—	—
Sturmer Pippin .. ..	0.1	—	—	—	0.3
Tasman Pride .. ..	Nil	—	—	—	—
Worcester Pearmain	0.3	—	—	—	—

In some instances there appeared to be a significant difference in the extent of breakdown in different seasons. Thus in 1927 rather more than 5 per cent. of the West Australian Jonathan apples

examined were affected with breakdown, a large proportion being at an advanced stage of the disease; the small quantities examined in 1928 were also affected to about the same extent. On the other hand, in 1929, when a fairly large sample was again covered, the injury was almost absent from the sample examined, the average amounting to only 0.3 per cent. Similarly, breakdown was fairly serious in Tasmanian Ribston Pippin apples in 1927, when some 3 per cent. was recorded, but in 1928 and 1929 the average amount observed was only 0.2 per cent. and 0.4 per cent. respectively. Considerably less breakdown was observed in Tasmanian Cox's Orange Pippin apples in 1929 than in the two preceding seasons, partly, it appeared, because a lower proportion of large-sized apples were met with in that year. It may also be noted that nearly all the breakdown observed in New Zealand Delicious apples was found in two late shipments in 1929. The figures quoted in Table XI are thus intended to indicate only the order of the loss from internal breakdown occurring on arrival at the market. It is reasonably certain, however, that the relative deterioration in the different varieties over the whole period was substantially as shown.

When breakdown occurred in a shipment wide variations were found in the severity of the disease as between different "marks." These variations may have been due to consistent differences in the susceptibility of fruits from various orchards, or to variations, peculiar to each consignment, in the conditions of harvesting or shipment. It was not possible, however, to follow the behaviour of particular "marks" in successive shipments on a large enough scale to secure adequate data on this aspect. The percentage of breakdown recorded in different shipments also varied appreciably, but the significance of this variation is uncertain, as the fruit in individual shipments is never entirely comparable.

#### *Internal Breakdown in Relation to Maturity.*

The percentage of breakdown observed in apples classified into the different maturity (colour) grades (*see* page 13) is set out in Table XII; it will be seen that in both Australian and New Zealand apples the disease was definitely more extensive in the fully ripe, yellow fruit than in the less mature samples. In some instances (for example, Tasmanian Cox's Orange Pippin and Western Australian Jonathan apples, 1927) there were indications that the extent of breakdown increased as the season advanced, but more frequently no very definite seasonal trend was observed.

TABLE XII.

*Maturity and Internal Breakdown at Time of Unloading in the more susceptible varieties (1928 and 1929).*

Country of Origin.	Variety.	Internal Breakdown (per cent.) in Apples classified as			
		<i>g</i> or <i>gg</i>	<i>yg</i>	<i>yyg</i>	<i>y</i>
Tasmania .. (1928 and 1929.)	Cox's Orange Pippin	Nil	0.3	0.6	3.8
	Jonathan .. ..	Nil	0.1	0.6	4.9
	Ribston Pippin ..	Nil	0.3	0.2	0.7
Victoria .. .. (1928.)	Jonathan .. ..	0.7	1.3	1.6	4.3
New Zealand .. (1928 and 1929.)	Cox's Orange Pippin	Nil	Nil	0.1	1.8
	Delicious .. ..	—	0.1	0.3	3.2
	Jonathan .. ..	—	Nil	0.2	1.0

The above relationship appears to throw some light on the type of breakdown occurring in Australian and New Zealand apples. If the injury were wholly of the low temperature type it is unlikely that it would always be most serious in the apples which were ripest on arrival; the tendency would rather be in the reverse direction, since low temperatures retard ripening. The relationship brought out in Table XII thus suggests that a form of breakdown connected with maturity is also involved.

As noted above, it has been definitely shown (2, 19, 20) that low temperature breakdown occurs in New Zealand apples. Recent storage experiments by Tiller (20) suggest that a form of breakdown connected with maturity may also occur in the Jonathan variety, although this conclusion is not explicitly drawn by Tiller himself. In these experiments, comparatively little breakdown was found in any sample after eight weeks in refrigeration; three weeks further storage at atmospheric temperature, however, brought about a considerable development of the disease in the late picked apples, but little increase in the earlier picked fruit. The final development of breakdown (Table XIII) appeared not to have been greatly influenced by the storage temperature.



TABLE XIII.  
*Percentage of Significant Internal Breakdown in New Zealand  
 Jonathan Apples Three Weeks after Removal from Cold Storage.  
 (After Tiller, 1929).*

Time of Harvesting.	Breakdown (per cent.) in Apples stored at		
	32° F.	35° F.	38° F.
Early . . . .	7	5	4
Late . . . .	16	12	15

This behaviour is more characteristic of the type of breakdown occurring in British Columbian Jonathan apples than of low temperature breakdown. The former type, it may be recalled, is serious only in late picked fruit, while its development is retarded, but not prevented by cold storage. It may further be noted that in earlier experiments by Tiller (19) undertaken in 1927 and 1928, temperature appeared to have relatively little influence on the development of breakdown in Jonathan apples; it is also stated, however, that in 1927 breakdown was no greater in late-picked fruit than in the normal either at high or low temperatures.\*

It thus appears that while there is conclusive evidence that breakdown in New Zealand apples is largely due to low shipping temperatures, there are also indications that in some varieties a form of breakdown connected with maturity may also occur. Further investigation on this point appears to be desirable.

Little is known of the causes of breakdown in Australian apples. There is some indication that a low temperature breakdown occurs (9); there are also several instances recorded of breakdown developing at comparatively high temperatures (9, 6). Further investigation in Australia to ascertain the causes and methods of controlling the disease are necessary.

\* It was also found in 1927 that breakdown in Dunns Favourite apples was greater at high than at low temperatures, but in 1929 the reverse was the case. In 1929, late picking increased the susceptibility to breakdown of Cox's Orange Pippin apples, and, to a less extent of Dunn's Favourite, Statesman and Sturmer Pippin apples, although in these cases storage temperatures had a preponderating influence.

*Internal Breakdown in Relation to Size.*

Like bitter pit, internal breakdown is considerably more extensive in large than in small apples. This relationship was illustrated in the earlier report by a graph showing the average percentage of breakdown observed during the 1927 survey in several of the more important varieties. Similar data for the whole period of the survey are given in Fig. IV and in Table XIV below. New Zealand apples show the same relationship, but are not included because of the different system of size grading employed.

TABLE XIV.  
*Percentage of Internal Breakdown Observed in Different Size Grades.*

Variety.	Internal Breakdown (per cent.) observed in Apples of Size				
	2 inch.	2½ inch.	2¾ inch.	2¾ inch.	3 inch.
<i>Tasmania (1927, 28 and 29).</i>					
Cox's Orange Pippin ..	0.6	1.7	2.5	4.4	—
Jonathan .. .. .	0.3	0.2	0.3	2.5	11.1
Ribston Pippin .. ..	—	0.1	0.8	2.4	—
<i>Western Australia (1927 and 29.)</i>					
Jonathan .. .. .	—	1.2	3.3	7.4	—
<i>Victoria (1928).</i>					
Jonathan .. .. .	—	0.4	1.1	4.6	8.8

The largest sizes of apples are, on the whole, somewhat riper on arrival than the medium and small sized fruits. It therefore seemed possible that the apparent increase in susceptibility to breakdown with size might be a reflection of this ripeness, or alternatively that the apparently greater breakdown in riper apples might be due to their larger average size. More detailed analysis, however, indicated that both relationships were valid. Apples of uniform maturity were found to show more breakdown in the larger sizes, while in apples of uniform size the injury was most serious in the riper fruits.

*Summary.*

Internal breakdown is not extensive in Australian and New Zealand apples on arrival at the market, its chief development

occurring during the later stages of marketing. At the time of discharge the most serious wastage was found in Tasmanian Cox's Orange Pippin, Jonathan and Ribston Pippin apples and in Victorian and Western Australian Jonathan apples: in most other varieties less than one per cent. of the fruit examined was affected. The injury appears to vary appreciably in extent in different seasons.

In all varieties, breakdown on arrival was most serious in apples which were fully ripe. In some instances, (e.g., Tasmanian Cox's Orange Pippin and Western Australian Jonathan apples 1927) there were indications that the extent of breakdown increased as the season advanced, but more frequently no very definite seasonal trend was observed. Large apples were much more affected by breakdown than small apples.

#### V.—OTHER TYPES OF WASTAGE.

In addition to the diseases considered above, various other forms of wastage were observed more occasionally during the survey, the most important being soft scald, Jonathan spot, brown heart and freezing injury. Although these types of wastage sometimes cause serious losses, they are more limited in their incidence and generally less important than fungal rotting, bitter pit or breakdown, and only a brief account of their occurrence is therefore given here. Other diseases very occasionally noted included surface scald of Tasmanian Cleopatra apples, a lentical spotting scald (superficial) of Tasmanian Jonathan apples, water core in several varieties from all areas, surface cracking of Dunn's seedling and Cox's Orange Pippin apples, and "fly speck" on various Tasmanian apples.

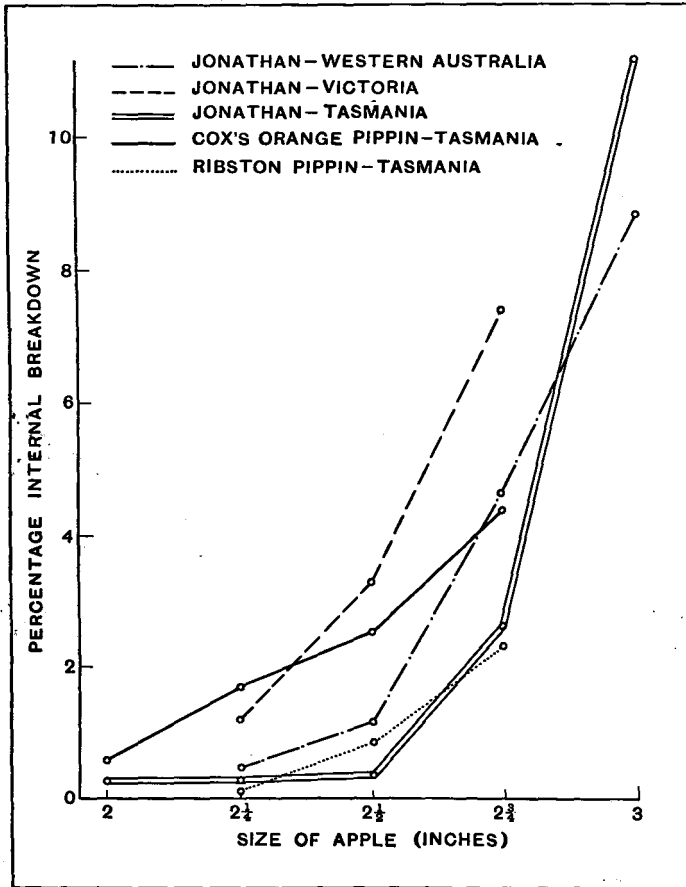
##### *Soft Scald.*

Soft scald is one of the less common storage diseases and affects only a few varieties: it is characterised by irregular but sharply defined areas of soft, light brown tissue which may extend a considerable distance into the flesh. The tissue in the neighbourhood of the stem and calyx appears to be immune and in the most advanced cases the injury spreads round the middle of the apple in an irregular band. The disease has been shown to occur only in fruit which has been stored at low temperatures in the neighbourhood of 32° F. (2, 20).

FIG. IV.

To face page 36

INTERNAL BREAKDOWN IN RELATION TO SIZE.



During the present survey, soft scald has been observed in several shipments of Jonathan apples from New Zealand, Tasmania and Victoria. A high proportion of the fruit in some "marks" was affected, but the total losses from the disease were not extensive.

#### *Jonathan Spot.*

Several varieties are susceptible to this disease, but it is especially common in the Jonathan. The skin of an affected apple develops numerous, small, brown or black spots which are usually deeper in colour than bitter pit spots and do not extend appreciably into the flesh. The appearance of the fruit is impaired, but it is doubtful if the injury is of great commercial importance except in extreme cases. No effective method of control has yet been established.

Carne (6) has recently suggested the classification of physiological spotting injuries into three distinct diseases: Jonathan spot, Lenticel Blotch and Lenticel Scald. In the present report the term Jonathan spot is used in its customary sense to include all physiological spotting of the skin, but it may be noted that injuries resembling Carne's descriptions of both Jonathan spot and lenticel blotch have been observed.

Jonathan spot has frequently been observed in Western Australian and Victorian apples. In 1927 some 10 per cent. of the Western Australian Jonathan apples examined were affected, and in 1929 the corresponding figure was 5 per cent.; rather more than 6 per cent. was recorded in 1928 in Victorian apples of the same variety. Tasmanian Jonathan apples were much less extensively affected, the average spotting having been of the order of one per cent. in all three seasons of the dock survey, and in the case of New Zealand the proportion was still lower. In other varieties from all areas the spotting observed was negligible.

In 1927, Western Australian Jonathan apples appeared to be more extensively spotted at the beginning than at the end of the season; but in 1929, when extended observations were again possible, no very definite relationship was apparent. Similarly no marked seasonal variation has been noticed in the case of Victorian or Tasmanian apples.

Carne found in experiments undertaken in 1929 with Western Australian Jonathan apples that small fruits developed more spotting than the larger sizes. Here again, however, no general relationship

has emerged in the present survey. For example, an average of 7.1, 6.9 and 6.3 per cent. of spotting was observed in Victorian Jonathan apples of the 2 $\frac{1}{4}$ , 2 $\frac{1}{2}$  and 2 $\frac{3}{4}$  inch sizes respectively, while in Western Australian apples rather more Jonathan spot was recorded in the 2 $\frac{1}{2}$  inch size than in either 2 $\frac{1}{4}$  or 2 $\frac{3}{4}$  inch apples.

#### *Brown Heart.*

The physiological injury, brown heart, was formerly responsible for very heavy losses in Australian apple shipments. Investigations at the Low Temperature Research Station, Cambridge (11), showed that it was caused by the accumulation of high concentrations of carbon dioxide in ship's holds; adequate ventilation therefore effectively prevents its occurrence. Susceptibility to brown heart increases as the temperature of fruit is reduced, and at low temperatures the disease may be incurred at a gas concentration which would have no injurious effect at a higher temperature.

Sharply defined areas of firm, deep brown tissue develop in the interior of an affected apple; these gradually enlarge and may ultimately involve the whole flesh. Even in fairly advanced cases the external appearance of the fruit is often quite normal, but in such cases it is sometimes possible to detect affected apples by a characteristic resilience due to the underlying dead tissue. If the causal conditions (high carbon dioxide concentrations) are removed after a time, the brown areas do not continue to increase in size, but dry out leaving cavities lined with brown, leathery tissue in the interior of the fruit.

Cases of brown heart still occur occasionally and, in view of the large number of boxes affected in each instance, cause appreciable losses. Two shipments of Australian apples showing brown heart arrived during the period covered by the present report, one in 1927 and one in 1930. In both cases the injury was confined to one hold, but in these holds a high proportion of the fruit was affected. In addition, one outbreak of brown heart occurred in New Zealand apples during 1930.

#### *Freezing Injury.*

Freezing injury of apples is characterised by a softening and brown discoloration of the flesh somewhat resembling internal breakdown; it may generally be distinguished from the latter disease, however, by a typical radial appearance of the flesh often apparent when a frozen apple is cut transversely, while any bruises incurred when the

apple is frozen show prominently after thawing as deep brown sectors of water-soaked tissue extending inwards to a considerable depth. In severe cases of freezing, the fruit may become brown and shrunken and the skin tends to split irregularly.

Freezing injury is not uncommon in Australian and New Zealand fruit shipments; frequently a few boxes of frozen apples are found in a cargo, and on four occasions during the survey more serious damage involving several hundred boxes was observed.

#### VI.—WASTAGE IN PEARS.

Serious wastage, mainly as a result of over-ripeness, was frequently observed in Australian pears on unloading at the dock, and there can be no doubt that considerable further losses were incurred during the later stages of marketing, in view of the rapidity with which many varieties pass from eating maturity to an over-ripe and sleepy condition. Wastage was also caused by fungal rotting and by the physiological diseases, core-breakdown and scald. In addition, extensive losses from brown heart and freezing injury respectively were observed in two shipments during the survey.

The New Zealand pears examined were on the whole in better condition, but extensive over-ripeness occurred in several shipments.

##### *Fungal Rotting.*

In general, fungal rotting was most frequently observed in pears which were over-ripe or affected by scald when unloaded, and in such consignments the injury was sometimes extensive. Several examples were also observed, however, of serious rotting in firm, green pears. In these instances the decay had usually originated at case injuries, or at wounds such as stem and nail punctures which appeared to have been incurred before packing. Slight wastage of this type was fairly common in most consignments. As in apples, the greater part of the rotting observed in pears at the dock examinations was caused by the fungi *Penicillium expansum* and, to a less extent, *Botrytis cinerea*.

The average extent of rotting in the principal varieties examined is set out in Table XV. In most instances the percentage affected was low: the comparatively high figure recorded for Victoria Beurre Bosc pears was largely due to extensive rotting secondary to scald which occurred in several shipments in 1928.

TABLE XV.  
*Percentage of Fungal Rotting Observed in Australian and New Zealand  
Pears at Dock Examinations, 1927-1929.*

Variety.	Fungal Rotting (per cent.).			
	Tasmania.	Victoria.	Western Australia.	New Zealand.
Beurre Bosc .. ..	1.8	3.0	—	1.6
Beurre Clairgeau ..	0.2	—	—	—
Doyenne du Comice ..	1.6	—	0.6	0.2
Easter Beurre .. ..	1.2	—	—	—
Glou Morceau .. ..	1.9	—	—	—
Josephine .. .. .	0.6	1.3	0.8	0.4
Winter Cole .. .. .	1.6	—	—	0.1
Winter Nelis .. ..	0.8	0.7	0.4	0.7
Vicar of Winkfield ..	0.5	—	1.8	0.1

*Over-ripeness.*

Shipments of pears vary widely in maturity at discharge : in some instances most of the fruit is green and firm, while in other cases a large proportion of the cargo is over-ripe. In the latter shipments it is reasonably certain that the over-ripeness is mainly due to relatively high carrying temperatures, since most varieties of pears may be kept for a considerable time in the neighbourhood of 32°-34° F., but soften more or less rapidly at somewhat higher temperatures. Direct evidence of the influence of carrying temperatures on the condition of pears has been obtained in experimental shipments with New Zealand pears (2). It is also probable, however, that some wastage results from the shipping of fruit which is already too ripe when loaded into the ship's hold.

Wastage from over-ripeness varies considerably in different seasons. It was more extensive in both Australian and New Zealand pears in 1928 than in 1927, or 1929 and is reported to have been particularly severe in 1926.

Different varieties show a wide variation in susceptibility to over-ripeness. For example, in Beurre Bosc, Doyenne du Comice, and William's Bon Chretien, the over-ripe condition is particularly common ; others, such as P. Barry and Vicar of Winkfield, are almost invariably firm and green on arrival, even in the ripest shipments. Many instances were seen, particularly in the two latter and in the Winter Nelis and Winter Cole varieties, where pears appeared to have



been picked too early. Such pears were immature in appearance and often more or less shrivelled; and it seemed improbable that the fruit would ripen satisfactorily.

The conditions as regards ripeness of the principal varieties examined is summarised in Table XVI, which combines the results of three seasons' examinations. Pears classified in the first group were definitely firm and unripe when examined; those in the second group were almost or quite ready for eating. The third group includes "sleepy" fruit and also pears which were so soft that they were likely to become uneatable within a few days: the latter would in many instances have been saleable only at low prices.

TABLE XVI.  
*Condition of Australian and New Zealand Pears Examined.*

Variety.	No. Boxes examined.	No. Boxes containing firm, green pears.	No. Boxes containing pears beginning to soften.	No. Boxes containing over-ripe or sleepy pears.
<i>Tasmania.</i>				
Beurre Bosc .. ..	136	100	18	18
Beurre Clairgeau .. ..	54	34	13	7
Doyenne du Comice .. ..	75	41	23	11
Easter Beurre .. ..	65	58	4	3
Glou Morceau .. ..	139	71	51	17
Josephine .. ..	43	30	11	2
Winter Cole .. ..	64	31	15	18
Winter Nelis .. ..	99	63	32	4
Vicar of Winkfield .. ..	75	72	0	3
<i>Victoria.</i>				
Beurre Bosc .. ..	131	94	17	20
Josephine .. ..	50	41	5	4
Winter Nelis .. ..	42	38	3	1
<i>Western Australia.</i>				
Doyenne du Comice .. ..	27	12	3	12
Josephine .. ..	71	29	27	15
Winter Nelis .. ..	56	29	11	16
Vicar of Winkfield .. ..	30	29	1	0
<i>New Zealand.</i>				
Beurre Bosc .. ..	38	25	11	2
Doyenne du Comice .. ..	33	13	8	12
Josephine .. ..	27	24	2	1
Winter Cole .. ..	55	31	22	2
Winter Nelis .. ..	87	57	25	5
Vicar of Winkfield .. ..	20	19	1	0

### *Scald and Core Breakdown.*

The physiological diseases, scald and core breakdown, may be conveniently considered together, since they are usually found in association on Australian pears, frequently occurring on the same fruits.

In the initial stages of scald, brown areas develop on the skin, somewhat resembling superficial scald of apples. Later the underlying flesh is affected, and the discoloured skin often becomes loose and easily rubbed off. Finally the whole skin becomes deep brown in colour, and the injury may extend a considerable distance into the flesh. Affected pears are readily invaded by rot-producing fungi. Comparatively little has been published on the disease, and no systematic study appears to have been undertaken in Australia. Experiments with South African William's Bon Chretien pears (16) indicated that scald developed only after a fairly prolonged period of storage. In most cases the disease developed more rapidly in late picked than in early picked fruit, and there was also some indication that development was more rapid at 45° F. than at 32° F. Fruit from a number of localities showed considerable differences in susceptibility. Oiled wrapping paper, which gives a good control of superficial scald of apples, proved generally ineffective in the case of pear scald.

Core breakdown is characterised by a discoloration and softening of the core region which frequently tends to separate from the surrounding tissue. The outer flesh is sometimes firm and unripe, and in other cases mealy and flavourless. In advanced stages of the disease, the discoloration may extend beyond the core region into the cortical tissue. The disease appears only to develop in storage as the fruit approaches eating maturity. Here again, no systematic study of the disease appears to have been undertaken in Australia. Investigations in America (10) indicated that core breakdown of Oregon pears is related to the harvesting maturity, and is serious only in fruit picked after a certain optimum harvesting time. In South Africa, however, core breakdown has been recorded as occurring in fairly early picked William's pears (16.) In this connection it is to be noted that breakdown of Australian pears is not confined to the latter part of the shipping season of the susceptible varieties. During the present survey it has in fact been more frequently noted in early and mid-season shipments.

Both scald and core breakdown were only very occasionally noted during the first year of the dock survey. In 1928, however, the two diseases occurring in association caused very serious losses in a number of shipments of Victorian and Tasmanian Beurre Bosc and Beurre Clairegeau pears. In some "marks" nearly 100 per cent. of the fruit was affected, the injury ranging from an early stage to a condition in which both skin and flesh were a uniform deep brown colour and the pears so soft and collapsed that they had sunk half-way down the boxes. This extensive injury was observed in three early and mid-season shipments, while less serious examples of the same type of wastage were noted in a number of other cargoes. Severe scald and core breakdown of Tasmanian Beurre Bosc pears was also observed in 1929. Both diseases develop rapidly after removal from cold storage; instances have been noted, for example, of pears which appeared sound on unloading, but which were completely discoloured by scald one day later.

In addition to the varieties mentioned above, scald and core breakdown have been found, though to a less serious extent, in Beurre de Capiaumont, Josephine and Winter Cole pears.\* Scald without breakdown has been noted in Black Achan, Packham's Triumph and Beurre Diel pears, and core breakdown unaccompanied by scald in Winter Nelis pears. The injuries have sometimes been observed in Western Australian pears, but not in pears from New Zealand.

It is to be noted that the factors influencing the development of scald and core breakdown have not yet been established, and in consequence satisfactory control measures cannot be suggested. Investigation into both diseases is desirable.

#### VII.—THE DEVELOPMENT OF WASTAGE IN APPLES AFTER UNLOADING.

In the preceding sections consideration has been given to the wastage found in Australian and New Zealand apples on arrival at the docks. This wastage, however, by no means represents the total loss from wastage incurred in marketing. It has long been known that extensive deterioration often develops after the fruit has been removed from the ship's hold, even in apples apparently sound when unloaded. Hitherto little reliable information has been available on this subject,

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\* In 1931 very serious scald and core breakdown occurred in a shipment of William's Bon Chretien pears from Victoria.

but recently striking data of the great increase in breakdown and fungal rotting sometimes occurring in samples of imported Australian and New Zealand apples retained under observation have been published by the Food Investigation Board (1).

Considerable attention has been given to this aspect of wastage during the present survey, but progress has been slow on account of the inherent difficulty of the work. As a first step, samples of fruit were traced from the dock to the wholesale warehouse or retail shop for re-examination, and in this way some idea was gained of the nature of the wastage developing in the later stages of marketing. On account of the wide distribution of the fruit, however, it was not possible to undertake these examinations on a sufficiently large scale to give reliable quantitative results. Moreover, it was recognised that any investigation should include enquiries on the time taken between unloading and arrival in the retail shop, since the extent of wastage will be largely dependent on the length of this period.

Towards the end of the 1929 season, a new method of approach to the problem was tried. Cards were inserted in a random sample of boxes at the London docks asking the retailer to fill in (a) the date of opening the box and (b) the amount of wastage then present. Altogether some 1,200 cards were inserted in boxes of apples from four shipments, three from New Zealand and one from Australia. Only 91 (7 per cent.) were returned, but the results appeared to be of sufficient interest to justify continuing the experiment. In the following season the enquiry was entirely confined to New Zealand apples.

The results obtained in the two seasons are summarised below. It should be emphasised, however, that in view of the comparatively small scale of the enquiries no great significance is to be attached to the data presented, which are to be considered as a suggestive sketch rather than an accurate picture of the time taken and wastage developing in the later stages of distribution. It is hoped later to develop the investigation on a more comprehensive scale.

#### *The 1929 Enquiries.*

In 1929 the great majority of the cards were placed in boxes of Sturmer Pippin apples, which constituted the greater part of the shipments at the time of the experiment. In this variety, the period

between unloading the boxes at the dock and opening in the retail shop varied from 2 to 31 days (average 10 days). Very few boxes were opened in the first five or six days after discharge, but about two-thirds of those for which returns were made had been opened within two weeks. Wastage reported in individual boxes varied from nothing to 67 per cent. (average 9 per cent.) and, in general, was considerably higher in the later boxes opened. About 30 per cent. of the boxes were reported to contain no wastage, while some 50 per cent. showed less than 2 per cent. of wastage. On the other hand, 30 per cent. of the boxes contained over 10 per cent. of decayed fruit; viewed from this angle the position is less satisfactory.

Considerably less wastage was reported in the first and third than in the second and fourth shipments, although the average time of distribution was not appreciably different. In view of the small size of the sample, it is not claimed that the difference in wastage is significant, but it is of interest to note that the apples examined at the dock were considerably more mature in the two latter than in the two former shipments, the apples in the first shipment in particular being remarkably green and firm for so late a stage in the season.

#### *The 1930 Enquiries.*

In 1929 cards were placed in a random sample of boxes at the dock, but in the following season some degree of limitation was attempted. The investigation was confined to the four varieties of New Zealand apples—Cox's Orange Pippin, Jonathan, Delicious and Sturmer Pippin—and cards were placed mainly in boxes from four growers, chosen by the New Zealand Fruit Board as likely to forward large and regular consignments of the selected varieties.

In addition, one further experiment was tried. For some years, it has been the practice of the New Zealand Fruit Board to place a quantity of fruit from one of the last shipments into cold storage for later marketing. It was decided to insert cards in boxes of this fruit in order to compare the wastage with that of fruit marketed in the usual way immediately after arrival.

Particulars of the cards inserted and returned for each variety are set out in Table XVII below. Altogether 19 shipments were covered, some of which contained fruit of more than one of the selected varieties.

TABLE XVII.  
Number of Cards Inserted and Returned, 1930.

Variety.	Number of Shipments Covered.	Number of Cards Inserted.	Number of Cards Returned.	Percentage Cards Returned.
Cox's Orange Pippin ..	5	677	77	11.4
Jonathan .. .. .	8	817	73	8.9
Delicious .. .. .	3	347	28	8.1
Sturmer Pippin .. ..	5	1,113	109	9.8
Sturmer Pippin (Cold Storage).	1	1,000	77	7.7
Total .. .. .	—	3,954	364	9.2

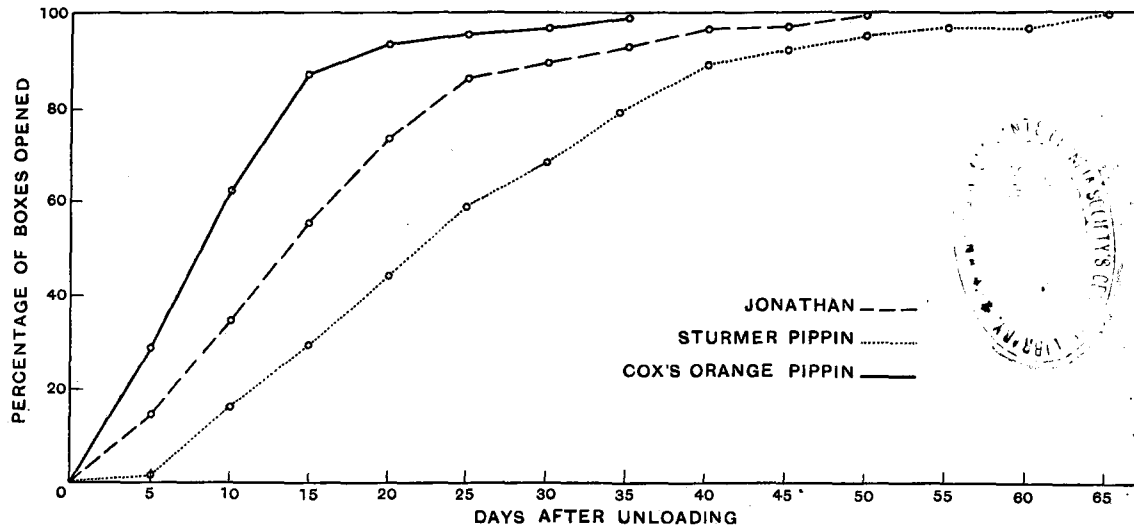
*Time of Distribution.*

The average time of distribution of each variety and the percentage of boxes opened in each five-day period after unloading are shown in Fig. V and in Table XVIII. This table combines the results of all shipments marketed on arrival, but does not include the Sturmer Pippin apples retained in Cold Storage at Southampton. No figures are given for the Delicious variety because of the small number of returns.

TABLE XVIII.  
Rate of Distribution of New Zealand Apples, 1930.

Variety.	Number of Cards Returned.	Average Time of Distribution (Days).	Percentage of Boxes Reported Opened in each Five-Day Period after Unloading.									
			1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	Over 41 (max. 64 days).	
Cox's Orange Pippin	77	10	31	30	26	8	1	1	3	—	—	
Jonathan .. .. .	73	15	16	19	21	18	14	3	5	3	1	
Sturmer Pippin ..	109	22	1	15	13	16	15	8	11	11	10	
All Varieties ..	259	16.5	14	21	19	14	10	5	7	6	4	

Two outstanding points emerge from the above Table: the marked difference in the rate of marketing the three varieties, and the slow rate of distribution of the Sturmer Pippin apples. In the



RATE OF DISTRIBUTION OF NEW ZEALAND APPLES, 1930.

FIG. V.

To face page 46.



latter variety, the average time elapsing between unloading and opening in the retail shop was 22 days, more than twice as long as the corresponding average period for Cox's Orange Pippin. Again, while 87 per cent. of the boxes of Cox's Orange Pippin apples were opened within 2 weeks of unloading, only 29 per cent. of the Sturmer Pippin apples were opened in the same interval and 90 per cent. were not reported until nearly five weeks after discharge. Jonathan was intermediate between the above two varieties in time of distribution. The relatively rapid distribution of Cox's Orange Pippin may probably be accounted for by its wide popularity, its reputation for rapid deterioration, and possibly also by more favourable market conditions. Similar considerations appear to explain the slower distribution rates of Jonathan and Sturmer Pippin.

It may be noted that the rate of distribution of Sturmer Pippin apples appears to have been slower in 1930 than during the preliminary experiment in 1929, probably because of the much larger quantities shipped in 1930 and the intensified industrial depression. No comparative figures for the two seasons are available for the other varieties.

In general there was no marked difference in the rate of distribution of individual shipments. A noticeable exception occurred, however, in the case of one shipment of Cox's Orange Pippin apples which appears to have been moved into consumption unusually rapidly. Several boxes from this shipment were reported by retailers to have been opened the day after unloading at the docks, while some 70 per cent. of the total returns were received within the first five-day period. This followed a temporary shortage of New Zealand apples, but ample supplies of Australian apples were available at the time.

#### *The Development of Wastage during Distribution.*

The extent of wastage reported varied widely, but in many instances serious deterioration had evidently occurred. On the other hand, a large proportion of the boxes had reached the retailer in very good condition and many favourable comments were received. Table XIX shows the average wastage reported in all returns of each variety and also the percentage of returns falling into three wastage groups. The latter figures probably give the more accurate idea of the extent of wastage. The comparatively high average wastage in Sturmer Pippin apples, for example, is mainly due to the occurrence of a small number of exceptionally



wasty boxes. Actually, all varieties appear to have reached the retailer in fairly similar condition, since the proportion of boxes classified in the three "wastage groups" was approximately the same in each case. Serious wastage (over 10 per cent.) had developed in about 20 per cent. of boxes in all varieties.

TABLE XIX.  
*Distribution of Wastage : New Zealand Apples, 1930.*

Variety.	No. of Cards Returned.	Average Percentage Wastage.	Percentage of Returns Reporting		
			Up to 2 per cent. Wastage.	2 to 10 per cent. Wastage.	Over 10 per cent. Wastage.
Cox's Orange Pippin ..	77	4	51	36	13
Jonathan .. ..	73	7	52	22	26
Sturmer Pippin.. ..	109	8	48	33	19
All Varieties ..	259	—	50	31	19

No figures are available as to the extent of wastage at the time of unloading at the docks, as the number of boxes examined at that point in 1930 was not sufficient to afford a reliable average. From experience during the preceding three seasons, however, it is reasonably certain that wastage at the dock was considerably less than that reported from the retail shop, a large proportion of which must have developed during the period of distribution. In particular, Sturmer Pippin apples show a negligible amount of wastage when first discharged from the ship's hold. As in 1929, more extensive wastage was reported in the later boxes opened; this illustrates very clearly the importance of moving fruit into consumption as quickly as possible after unloading.

Considerable differences were again reported in the condition of the fruit from different shipments, more particularly in the Sturmer Pippin variety. Further, the last shipments of Cox's Orange Pippin and Jonathan appear to have been rather more wasteful than the average. In view of the small number of cards returned in each particular case, no great significance can be attached to these differences, but they suggest that results of interest might be obtained if similar experiments were conducted on a larger scale.

### *Nature of Wastage.*

From general observations made in markets and retail shops, it appears that rotting and internal breakdown are the most important causes of the development of wastage in New Zealand Cox's Orange Pippin, Jonathan and Sturmer Pippin apples after unloading. In addition, bitter pit sometimes occurs in Cox's Orange Pippin apples: this disease does not appear to increase appreciably after unloading, although the spots may become darker and more prominent. Breakdown and rotting were also the main causes of wastage in the storage experiments of the Food Investigation Board (1) already mentioned, while similar results were obtained in recent storage experiments undertaken in New Zealand (20). It is thus probable that the greater part of the wastage reported by retailers was due to breakdown and to fungal rotting following over-ripeness. Comparatively few returns, however, included precise information of the nature of the wastage, although in one or two cases descriptions were given which appeared to indicate internal breakdown.

Over-ripeness was a fairly frequent cause of complaint, while some Sturmer Pippin apples which were opened a considerable time after unloading were reported to be badly spotted and shrivelled. Spotting was also reported on two occasions in the Cox's Orange Pippin variety: this fruit had been unloaded only a few days previously and the injury was probably bitter pit. Bitter Pit was once reported as such in Cox's Orange Pippin apples. "Eye-rots" were twice mentioned in Jonathan apples. Three retailers stated that Delicious apples which appeared sound were brown at the core and had been returned by customers; these apples were found to be suffering from "mouldy core," a type of rotting fairly common in the Delicious variety.

### *Bruising.*

Bruising was the complaint most frequently received in regard to all varieties, and many retailers suggested that larger boxes, looser packing or additional packing material should be employed to minimise such losses. It is possible that in some cases badly bruised apples were stated to be wasty, but a large number of retailers reported bad bruising separately from ordinary wastage: these bruised apples have not been included in Table XIX. It is evident that at present bruising is a serious cause of deterioration, and further investigations into methods of reducing this injury are likely to lead to results of great benefit to the industry.

*Sturmer Pippin Apples Marketed after Cold Storage.*

Cards were inserted in 1,000 boxes of Sturmer Pippin apples held in cold storage to ascertain whether serious wastage developed in the fruit and to compare its condition with that of fruit marketed in the ordinary way. The apples were unloaded at Southampton on July 3rd and immediately placed in cold storage. The first boxes containing cards were taken out of cold storage on July 29th after 26 days' storage, and the last on September 2nd after 61 days. All the cards had of necessity to be inserted before any fruit was distributed and there was therefore no means of ascertaining how long any particular box had been out of cold storage when opened by the retailer.

An analysis of the returns for the Sturmer Pippin variety is given in Table XX, and it is seen that on the whole the cold-stored apples showed rather less wastage than the fruit marketed immediately after unloading. The sound condition of the cold-stored fruit may have been due to some extent to rapid marketing after removal from cold storage.

TABLE XX.

*Wastage in New Zealand Sturmer Pippin Apples Marketed after Cold Storage at Southampton, Compared with Fruit Marketed Immediately after Unloading.*

Sample.	Number of Cards Returned.	Average Wastage (per cent.).	Percentage of Returns Reporting.		
			Up to 2 per cent. Wastage.	2 to 10 per cent. Wastage.	Over 10 per cent. Wastage.
Fruit Marketed on Arrival .. ..	109	8	48	33	19
Fruit Marketed after Cold Storage .. ..	77	5	66	22	12

*Discussion of Method.*

In conclusion, certain possible criticisms of the "card" method of investigation may be considered. The first and most serious is the small size of the sample and, until further evidence is forthcoming, the results obtained must be regarded with caution.

Except that in the earlier 1930 shipments a high proportion of cards was inserted in boxes from four selected growers, every effort was made to render the sample as representative as possible and cards were placed in boxes of all counts and grades. The sample boxes were not opened to insert cards and were indistinguishable from the remainder of the consignment: there is therefore no reason to suppose that they received different treatment from other similar boxes then on the market. One objection which may be raised against the representative nature of the sample, however, is that retailers would perhaps be more likely to report on a box received in poor condition than on a sound box, which would tend to be passed over as lacking in interest. How far this was actually the case is uncertain, but it may be noted that 29 per cent. of the cards returned related to boxes containing no wastage whatever, while in 50 per cent. of the returns less than 2 per cent. of wastage was reported. Further, many retailers commented on the excellent condition of the fruit.

Some uncertainty is also introduced into the results by the possibility of divergence in the opinion of retailers as to what constitutes a "wasty" apple. It has in fact been found in other retail investigations that fruit which would be rejected in a "high class" shop would be unhesitatingly sold in a shop with a less wealthy class of customers. There is therefore the likelihood that slightly spotted or bruised apples would be considered wasty in the former class of shop, while in the latter fruits showing eye-rots or similar unobtrusive decays would be classed as sound. These opposing tendencies may be expected to counterbalance to some extent, but uncertainty as to what exactly is classified as wasty is an unsatisfactory but inevitable feature of this type of investigation.

Throughout this section, the "times of distribution" quoted represent the number of days elapsing between the date of unloading at the docks and the date of opening the box as reported by the retailer. This period may not in every case correspond exactly with the time taken to reach the shop, since the retailer will not necessarily open the box on the day it is received. From investigations among retail fruiterers, however, it appears that most retailers usually buy only a few boxes of fruit at a time: in all probability, therefore, the date of opening a box does not differ greatly from the date of receipt in the large majority of cases. Where fruit had been stored by the fruiterer the fact was sometimes reported on the card. In any

case, deterioration continues unchecked after the fruit comes into the hands of the retailer and, from the point of view of wastage, the date of opening the box is of more significance than the date of its receipt.

At the beginning of the enquiry some anxiety was felt as to the attitude retailers would adopt. It was realised that the percentage of cards returned would not be high and some doubt was experienced as to the care and accuracy with which the details would be inserted. From the evidence of the cards themselves, however, it appeared that those retailers who answered the enquiry did so with some interest. Many criticised or commended the packing and quality of the fruit, others gave particulars of their experience with New Zealand and Australian apples this season and similar information likely to be of assistance. It is therefore felt that most fruiterers who returned cards were at some pains to ensure that their information was satisfactory.

On the whole, it appears that while this type of investigation has certain limitations, it presents an effective method of obtaining quantitative information of the behaviour and development of wastage after unloading. The larger and more representative the sample covered, however, the greater will be the accuracy of the results, and it is hoped later to develop the investigation on more comprehensive lines.

The preliminary results suggest that serious wastage develops in an appreciable proportion of boxes of New Zealand apples by the time they reach the retail shop; investigations with Australian apples would probably yield similar results. This wastage appears to be intensified by the considerable period which often elapses after unloading before the fruit comes into the hands of the retailer, and the data already secured emphasise the importance of reducing this interval to a minimum.

#### VIII.—DISCUSSION OF RESULTS.

Wastage in Australian and New Zealand apples is seen to be due mainly to over-ripeness and fungal rotting, to internal breakdown and to bitter pit. Fungal rotting and internal breakdown largely develop after the removal of the fruit from the refrigerated hold; bitter pit on the other hand has normally attained its full development on discharge, though the injury may subsequently become more conspicuous. In pears, over-ripeness is the principal type of wastage, both at the time of unloading and during the later stages of marketing.

### *Temperature of Shipment.*

Recent investigation has shown that the types of wastage mentioned above are closely related to the conditions maintained in the hold during shipment. Over-ripeness and fungal rotting in both apples and pears result mainly from too high a carrying temperature: internal breakdown, on the other hand, at least in some varieties, is largely due to shipment at low temperatures. Deep scald of apples and, of course, freezing injury also result from low temperatures. The temperature relations of bitter pit are less clearly established and further investigation is needed to define the most suitable conditions of storage. It is certain, however, that storage conditions have a marked effect on the ultimate development of pitting.

It is thus clear that a considerable reduction of wastage might be effected if the temperature conditions in holds carrying fruit could be accurately adjusted to the optimum value. This, however, is a matter of extreme difficulty, and it has been found that at present there is often a considerable temperature variation as between different parts of a ship's hold. The maintenance of uniform temperatures in large masses of fruit is now being studied at the new Ditton Experimental Station and it is anticipated that improved methods will gradually be evolved.

A report (2) on the influence of carrying temperatures on wastage in New Zealand apples has recently been published by the Food Investigation Board, and there can be little doubt that the conclusions reached are for the most part also applicable to Australian apples. No further consideration of this subject is therefore included here; for further particulars, reference should be made to this publication.

### *Bitter Pit and Time of Harvesting.*

The results of the dock survey have amply confirmed the view that bitter pit is more extensive in early than in late picked apples, and it is clear that a marked reduction of this type of wastage could be effected if the harvesting of susceptible varieties were not commenced until later than is now customary. In view of the immature condition in which early shipments often arrive, later picking would in many cases be of benefit from the point of view of eating quality as well as from that of bitter pit.

It should be emphasised, however, that while material improvement may be effected by this means, complete control is not to be expected. Reference to Table IX shows that in many cases during seasons of

heavy pitting the injury did not fall to negligible proportions until an advanced stage in the season, while in some instances (e.g., Tasmanian Cox's Orange Pippin, 1927) fairly extensive pitting was present in even the final shipments.\* In such cases, the delay in harvesting needed to secure effective control appears impracticable in view of the great shortening of the shipping season involved.

It should further be noted that while Cleopatra and Sturmer Pippin apples could be harvested later than at present with little danger of over-ripeness, this is by no means the case with the very susceptible varieties, Cox's Orange Pippin and Ribston Pippin. Under existing conditions these varieties often arrive in a very ripe and forward condition and later picking would be attended with grave risk.

Thus it appears that while a considerable reduction in the extent of pitting could be effected by delayed harvesting, more especially in the Cleopatra and Sturmer Pippin varieties, the limitations of the method are considerable and further investigation is necessary to devise supplementary control measures. It may be noted, however, that the method would be capable of wider application if shipping conditions could be adjusted sufficiently accurately to eliminate risk of over-ripeness in the later picked apples. Thus the investigations into methods of securing temperature uniformity at present in progress at the Ditton experimental station are likely to have an important indirect bearing on the control of bitter pit.

In addition, storage conditions have been shown to have a considerable direct influence on the ultimate development of pitting, and it seems probable that a large measure of control might be obtained by suitable methods of storage. The optimum conditions of temperature and humidity for controlling the injury have not, however, been established, and further investigation in this direction with Australian apples appears likely to lead to valuable results.

#### *Pitting in Different Seasons.*

One of the most striking observations made during the survey has been the very large seasonal difference in the extent of pitting, which in the more susceptible Tasmanian varieties was many times more serious in 1927 and 1929 than in 1928. It is suggested that this variation is related to the size of the Tasmanian crop, which was

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\* To some extent, however, this late season pitting may have occurred in apples picked comparatively early and held in storage for some time before shipment.

unusually heavy in 1928, but light in 1927 and 1929.\* Should this suggestion be confirmed by further investigation in Australia, it appears that special attention should be paid to the harvesting, storage and shipment of fruit from lightly laden trees to ensure it being handled under the optimum conditions for the control of pitting.

In this connection a recent large scale experiment at Penticton, British Columbia, is of interest. Breakdown in British Columbian Jonathan apples has been shown to be particularly severe in fruit from trees bearing a light crop; it may be controlled by earlier harvesting. In 1929 the experiment was accordingly tried in the Penticton area of flagging all trees of Jonathan apples bearing light crops and fixing final dates for harvesting fruit from lightly and heavily laden trees respectively. This harvesting programme proved completely successful. No claims for breakdown were received throughout the season, while the cost of the scheme amounted to only 0.8 cents per box. It seems likely that similar methods may prove of value in controlling bitter pit.

#### *Types of Internal Breakdown.*

Reference has already been made (Section IV) to the two types of internal breakdown at present recognised, and associated with storage at low temperatures and with late harvesting, respectively. Experimental shipments (2) have conclusively shown that the low temperature form is responsible for a large proportion of the losses in New Zealand apples. Little is known, however, of the type occurring in Australian apples. There is some indication that low temperature breakdown occurs, but several instances have been recorded of breakdown developing at comparatively high temperatures. In the present survey, it has been found both in Australian and New Zealand shipments that at the time of unloading the injury is most extensive in the ripest apples. This suggests the occurrence of a breakdown connected with advanced maturity, in addition to the low temperature type already observed. Further investigation into this matter is highly desirable, particularly in Australia, since it is clear that no control measures can be prescribed until the factors responsible for the development of the disease are definitely established.

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\* Striking data of the comparative pitting of Tasmanian apples in 1929 and 1930, in agreement with this suggestion, have recently been published by Thomas and Raphael (*Tasmanian Journal of Agriculture*, 1931, II, 5).



#### *Size and Wastage.*

Special attention has been devoted during the survey to the influence of size on wastage, and it has been established that both bitter pit and internal breakdown are many times more extensive in large than in small apples (Figs. III and IV). Thus in the seasons of extensive pitting an average of some 15 to 16 per cent. of the injury was recorded in the largest sizes of Cleopatra and Sturmer Pippin apples, while the average pitting in 2½ inch Ribston Pippin and Cox's Orange Pippin apples amounted to nearly 30 per cent. and 40 per cent. respectively. Further, the larger sizes of the two latter varieties also showed extensive breakdown on discharge (Table XIV), which in most instances is reasonably certain to have increased substantially shortly after unloading. Similarly, very extensive breakdown often occurs in the largest sizes of Jonathan apples.

The relationship between size and wastage is widely recognised in the fruit trade, and the suggestion has often been made that the export of the largest sizes of apples should be prohibited, it being maintained that the export of apples so liable to wastage can scarcely be profitable in itself, and must inevitably affect the reputation of all fruit from the exporting country. Prohibiting the export of very large apples therefore merits serious consideration.

#### *Duration of Export Season.*

It has already been noted that the export season of some Australian varieties often appears to be unduly prolonged, having regard to the pre-shipment and shipping facilities available. Comparatively small consignments of the earlier varieties continue to arrive for some weeks after the main shipments have terminated, while in heavy crop seasons shipments of late varieties are maintained up to a month later than in light crop seasons. These late consignments commonly arrive in a forward condition, show more rotting than the normal, and are likely to deteriorate rapidly after arrival.

In New Zealand final dates are fixed for the export of each variety from the different growing areas.

#### *Fungal Rotting and Bruising.*

Bruising is at present an important source of loss in both Australian and New Zealand apples, seriously disfiguring an appreciable proportion of the fruit, particularly at the top, bottom and sides of boxes,

and rendering it very susceptible to rotting. Greater care in packing and handling is still necessary to reduce this wastage, while investigations to establish the methods of packing which afford the maximum protection against bruising appear likely to yield results of great value.

#### *Scald and Core Breakdown of Pears.*

Serious wastage has been observed in several shipments of Australian pears as a result of scald and core breakdown, the two diseases usually occurring in association. Control measures for these diseases have not yet been established, and investigations in Australia into the factors affecting their development are very desirable.

#### *Wastage after Arrival.*

Finally, consideration may be given to the wastage which develops after the fruit has been unloaded. Wastage of this type in pears is too well known to need emphasis, and recent storage experiments by the Food Investigation Board have indicated that there is often a rapid post-shipment development of fungal rotting and internal breakdown in apples. This conclusion is confirmed by general observations in markets and retail shops, and by the results of the preliminary card enquiry undertaken in 1930. In this enquiry, the wastage reported by retail fruiterers was on the average substantially higher than that observed at the docks, and in general the latest returns received reported the highest wastage.

It is thus clearly of the greatest importance to move fruit into consumption with the least possible delay in order to minimise the period during which this deterioration may continue. General observation and the results of the card enquiry suggest that there is at present a considerable variation in this respect, and that while some boxes reach the retail shop within a few days of unloading, in other cases there is an interval of some weeks. Doubtless some lag is often unavoidable when heavy shipments, such as those of 1930, are arriving, but the importance of rapid marketing cannot be over-emphasised. For example, in the card enquiry it was found that Sturmer Pippin apples took, on the average, more than twice as long to reach the retail shop as Cox's Orange Pippin apples. The explanation probably lies partly in differences in demand and partly in the fact that the Sturmer Pippin is commonly regarded as a good keeping variety, and there is therefore less inducement to expedite

its marketing. Actually, however, more wastage was reported by retailers in Sturmer Pippin apples, and it thus appears that in this instance the better keeping qualities of the variety were largely nullified by the slower rate of distribution. It is not suggested that this example is representative, and it is quoted only to illustrate how largely the time taken in distribution may affect the ultimate development of wastage. For it is certain that whatever is done by improved cultural, harvesting and shipping procedure to land fruit with a minimum of deterioration will be ineffective unless it is moved into the hands of the consumer before reaching a stage in its storage life at which resistance to wastage is seriously impaired.

#### ACKNOWLEDGMENTS.

The Board's officers have been in close touch with officials of the Australian Federal and State Governments, of the New Zealand Government, and of the New Zealand Fruit Export Control Board, to whom they are indebted for assistance at all stages of the survey. They also wish to express their particular appreciation of the advice and assistance given by the staff of the Low Temperature Research Station, Cambridge.

Acknowledgment and thanks for facilities afforded are due to the Port of London Authority, Mersey Docks and Harbour Board, Liverpool Port Sanitary Authorities and City Markets Department, Shipping Companies, and members of the wholesale and retail Fruit Trades.

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## APPENDIX I.

### (a) VARIETIES OF APPLES EXAMINED DURING THE SURVEY.

#### *Tasmania.*

Adam's Pearmain (Dutch Mignonne).	King David.
Alexander.	King Pippin.
Alfriston.	King of Tomkin's County.
Allington Pippin.	Late Aromatic.
Annie Elizabeth.	Lord Wolseley.
Aromatic.	Mobb's Codling.
Ben Davis.	Newtown Pippin.
Bismarck.	Norfolk Beauty.
Blenheim Orange.	Peasgood Nonsuch.
Blue Pearmain.	Pitmaston Russett.
Claygate Pearmain.	Prince Alfred.
Cleopatra (New York Pippin).	Prince Bismarck.
Commerce.	Reinette de Canada (Fameuse, Lady in Snow).
Cornish Aromatic.	Reinette Superfine.
Cox's Orange Pippin.	Rhode Island Greening.
Cranberry Pippin.	Ribston Pippin.
Crofton.	Rokewood.
Crow's Egg.	Rome Beauty.
Delicious.	Royal Pearmain.
Democrat (Tasma.).	Rymer.
Duke of Clarence.	St. Lawrence.
Dunn's Seedling (Munro's Favourite).	St. Martin's.
Egremont Russett.	Scarlet Nonpareil (Scarlet Pearmain).
Esopus Spitzenberg.	Senator.
Fanny.	Shepherd's Perfection.
Five Crown Pippin (London Pippin).	Spitzenberg.
French Crab.	Statesman.
Gloria Mundi.	Stayman Winesap.
Golden Pippin.	Stone Pippin.
Golden Spire.	Sturmer Pippin.
Gooseberry Pippin.	Tasman Pride.
Granny Smith.	Venus Pippin.
Gravenstein.	Wellington (Dumelow's Seedling).
High Canons.	White Nonpareil.
Hody.	White Transparent.
Hollow Crown.	Winter Majetin.
Hoover.	Winter Pearmain.
James Greive.	Worcester Pearmain.
Jonathan.	Yates Imperial.
Kings' Acre Pippin.	

APPENDIX I—*contd.*(a) VARIETIES OF APPLES EXAMINED DURING THE SURVEY—*contd.**Western Australia.*

Adam's Pearmain.	Lord Wolseley.
Ben Davis.	Newtown Pippin.
Blenheim Orange.	Pioneer.
Cleopatra.	Red Kent.
Commerce.	Reinette de Canada.
Cox's Orange Pippin.	Rokewood.
Delicious.	Rome Beauty.
Democrat.	Senator.
Dougherty.	Shepherd's Perfection.
Dunn's Seedling.	Shockley.
Esopus Spitzenberg.	Strawberry Pippin.
French Crab.	Statesman.
Granny Smith.	Stayman Winesap.
Hody.	Sturmer Pippin.
Hoover Pippin.	Wellington.
Jonathan.	Winter Pearmain.
King David.	Yates Imperial.
London Pippin.	

*Victoria.*

Adam's Pearmain.	Lady Henniker.
Alfriston.	London Pippin.
Buncombe.	Newtown Pippin.
Champion.	Pioneer.
Cleopatra.	Reinette de Canada.
Cox's Orange Pippin.	Ribston Pippin.
Delicious.	Rokewood.
Democrat.	Rome Beauty.
Dougherty.	Rymer.
Dunn's Seedling.	Scarlet Pearmain.
Ecklinville.	Shepherd's Perfection.
Esopus Spitzenberg.	Statesman.
French Crab.	Stayman Winesap.
Granny Smith.	Stone Pippin.
Gravenstein.	Sturmer Pippin.
Hoover Pippin.	Winesap.
Jonathan.	Yates Imperial.
King David.	

*South Australia.*

Aromatic.	Nickajack.
Beauty of Australia.	Rokewood.
Cleopatra.	Rome Beauty.
Cox's Orange Pippin.	Rymer.
Democrat.	Scarlet Pearmain.
Dunn's Seedling.	Spitzenberg.
Fanny.	Stone Pippin.
Garibaldi.	Strawberry Pippin.
Gravenstein.	Sturmer Pippin.
London Pippin.	

APPENDIX I—*contd.*

(a) VARIETIES OF APPLES EXAMINED DURING THE SURVEY—*contd.*

*New South Wales.*

Cleopatra.	Jonathan.
Dunn's Seedling.	McIntosh Red.
Five Crown Pippin.	Rome Beauty.
Granny Smith.	Stayman Winesap.

*New Zealand.*

Adam's Pearmain.	London Pippin.
Alfriston.	Lord Wolseley.
Ballarat.	McLiver's Winesap.
Beauman's Reinette.	Newtown Pippin.
Blenheim Orange.	Parlin's Beauty.
Boston Russett.	Pioneer.
Brighton.	Premier.
Brownlee's Russett.	Ribston Pippin.
Cleopatra.	Rokewood.
Cox's Orange Pippin.	Rome Beauty.
Delicious.	Salome.
Dougherty.	Scarlet Nonpareil.
Dunn's Seedling.	Shorland Queen.
Esopus Spitzenberg.	Stark.
Golden Delicious.	Statesman.
Golden Pippin.	Stayman Winesap.
Granny Smith.	Sturmer Pippin.
Gravenstein.	Simmond's Winter.
Hoover.	Tasma.
Jonathan.	Tasman Pride.
King David.	Willie Sharp.
	Worcester Pearmain.

(b) VARIETIES OF PEARS EXAMINED DURING THE SURVEY.

*Tasmania.*

Black Achan.	Glou Morceau.
Beurre d'Anjou.	Howell.
Beurre Bosc.	Josephine.
Beurre de Capiaumont.	Keiffer.
Beurre Clairgeau.	La Conte.
Beurre Diel.	Madame Cole.
Broom Park.	Monchallard.
Catillac.	Napoleon.
Conference.	Packham's Triumph.
Doyenne du Comice.	P. Barry.
Duchesse.	Petite Marguerite.
Easter Beurre.	Swan's Egg.
Elizabeth Cole.	Vicar of Winkfield.
Eyewood Bergamotte.	Winter Bartlett.
Gibbons.	Winter Cole.
Giblin's Seedling.	Winter Nelis.

APPENDIX I—*contd.*

(b) VARIETIES OF PEARS EXAMINED DURING THE SURVEY—*contd.*  
*West Australia.*

Beurre Bosc.	La Conte.
Beurre Clairgeau.	L'Inconnue.
Beurre de Capiamont.	Madame Cole.
Broom Park.	Marie Louise.
Doyenne du Comice.	Packham's Triumph.
Duchesse.	Vicar of Winkfield.
Glou Morceau.	Winter Bartlett.
Josephine.	Winter Cole.
Keiffer Hybrid.	Winter Nelis.
Le Lectier.	

*Victoria.*

Black Achan.	Josephine.
Beurre d'Anjou.	Keiffer Hybrid.
Beurre Bosc.	La Conte.
Beurre Clairgeau.	Madame Cole.
Beurre Diel.	Marie Louise.
Brockworth Park.	Packham's Triumph.
Broom Park.	Vicar of Winkfield.
Conference.	Victoria.
Easter Beurre.	Winter Bartlett.
Gibbons.	Winter Cole.
Glou Morceau.	Winter Nelis.
Howell.	

*New South Wales.*

P. Barry.	Vicar of Winkfield.
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*New Zealand.*

Beurre Bosc.	Josephine.
Beurre de Capiamont.	Keiffer.
Beurre Clairgeau.	Marie Louise.
Beurre Diel.	Packham's Triumph.
Conference.	P. Barry.
Doyenne du Comice.	Vicar of Winkfield.
Elizabeth Cole.	Winter Cole.
Glou Morceau.	Winter Nelis.



APPENDIX II.

*Samples on which Tables III, VII and XI are based.*

Variety	Number of Boxes examined.				
	Tasmania (1927-28-29).	Victoria (1928).	Western Australia (mainly 1927 & 28).	South Australia (1928).	New Zealand (1927-28-29).
Alexander .. ..	44	—	—	—	—
Alfriston .. ..	191	—	—	—	—
Cleopatra .. ..	979	69	197	43	94
Cox's Orange Pippin	630	48	—	—	211
Crow Egg .. ..	83	—	—	—	230
Delicious .. ..	—	—	—	—	99
Dougherty .. ..	—	—	—	—	—
Duke of Clarence ..	130	—	—	—	—
Dunn's Seedling ..	81	101	90	—	116
French Crab .. ..	216	—	—	—	—
Granny Smith .. ..	—	—	47	—	—
Jonathan .. ..	522	435	311	50	439
King Pippin .. ..	209	—	—	—	—
London Pippin .. ..	190	57	—	—	47
Ribston Pippin .. ..	357	—	—	—	—
Rome Beauty .. ..	41	71	52	—	46
Scarlet Pearmain ..	392	—	—	—	—
Statesman .. ..	—	—	—	—	81
Stone Pippin .. ..	72	—	—	—	—
Sturmer Pippin .. ..	2,506	—	—	—	558
Tasman Pride .. ..	45	—	—	—	—
Worcester Pearmain	57	—	—	—	—



**Frontispiece.** The significance of resistance. Two plots planted in 1928 and photographed February, 1931. Panama Disease has practically destroyed the Gros Michel (left) and left I.C.1 (right) healthy.

E.M.B.47



4

# BANANA BREEDING AT THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE

A PROGRESS REPORT

By  
E. E. Cheesman, M.Sc., A.R.C.S.



DECEMBER, 1931

LONDON:  
PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE  
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:  
Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh;  
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff;  
15, Donegall Square West, Belfast;  
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## PREFACE.

**F**RUIT is steadily becoming more popular in the United Kingdom, and the banana is sharing fully in this very welcome trend of public taste. A record for the consumption of bananas was set up in 1930 by an import figure of almost 15,000,000 bunches. Nearly 6,000,000 of these came from the West Indies whose exports of bananas to the home market have increased very rapidly in the last five years. The banana industry, therefore, is important both to this country, which is concerned with securing an ample supply of good fruit from Empire sources, and to parts of the West Indies, which are depending more and more on the crop for their living.

The Empire Marketing Board has already published three Reports on the scientific work on bananas which is being carried out by the Imperial College of Tropical Agriculture in Trinidad. In these it was explained that probably the most serious menace to the future prosperity of the banana industry in the West Indies is Panama Disease, which has done great damage to the trees on the mainland and which is spreading in Jamaica. It was also explained that attacks were being made on the disease at the College from three angles—the improvement of transport and storage so that more delicate but immune varieties of banana might be exported, the control of the disease itself in the field, and the breeding of immune varieties.

The previous publications dealt with the first two subjects. This report gives an account of the progress of Mr. Cheesman's valuable breeding work, which is directed towards evolving a new banana immune to Panama disease and yet retaining the characters of hardiness and attractive appearance of the Gros Michel which have placed it in the forefront of commercial bananas. The problem, as Professor Cheesman explains, is scientifically extremely complex, for bananas are naturally reproduced by vegetative means. The plant-breeder must first induce the formation of seeds and then, if he wishes to produce a variety of commercial value, he must completely eliminate them again—for the presence of hard black seeds in a banana would hardly enhance its market value. It is remarkable that so large a measure of success has been achieved in these attempts to ring the changes on nature. Although the problem is far from solved, Professor Cheesman is optimistic that further work may go some way towards a solution.

I should like to call attention, in particular, to one point mentioned by Professor Cheesman. Not the least among his difficulties is the chaotic state of the nomenclature and classification of banana varieties existing in different parts of the world. It is even suggested that the number of languages involved is greater than the number of banana types. Many varieties may have a score of aliases in different parts of the world. This state of affairs obviously complicates enormously the work of the plant-breeder. Many of the countries concerned, of course, are in a comparatively rudimentary stage of development where time, staff and funds have not hitherto been available for the work of classification. This appears, however, to be another case where international co-operation among scientific workers would be of great value to the progress of agriculture—still the basic industry of the world.

I commend this thoughtful study to all concerned.

T. DRUMMOND SHIELS,  
*Chairman of the Research Grants Committee.*

Empire Marketing Board.  
August, 1931.

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*(All photographs except Fig. 4 by the Tucker Picture Co., Trinidad.)*

# BANANA BREEDING AT THE IMPERIAL COLLEGE OF TROPICAL AGRICULTURE.

## A PROGRESS REPORT.

By E. E. Cheesman, M.Sc., A.R.C.S.

### *Introduction.*

Banana breeding has been in progress at the Imperial College of Tropical Agriculture since the inception of that institution in 1922. Inheritance in bananas being previously an entirely unworked field of research, the scope of the investigations has inevitably broadened into a general botanical study of the whole group, but the primary economic end which has been kept in view throughout is the production of a new variety combining resistance to Panama Disease with the good commercial qualities of Gros Michel, the outstanding variety of Northern markets.

The existence together in Gros Michel of many characters desirable in a commercial banana, such as compactness of bunch, a fruit skin not abnormally sensitive to bruising, ability to stand up well to conditions of bulk transport, and an attractive appearance on ripening, would appear at first to render the problem a simple one. All that is immediately required is to "build in" to this type resistance to Panama Disease, and there are not a few varieties possessing the resistant character, several of them to a degree which, for practical purposes, is immunity, though it is in them combined with one or more of the undesirable opposites of the qualities mentioned above. In many crops the solution would be a comparatively elementary exercise in plant breeding.

Actually these investigations have been complicated by the peculiar nature of the problem set when viewed from another angle. The banana is a sterile plant, normally propagated by vegetative offsets, and the fruit of commercial varieties develops without pollination and contains no seeds. This is due largely to the fact that the reproductive organs of both sexes are abortive to an extent of more than 99 per cent. There is probably another reason, since the whole of our programme depends on the fact that occasional seeds may develop under special conditions. Good evidence has been obtained for believing that these varieties, like some temperate fruits, are self-sterile, and hence, when they are grown in the usual way in pure stands, even the small percentage of normal sexual cells formed have no chance of functioning. A banana seed, which the great



majority of banana-eaters in temperate countries have never seen, is about a quarter of an inch in diameter, black in colour, and very hard. Seeds must be induced by appropriate treatments in commercial varieties before any breeding work is possible with them at all, but it is equally essential that any new variety intended for commercial use shall be incapable of producing them spontaneously when grown under ordinary field conditions, for the presence of such bodies in the pulp, even if only occasional, would constitute a serious blemish.

To start with a plant almost completely sexually sterile, raise progeny in sufficient numbers to make a breeding programme possible, combine desirable characters and end with another sterile plant, is very nearly unique in plant breeding. It may, perhaps, be done by empirical methods, if these are employed on a sufficiently large scale and attended by a not inconsiderable element of luck. Otherwise it needs the application of cytology, the most recent advances in our knowledge of polyploidy and of sterility, and in the particular case of bananas, concurrent investigations of any questions which promise to add something to our very imperfect knowledge of the botanical group to which they belong, the genus *Musa*.

As a fact, work has perforce been directed along several lines which are expected to converge, and the division of effort coupled with the rather long life-history of the banana has prevented the complete exploration of any single line. The accumulated data, though incomplete, may possibly be of use to other workers in the same or similar fields, and what is here presented is therefore in the nature of a progress report. For the sake of record, the results on the breeding side are presented in detail, but descriptions of cytological phenomena have been omitted as inappropriate, and only broad results stated. The early stages of the work are presented historically to show how naturally the present programme developed. The stage reached in each of the several lines of investigation is then indicated, and finally the potentialities of the future are discussed in the light of the experience gained to date.

#### *Literature.*

The whole of the information relevant to banana breeding and available when these researches started, is contained, so far as can be discovered, in the writings of two authors. Tischler published in 1910 (*10*) an account of pollen development in three varieties of bananas, with cytological details, and in 1912 (*11*) a description of

embryo-sac development in four species of *Musa* and six varieties. In the second paper he mentions being assured in Java that some varieties of edible bananas not infrequently produce seed, and quotes a letter in which Professor Went records having sown such seeds and raised one plant, which produced fruit. The fruit was very seedy, and consequently inedible.

D'Angremond published in 1912 (1) and 1914 (2), accounts of investigations on fruit and seed development in several species and varieties in Surinam, one of which was Gros Michel. He pollinated 1,539 flowers of Gros Michel and 1,156 of a variety called Appelbacove with pollen from the fertile species *M. ornata* and *M. Basjoo*. The result was four apparently perfect seeds in the Gros Michel fruits and thirty-eight in the Appelbacove, besides a number of empty ones. None of these seeds germinated.

Since our work has been in progress, two important cytological contributions have been made by D'Angremond (3) and White (13), and the Jamaica Department of Agriculture has reported on experiments in crossing varieties and raising seedlings (8). Some information on seed production in Philippine bananas has been given by Mendiola (9).

#### *History of Present Work.*

The logical development of our programme can best be followed through its history, and this starts as far back as 1920. In that year certain correspondence passed between the Colonial Office and the Imperial Commissioner of Agriculture for the West Indies at the instance of the Colonial Research Committee, who were anxious to have further studies made on Panama Disease, as its spread in Central America was giving cause for alarm. As a result, Mr. W. R. Dunlop of the Imperial Department of Agriculture, visited British Honduras and Guatemala, and in his report laid particular stress upon the need for botanical studies, including breeding, to be made on the banana plant.

Following on this, Sir Francis Watts, then Imperial Commissioner, proposed among other things that an extensive collection of banana varieties should be made and studied at some central station, and that efforts should be made to raise and test seedlings—a method analogous to that employed with so much success in sugar cane—the object in this case being the combination of the many good commercial qualities of the Gros Michel banana with the resistance

to Panama Disease which, unfortunately, that variety so conspicuously lacks. These proposals met with the general approval of the Secretary of State for the Colonies and the Kew authorities.

Two years later, the Imperial College of Tropical Agriculture (called at that time the West Indian Agricultural College) was founded in Trinidad, and the Imperial Department of Agriculture merged in it. With some financial assistance from the Colonial Office, the new institution was able to start the actual research work towards the end of 1922.

Dr. T. G. Mason, then Professor of Botany in the College, commenced with a large-scale pollination experiment, and between December, 1922 and March, 1923, about 1,150 "hands" (or nearly 20,000 flowers) were pollinated.

The College, being in the first year of its existence, had practically none of its own land under cultivation, but there existed at St. Augustine Experiment Station some plots of six varieties of bananas (Gros Michel, Governor, Congo, Silk, Sucrier and Red Fig), which had been planted about October, 1921, and the Trinidad Department of Agriculture generously accorded facilities for the use of these plants. The edible varieties were intercrossed to some extent, but as pollen of such varieties is sparse, many of the crosses were made with the highly fertile pollen from two seed-bearing species of *Musa* which happened to be available in the Royal Botanic Gardens in Port of Spain, and which have since been determined as *Musa ornata* Roxb. and a variety of *M. malaccensis* Ridl. (Fig. 1.)

Dr. Mason left the College in February, 1923, and the work was taken over for eight months by Professor J. S. Dash, whose account of it (5) is the source of many of the facts concerning this earlier period given here. The pollinated fruits were cut open when almost ripe and carefully examined for seeds. The total number of seeds found was 182, of which 123 appeared to be perfect and the rest empty. All the perfect seeds occurred in two varieties, 49 in Gros Michel and 74 in Silk, and with one exception, all were due to pollen from one or other of the seeded species.

In October, 1923, Dr. S. C. Harland and the writer joined the College staff, and Dr. Harland, as Professor of Botany, took charge of the breeding programme. The position then was that only three of the seeds had germinated, but during the few weeks ensuing several more seedlings appeared, until the total number of germinations



**Fig. 1.** *Musa malaccensis* B. The most used male parent.

reached seventeen. Sixteen of these were crosses between Gros Michel and the seeded forms, and the remaining one a cross of Gros Michel by the edible variety Congo. This last was a weakly plant, and although it was kept alive with considerable difficulty for nearly four years, it never had promise of any vigour and ultimately died. Of the sixteen, several had little vigour from the first, and died whilst quite young, others died from disease at later stages, and five survived to fruit.

During 1924, pollinations were suspended until the new seedlings should indicate what promise there might be in following up this line, but Professor Dash was pushing on steadily with a collection of banana varieties which he had commenced in the previous year, and Professor Ashby was carrying on mycological studies and tests of resistance of varieties.

In March, 1925, the most forward of the hybrid seedlings flowered, and was found to produce a fair-sized fruit, of good flavour, and seedless. It was thus demonstrated that the line of attack adopted was hopeful, and might usefully be continued and expanded. Later it was also proved that this particular plant was resistant to Panama Disease, which it has entirely failed to contract in six years of close observation, often under severe tests. It has been given the label I.C.1\*, and figures prominently on the present programme. Its chief commercial disadvantage is the presence of an occasional seed as a result of self-pollination when multiplied up by suckers and grown under ordinary banana-field conditions. Its sister plants all proved at least as susceptible to the disease as Gros Michel, became thoroughly infected, and after being retained long enough for necessary studies, were allowed to die out.

The frontispiece shows I.C.1 alongside Gros Michel, and demonstrates the significance of resistance. It also serves to bring out the fact that the experimental area in use is very well suited to the testing of immunity of new varieties. There is a heavy natural infection of the whole area, and susceptible varieties usually show symptoms of Panama Disease within a year or eighteen months without any necessity for artificial inoculation.

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\* The original label of this seedling was GM × B2, and it appears as such in certain literature, notably the Report of Drs. Wardlaw and McGuire, E.M.B. 36. The change was made recently, for good reasons, and it is hoped that confusion may be prevented by a categorical statement that GM × B2 and I.C.1 are one and the same plant.

Realizing that inheritance in a sterile crop like the banana was likely to be anything but regular, the writer at this time (1925) commenced cytological studies of the hybrids and their parents, which have been continued as opportunity offered ever since and extended to other varieties. Extensive pollinations were also made in this year on a number of varieties in Professor Dash's collection, and although no seedlings of outstanding interest were raised, information was obtained about the seed-bearing possibilities of the varieties. Meanwhile, multiplication of I.C.1 was pushed on as fast as possible, and this hybrid was back-crossed to each of its parents.

In July, 1925, Dr. Harland, by an arrangement between the College and the Colonial Office, started on a six months tour touching Panama, California, Hawaii, Japan, the Philippine Islands, Malaya, Burma, and Ceylon, studying the distribution of the Gros Michel banana and allied types, and laying a basis of information upon which introductions since then have been made (6).

In the summer of 1926, Dr. Harland left the College, and the writer took charge of the breeding operations. The nucleus collection of varieties made by Professor Dash was taken over about this time, and added to the breeding plots. There was a break in the work on Gros Michel, due to a shortage of material consequent on the ravages of Panama Disease, and whilst new land was being brought in to this variety, attention was diverted to crosses between resistant varieties such as Governor (the Cavendish or Canary type) and Congo. Results from this line, however, proved unpromising.

In 1927 crossing and back-crossing on Gros Michel were resumed, and have continued ever since. The supply of this variety, however, has never been equal to the heavy demands of the programme upon it, and much remains to be done. The back-cross of I.C.1 to Gros Michel was regarded at that time as the most important of all lines to pursue, as it might be expected to give plants more like Gros Michel than the first generation hybrids, and some of them might retain resistance to disease. Anticipating a later section, it may be stated that this hope has not been fulfilled. The two types exhibit evidence of cross-sterility, and very few back-cross plants have been raised, whilst those few are economically useless. It is still felt that this cross must be more fully explored, but less hope is now placed in it.

In the same year (1927) the cytological observations began to shed light on the breeding problem. It was found that whereas Gros Michel had, as stated by d'Angremond, thirty-two (diploid) chromosomes, the male parent of I.C.1 and its sister plants, apparently a variety of *Musa malaccensis*, had only twenty-two. The hybrids themselves had not, as might be expected, twenty-seven (16 + 11), but forty-three (16 + 16 + 11), and they produced pollen carrying approximately half this number, i.e., usually twenty-one. This explained the promising nature of the first seedlings, which evidently possess a double complement of Gros Michel chromosomes, and also first suggested a doubt of the efficacy of back-crossing, since there was now no predicting what it might yield. Furthermore, this single result served to emphasise the complexity of the problem in hand, and indicated that a wise course would be, not to concentrate exclusively on one line of attack, but to spread a wide net for general information about genetic behaviour in bananas as a group. This policy is still being pursued, and at this point, therefore, the historical presentation may be left.

#### *General Survey of the Genus Musa.*

The scope of the investigations now in progress can be better defined if a brief review is first given of the present systematic position with respect to bananas as a group. It is desirable at the outset of any breeding operations to discover as far as possible the range of variability expressed by allied types, and in the case of bananas, the study of related wild species has a special significance. It is beyond dispute that the sterile edible bananas must have originated from seeded types, and it is a possibility not to be neglected that the parental types still exist, and that what has occurred more than once in Nature may be repeated experimentally. Examination of the recorded systematic knowledge of *Musa* has therefore been a part, by no means negligible, of these studies.

The *Index Kewensis* with its Supplements covering the literature down to 1925, lists altogether 134 specific names under *Musa*, and does not contain all the names which have been applied. As for varietal names, commonly included under the general term *M. sapientum*, an attempt to compile a complete list resulted in over seven hundred entries in a few weeks, and it then became doubtful whether a list three times as long would be anywhere near complete, or whether it would serve any really useful purpose.

The reasons, in the case of species, are numerous synonyms, the validity of which is very difficult to check, and the inclusion of edible, sterile varieties under distinct specific names. The bestowal of binomials on sterile forms, in the present state of our knowledge of their relationships, leads to nothing but confusion, and the only practical working plan is to ignore them. This course reduces the apparent number of species, and a further reduction can be made for practical purposes by discarding a large section of the genus. The classification in general use, based on the work of Baker in 1893 (4), recognizes three sub-genera called *Physocaulis*, *Eumusa*, and *Rhodochlamys*, and of these *Physocaulis* can be neglected from the point of view of economic work on bananas. Its members are so definitely marked off from the rest that they might appropriately form a separate genus. They are almost completely restricted to Africa in distribution, and in general have their trunks swollen at the base and lack vegetative offsets, so that the whole plant dies after flowering. Their fruit is filled with smooth globose seeds, commonly about half an inch in diameter, whereas the other sections have small seeds, about a quarter of an inch across, tubercled on the surface and either flattened or irregular in shape. Several species of this section have been grown in our variety plots, and upon observations of their characters it has been decided to reject them entirely, as they seem to have no bearing on our particular problem. *Eumusa* and *Rhodochlamys* have more features in common than points of difference, and attempts are being made to collect as many species as possible of both, for study in the fundamental search for the wild ancestors of the cultivated bananas. From evidence which cannot be detailed here, it has been concluded that their number, if sterile forms are excluded, is probably about forty or less, of which perhaps half a dozen are likely to prove important. Our collection to date contains more than twenty seeded types, but some of these are scarcely sufficiently distinct to be ranked as species, and many more will be required before the most important in relation to the main problem can be chosen.

The actual number of cultivated varieties is more difficult to estimate, but it is certainly much smaller than would appear from the names. Each country names its varieties in its own languages or dialects, and considering the wide distribution of the crop, we may even wonder whether the number of varieties extant or the number of languages involved is the greater factor in the product.



This state of affairs is definitely harmful, as it prevents the interchange of reliable information between countries, and thus hinders progress. The banana is an important food crop throughout the Tropics, and even apart from the Panama Disease problem it is highly desirable that its varieties should be reduced to some sort of order. The breeding work requires the introduction and study of a wide range of varieties, and although for this purpose their names are of minor interest, the opportunity which presents itself for reducing by a little the prevailing systematic chaos is not being neglected.

The Imperial College collection contains at present eighty "numbers" obtained from several parts of the Tropics. The number of true varieties represented is estimated at forty, the remainder being duplicates differing only in name. When identity is established with absolute certainty, it will be reported and the duplicates will be dropped to save space and upkeep, but so far nothing has been discarded, because determination of identity needs great care. There are apparently cases where no morphological differences can be found on minute scrutiny, but where a genetic difference is demonstrated physiologically when the fruit is put into cool storage. The tests adopted are therefore rigid. When two "numbers" are suspected to be identical, several stools of each are planted side by side in a special plot, alternating in the row, and these are kept under the closest observation throughout their growth, chromosome numbers are checked, and finally fruit bunches of comparable ages are to be compared under storage conditions. Observations on points such as seed-production on pollination, pollen fertility, etc., will be available from the general plots by the time the comparison is complete and will form an additional check on the conclusions.

It is thus expected that gradually a collection of "standard types" will be established, against which any variety can be compared, and assigned with confidence to its position. Some such arrangement is particularly necessary, because bananas are specially difficult to study from anything but living material. Many of the characters which must be used in diagnosis fluctuate so widely under different environmental conditions, that preserved material collected in one place may look quite distinct from genetically identical material collected and preserved elsewhere. Furthermore, there is no really satisfactory method of preservation available, for diagnosis has often to take account of subtle points of habit or colour only to be observed in the field.

It becomes very important from this point of view to know whether the total number of banana varieties extant is sufficiently small for a complete collection and classification to be a practical proposition. It must be admitted that the majority of writers on the banana seem to be impressed by the diversity of the crop, but such an impression might be as easily derived from a hundred types as from a thousand, when formed from a travelling survey embracing all kinds of conditions and inevitably biased by the multiplicity of local names. The frequency with which close study reveals identities in a small but widely gathered collection encourages the hope that the group is manageably small, and it is perhaps a significant fact, though no stress can be laid on it, that no collection of more than a hundred varieties has yet been recorded in any country, except such as admittedly contained duplications.

The question of collection and survey of types affects the breeding programme in every aspect, and a few words on the technique of introduction must find a place here. The only propagating material of the cultivated bananas is the vegetative offset or sucker. Such material cannot be introduced from various countries into a central research station without elaborate precautions, lest it carry, either in itself or in attached soil, the germs of diseases hitherto unknown in the country of introduction. As an example, Trinidad is free from the serious disease known as Bunchy Top, and not the slightest risk of its introduction dare be run. Precautions are therefore taken at every stage, the most important being introduction *via* a temperate country where it is impossible for any disease to get away. The Empire Marketing Board, whilst financing research in Trinidad, made a grant (in 1928) to the Royal Botanic Gardens at Kew for the erection of a special quarantine greenhouse, and all introductions, with the exception of those from other parts of the West Indies, have come through that house. In the case of Empire sources and some foreign sources also, the material is chosen by responsible officers in the country of origin, and the risk thus minimised from the first, but it all goes to Kew, and is there grown under the constant supervision of specialists until fresh suckers are produced from the parent stem and repotted. These are watched for a further period, and only sent to Trinidad when proved healthy. Even then they undergo a second period of observation in an insect-proof greenhouse before they reach the variety plots. This procedure is necessary, but slow, and it explains why the collection is not yet very large. What



**Fig. 2.** Bunch bag and pollen bag in position on inflorescences of different ages.

may be lost on numbers, however, is largely counterbalanced by range, and India, Burma, Siam, the Philippines, Malaya, Ceylon, and the Canary Islands are all represented, as well as a fairly large number found in the West Indies, all originally introductions from the East many years ago.

The introduction of seeded types presents little risk, as no seed-borne diseases of bananas are known, but in this case the collection is often more arduous, as it probably involves journeys into uncultivated territory to collect from wild plants. This opportunity is taken to acknowledge very gratefully the services of helpers in Ceylon, India, Java, Malaya, Mauritius, New Guinea, the Philippines, and the Seychelles, who have generously responded to requests for seed. Our needs have been made fairly widely known, and it is hoped that as opportunities for collection occur, more types will come to hand.

#### *General Summary of Breeding Work.*

The breeding results can best be described under three separate headings, viz. : (1) Breeding from Gros Michel ; (2) Breeding from other edible varieties ; (3) Breeding from seeded types alone. There are, however, a few general conclusions for discussion before this division is taken up.

*Technique.*—Pollinations are done by trained assistants, who spend their mornings on this work and their afternoons in searching ripe bunches for seed. The breeding plots are examined daily for appearance of fresh inflorescences, so that practically every one which "shoots" is treated. As soon as the bud has fully emerged from the pseudostem, and before its first bract lifts to expose the first "hand" of female flowers, it is enclosed in a large calico bag, to exclude insects (Fig. 2). This is a very necessary precaution, as certain bees and wasps are eager visitors of the opening flowers of both sexes, and in a breeding plot where all kinds of pollen are present it is frequently found that a bunch which has escaped notice and not been bagged may contain as many seeds when it ripens as other bunches of the same variety which have been hand-pollinated. On one record occasion, no less than 29 seeds were extracted from an "unpollinated" bunch of Gros Michel growing near to several seeded types. Hence, if the parentage is to be controlled, bags must be used. Smaller bags are placed on the buds which are to be used as a source of pollen, as a precaution against contamination by bees going from plant to plant.

Bagged inflorescences are visited daily, and all exposed stigmas coated with the appropriate pollen. When types with abundant pollen are used, the grains are transferred simply by dabbing the stigma with an opened anther. When pollen is sparse, it is scraped out of the anthers on the point of a scalpel and transferred either direct from the blade or by a camel hair brush. All instruments used are carefully washed in alcohol at each change of pollen, to sterilise adhering grains.

A numbered metal tag is wired to the bunch stalk, and on a slip bearing the same number, the operator enters details—variety pollinated, pollen used, number of flowers, date and time of day, and operator's name. To prevent confusion, only one kind of pollen is used on each inflorescence. When all the female flowers have been treated, the bag is left in position for two or three days and then removed. Bunches are cut when "full," i.e. nearly ripe but still green, which is usually about four months after pollination, and taken into a room set aside for examination (Fig. 3). They are allowed to ripen, and each fruit is then cut longitudinally with a sharp knife. About four longitudinal incisions made in the pulp serve to explore the placentas thoroughly. When fully seeded species are being dealt with, the seeds are sown in flat boxes, but the few seeds found in edible varieties are sown singly in bamboo pots. In either case, sowing is done immediately, before the seed dries, potting soil is used, and the number on the metal pollination tag is painted conspicuously on the box or pot to prevent shuffling of movable labels. Germination may take place within a month, or it may be long delayed. Pots are usually kept for six months before they are destroyed. Greenhouse treatment and carefully controlled watering are necessary, as the young seedlings are very liable to damp off. At a height of three inches they are transferred to six-inch pots until sufficiently robust to be hardened off and planted in an outside nursery. It is found advisable to plant six feet apart, and allow the plants to sucker in the nursery. Suckers can be removed to their permanent position in the field, and if they happen not to establish themselves, there is still more propagating material in the nursery.

*Sterility.*—The sterility of bananas, consequent on their complicated chromosome mechanism, is manifested at every stage of the life cycle, and in different ways by different varieties. Some of these ways are indicated in the table below. In the first place, there is



Fig. 3. The room where bunches are ripened and searched for seed.



Fig. 4. Seeds in a Red banana. Beside the fruits are shown seeds of a *Physocaulis* species (left) and of a wild *Eumusa* species (right.)



Fig. 5. Seedlings at two stages.



**Fig. 6.** A nursery. Note the dwarf plant marked by a board placed behind it. This is of the same age and parentage as the robust plants in the same row (*Fillbasket* × *malaccensis* B).



the obvious difference in seed-producing capacity, shown, for example, between Gros Michel and Giant Fig. Secondly, there is the germination percentage. It will be noticed that this is always low, but it is not constant. It may be that the best conditions for germination have not been found—seeds are too valuable for experiments with drastic treatments—but the germination of fertile species under the same conditions is quite satisfactory. The probability that low germination percentages are an expression of sterility, is further supported by the fact that certain varieties produce quite large numbers of empty seeds, devoid of endosperm. In varieties where the testa is thick, it is not always easy to distinguish between empty and complete seeds, and it is probable that many of those sown are quite incapable of germination under any conditions.

Even after germination, semi-lethal factors demonstrate their existence. There is a certain type of dwarf plant, with thick, narrow leaves, flecked with yellow, and somewhat crinkled and distorted, which appears time after time in our cultures from all varieties (see Fig. 6), and always dies before it can be brought to flower. A certain number of seedlings also are always lost in the pot stage, and these usually show from the first a lack of vigour, and probably represent in great part other lethal or semi-lethal combinations of chromosomes.

*Tabulated Results.*—From September 1927 to the end of 1930, the total number of inflorescences pollinated on all varieties was 1,614. As it takes from seven to ten months to complete notes on seed production and germination, only the first 1,000 are reported upon here. There are some 150 records of pollinations prior to September 1927, but in view of the fact that these were made before the technique was fully developed, they have been omitted. The following table shows how the 1,000 was made up.

General Table—Pollinations 1-1,000.

Variety used as female.	Bunches pollinated.	Bunches lost.	Bunches harvested.	Seeds found.	Germi-nations.
Gros Michel .. ..	98	27	71	39	10
Giant Fig .. ..	88	9	79	—	—
Governor .. ..	96	4	92	—	—
Congo .. ..	36	7	29	—	—
Bumulan .. ..	11	4	7	—	—
Lacatan .. ..	23	8	15	—	—
Bolinaga .. ..	20	7	13	—	—
Giant Chinese .. ..	24	10	14	—	—
Fillbasket .. ..	74	13	61	196	14
Coccinea .. ..	9	—	9	35	—
Red types .. ..	9	1	8	102	9
Other edible varieties ..	97	22	75	75	5
College seedlings .. ..	219	110	109	27	4
Seeded types .. ..	143	82	61	numerous	numerous
Sundry .. ..	53	9	44	no significance	no significance
	1,000	313	687		

*Notes on Table.*—(1) The high percentage of losses recorded is due to several causes. In the case of Gros Michel, Panama Disease is the chief factor, and the same applies to College seedlings, as this entry includes a number of trials on the susceptible seedlings of the original crossing. It also accounts to some extent for the loss of miscellaneous edible varieties. The loss among seeded types is explained more fully below, and is referable to self-sterility among a family of species-hybrids. For the rest, wind and drought in the dry season are responsible, accentuated by soil conditions on the only land available for the breeding plots. The programme is usually curtailed during the dry season itself, but it is impossible to stop three months before dry weather sets in, and it is thought better to reap a percentage of the fruit than none at all.

(2) It will be noted that Gros Michel is fortunately a fairly good seed producer, and also produces a good percentage of viable seeds, whereas Fillbasket, with many more seeds, gives less plants, and Coccinea none at all.\* Several other varieties of good appearance and promise have never yet yielded a seed of any kind, and certain crosses have now been abandoned, where the evidence of their practical worthlessness is taken as conclusive.

(3) The entry under "Sundry" is chiefly made up of trials on suspect seedlings from earlier crosses, which proved subsequently to be rogues due to faults of technique. This entry is, therefore, of no practical significance, and is only included to complete the record.

\* Seeds of Coccinea from later attempts have recently germinated.

*Nomenclature.*—The names employed below are in some cases unfortunate, but each variety in the collection at present stands under the name on the label with which it was first received, and although in some cases that name is known to be misleading or even definitely wrong, it is thought best to retain it until the whole collection can be confidently classified and re-named, which is a long task not yet completed. Any other procedure would lead to confusion in the records. There are a few cases where records from two or more "varieties" have been grouped under one name, where synonymy is already practically ascertained, but this has been done for simplicity of presentation, and the distinctions are maintained in the original notes. As an illustration of the difficulties of nomenclature, "Fillbasket" stands for a variety which exists in the collection under six different names. All of them are local names in different countries, and none, therefore, is really suitable to use for a variety evidently widely distributed. One of them is "Rubra"—an obvious mistake, because the variety is not red, and misleading because "Rubra" is used in the literature for quite a different banana. Later it is hoped to issue an account of this variety, with a complete diagnosis and a suitable descriptive name for universal reference. Meanwhile, the West Indian name "Fillbasket" seems less likely to cause confusion than any of the others, and is temporarily employed.

*Breeding from Gros Michel.*

Extension of researches along the lines indicated above, and amplified below, has not been allowed to obscure the immediate problem. The Gros Michel is so pre-eminently well suited to the requirements of the fruit trade in its morphological characters, that exploration in every direction of its potentialities as breeding material still takes first place on the programme, and is limited only by the number of Gros Michel plants that can be grown with existing facilities.

In the first place, it cannot be taken as proved that the seedling I.C.1 represents the best combination that can be obtained from the original cross. That cross has, therefore, been repeated, and will be repeated until sufficient progeny has been raised to test the question thoroughly.

In the second place, the *M. malaccensis* variety (called here *M. malaccensis B.*) used for the first cross, was employed only because it was available. There is nothing to show that it is the best type that can be found for the purpose of exploiting the seed-producing

capabilities of Gros Michel. There are two classes of male parents which can be used, namely edible varieties which produce fairly abundant pollen, and fully fertile species. In their selection is seen the fundamental necessity of a large variety collection for breeding work, and the small extent to which they have so far been used is largely due to the fact that suitable types have only quite recently become available.

It might seem on general grounds that the use of edible varieties should give better hybrids than the use of fertile species. The cytological findings, however, do not give any support to that expectation, but rather tend to show that either type of male parent may equally well give useful progeny. This is a point which needs much more investigation. Meanwhile, so far as our collection shows, there are very few edible varieties with sufficient pollen to be suitable as male parents. The most promising of them is the variety called Congo in our list, which has fairly abundant pollen. This has been used extensively in Jamaica, where it is known as Robusta, and the resulting seedlings are very similar in appearance to those raised at the College by *malaccensis* B. pollen. It will be recalled that one weakly plant was raised from this cross in the first series of experiments. More recently all the available Gros Michel has been used for other crosses, but Congo pollen has been very largely used on other varieties as females, without result. The negative results in these cases were probably due to the sterility of the females chosen. A few seeds have been set by Congo pollen on *M. malaccensis* B. used as female, but the resulting plants are as yet too young for study.

As it was explained earlier, it at one time appeared that the most suitable pollen for use on Gros Michel should be that of its own offspring, I.C.1. This cross has given disappointing results. Two plants have resulted, neither of any economic value, but the number of seeds obtained has been unexpectedly low. Comparison of the results from this pollen with those from that of *M. malaccensis*, used at much the same time and under similar conditions, leaves little doubt that the underlying reason is cross-sterility between the two closely related varieties.

A second immune seedling, numbered I.C.2, has recently been brought into use, but has so far given no result.

Finally, the pollen of Gros Michel itself is being used on seeded types, but the results so far are not conclusive.

The results of pollinations on Gros Michel presented in the General Table, analyse as follows :—

Male Parent.	Bunches cut.	Seeds found.	Germinations.
M. ornata .. .. .	2	3	0
M. malaccensis B. .. .	35	35	10
M. Basjoo .. .. .	1	0	0
Congo .. .. .	2	0	0
I.C.1 .. .. .	24	1	0
I.C.2 .. .. .	7	0	0

The most interesting feature of this table is the unexpected worthlessness of I.C.1 pollen, as pointed out above. In spite of this result, that cross must be explored a little further. Two plants have been raised from it (from the earlier unreported series of pollinations), so that cross-sterility is not absolute, and the cytology of those plants is of importance, though economically they are useless. I.C.2 has not been available long enough for a complete trial, but results so far indicate a similar story.

*College Seedlings.*—Exploration of the potentialities of Gros Michel includes taking its offspring to further generations. In particular, great efforts have been made to raise an  $F_3$  from I.C.1. The entry "College Seedlings" in the General Table includes the following details :—

Cross.	Bunches cut.	Seeds found.	Germinations.
I.C.1 × I.C.1 .. .. .	57	12	1
I.C.1 × I.C.2 .. .. .	7	0	0
I.C.2 × I.C.1 .. .. .	3	1	0

In addition to these controlled pollinations, an area of about two acres was planted with I.C.1 in an isolated hollow in a Forest Reserve, by arrangement with the Conservator of Forests, Trinidad, and left to natural pollinating agents such as bees. Wild bees are abundant in the area chosen, and visit the banana flowers very freely. One hundred and nineteen bunches brought to the College and examined have yielded 19 seeds, from which three plants are now in the nursery, and more germinations may be expected. From these figures it will be seen that the seed production of I.C.1, though much too high for commercial requirements, is not a prominent character, and that the breeder has to be very careful before he can be sure that he has raised a completely self-sterile type.

It may be mentioned here in parenthesis, that the attempt to obtain seeds economically by natural crossing was not limited to one cross. Two areas were laid out in Gros Michel at the same time (1928), interplanted in one case with Congo and in the other with *M. malaccensis* B. at a rate of one pollen producing plant to five Gros Michel. The *M. malaccensis* B. did very badly under the forest conditions, and the results were negative. The same principle will be tested under cultivation conditions whenever facilities are available, for it is still believed that this is likely to prove the cheapest and most efficient method of bulk breeding, as shown by the seed production of unbagged bunches in proximity to fertile species in the breeding plots.

When I.C.1 first flowered in 1925, it was back-crossed on its male parent. Its pollen set abundant seed and germination was free. Fifty plants were retained for study and the rest destroyed. These fifty plants are still under observation. They are all economically useless, as might be expected, but they have all the vegetative vigour of Gros Michel (and incidentally the same chromosome number), apparently coupled, in most of them, with resistance to Panama Disease. They may yet yield information about the inheritance of resistance, and though attempts to cross them together have so far been unsuccessful, there is some hope still along that line.

*Breeding from Edible Varieties other than Gros Michel.*

It has been explained that in breeding from Gros Michel an attempt is made to add resistance to disease to the good characters which that variety already exhibits. Since Gros Michel is accepted as the best of the susceptible varieties, breeding from others would appear merely to add difficulties, and at least for the present to be better avoided.

Resistant varieties, however, afford an alternative means of attack. To what extent any of them are truly immune is an open question, but there are quite a number of varieties which will grow and produce a crop without showing any symptoms of Panama Disease, on land where Gros Michel has died of it. These all possess undesirable characters, such as bad bunch shape, weak finger stem, unattractive fruit colour, or one or more of several other drawbacks. The problems which they present to the breeder, therefore, vary, according to the nature of the characters which it is desired to eliminate.

Two preliminary questions are common to all of them, and work has not progressed beyond attempts to answer those, viz., what are the seed-producing capabilities, and what type of offspring will each give?

The varieties which have been most studied from this point of view fall into four groups, or can be considered to do so until the true inter-relationships of bananas have been worked out. Provisionally they will be referred to as the Cavendish, Congo, Sapientum and Fillbasket groups respectively.

*The Cavendish Group.*—The type of this group is the banana variously known as the Cavendish, Canary, or Chinese, and referred botanically to *M. Cavendishii*, Lamb. The Canary banana is well known on the English market, and the plant has many excellent qualities. The College collection contains two varieties, called Governor and Giant Chinese, both obtained in the West Indies, where the first is widely distributed and the second much less well known. Governor is generally held to be identical with the Canary Islands banana, but there is no proof of the identity, and in view of promising results obtained with it in trials by the Imperial College Low Temperature Research Station (12), steps are being taken to introduce plants of *M. Cavendishii* from the Canaries and several other parts of the world, for the study of variability within this group.

The evidence so far obtained indicates that any chances of breeding from this group are slender. No seed has yet been obtained from either of the two varieties, and the evidence in the case of one cross, Governor × Congo, is conclusive. It should be explained that Congo pollen was chiefly used on Governor because it was thought likely, on the basis of general observations, that the two were fairly closely related. In the light of later knowledge, closeness of relationship would not be taken as likely to facilitate seed production, and trials will continue with Governor and other male parents until all combinations have been proved. Meanwhile, the results are as follows:—

Female.		Male.	Bunches cut.	Seeds found.
Governor	.. ..	<i>M. malaccensis</i> B. ..	17	0
Governor	.. ..	Congo .. ..	66	0
Governor	.. ..	Gros Michel .. ..	7	0
Governor	.. ..	I.C.1 .. ..	2	0
Giant Chinese	.. ..	<i>M. malaccensis</i> B. ..	8	0
Giant Chinese	.. ..	Congo .. ..	5	0
Giant Chinese	.. ..	Gros Michel .. ..	1	0
			106	0

*The Congo Group.*—It must be emphasised that the term adopted here is purely one of convenience. The varieties included are Bolinaga, Bumulan, Congo, Giant Fig, and Lacatan. The plants of Bolinaga and Congo are shorter in stature than the general run of bananas, though taller than the Cavendish group. In all other morphological characters the five are very much alike, and also very similar to Gros Michel. They are sharply marked off from the latter, however, by physiological characters, especially their resistance to Panama Disease and the behaviour of their fruits in storage and transport, and as will appear, they also differ markedly from Gros Michel in their breeding behaviour. The recently published report of Wardlaw and McGuire (12) includes observations on four of the five which indicate important differences between the individual varieties with respect to their behaviour in cool storage, and it may be that further genetic and cytological studies will bring to light similar differences in fundamental constitution.

The pollination results are :—

Female.	Male.	Bunches cut.	Seeds found.
Bolinaga .. .. .	<i>M. ornata</i> .. .. .	1	0
" .. .. .	<i>M. malaccensis B.</i> .. .. .	7	0
" .. .. .	Congo .. .. .	5	0
Bumulan .. .. .	<i>M. malaccensis B.</i> .. .. .	2	0
" .. .. .	Congo .. .. .	3	0
" .. .. .	Gros Michel .. .. .	2	0
Congo .. .. .	<i>M. malaccensis B.</i> .. .. .	8	1
" .. .. .	Congo .. .. .	19	0
" .. .. .	Gros Michel .. .. .	1	0
" .. .. .	I.C.1 .. .. .	1	0
Giant Fig .. .. .	<i>M. malaccensis B.</i> .. .. .	22	0
" .. .. .	<i>M. Basjoo</i> .. .. .	1	0
" .. .. .	Congo .. .. .	39	0
" .. .. .	Gros Michel .. .. .	10	0
" .. .. .	I.C.1 .. .. .	7	0
Lacatan .. .. .	<i>M. malaccensis B.</i> .. .. .	11	0
" .. .. .	Congo .. .. .	3	0
" .. .. .	Gros Michel .. .. .	1	0

Quite recently one seed has been obtained in Lacatan from a pollination by *M. malaccensis B.*, not included in the series under review. This illustrates the difficulty of knowing when to stop and call a negative result conclusive, but the Giant Fig × Congo cross



*To face page 27.]*



**Fig. 7. A Sapientum variety.**

has been abandoned, and it is proposed in future to take a run of 25 unsuccessful attempts as evidence that a particular cross, though not necessary impossible, cannot be made with sufficient frequency to be worth further investigation at the present stage.

*The Sapientum Group.*—The specific name *Musa sapientum* is commonly used for a great variety of bananas, usually including indeed practically all edible varieties except the Cavendish and the plantains; the latter being called *M. paradisiaca*. There is no good evidence for the close relationship and common parentage implied by this use of a single specific name, and until the genus is much better known, the use of any Latinised binomials should be avoided as far as possible.

On the other hand, there is an apparently well-defined group of varieties which may justly be termed the Sapientum group. The characters which define it need not be detailed here, but may be gathered from the photograph given (Fig. 7). It should be explained that the name has been chosen because the drawings cited by Linnaeus in his *Species Plantarum* under *M. sapientum* quite clearly refer to a member of this group. Sapientum varieties are in general of poor quality as dessert fruit, and many of them rank as cooking bananas. Their pathology has not been exhaustively studied, but those in the College collection seem to be resistant to Panama Disease, though susceptible to other troubles, including a bacterial wilt.

They have been included in the genetic investigations more for the sake of general information than in the hope that they will give valuable seedlings, and their behaviour has proved to be interesting. In the first place, they tend to produce more seeds than most other varieties, but have a curious habit of producing a high proportion which are empty. There are some fully-seeded varieties of the same affinity which do the same thing, sometimes to such an extent that although the fruit is full of seeds, not one of them is viable.

In the second place, some seedlings were raised from a cross between a member of the group called Bluggoe and *M. malaccensis* B., which proved to be intermediate in their characters between the two parents. This is in sharp contrast to the results of Gros Michel crosses, and although cytological examination of the hybrids has not yet been made, it may be expected to show that the doubling of chromosomes from the female parent, characteristic of the Gros Michel seedlings studied, has not occurred here.

Pollinations on this group have been restricted, owing to their apparently small economic importance and pressure of other investigations. The conclusions presented above are based partly on the results of the earlier unreported series, and partly on observations of open-pollinated bunches. The few figures available in the present series represent the behaviour of the Sapiantum group very inadequately, and are therefore omitted. Data are now being collected to supply the deficiency at a later date.

*The Fillbasket Group.*—The variety called Fillbasket (Fig. 8) has been obtained under various names from British Guiana, Burma, Dominica and South India. The last mentioned introduction was under the label Mysore, and was collected by F. N. Howes and described by him under that name in the Kew Bulletin of 1928 (7). Identity has not yet been established according to our standards, but there is little doubt of it. Morphologically, this groups with several other varieties, but differs, from some of them at least, in disease resistance, just as the Congo group differ from the morphologically similar Gros Michel. The group has a few characters recalling Sapiantum, but is quite distinct in others.

The chief merits of Fillbasket as a female parent for breeding investigations are resistance to Panama Disease, resistance to wind damage, vigorous habit, a particularly neat and compact bunch, good fruit colour on ripening, and a fairly abundant seed production on pollination. Its demerits are small size of fruit, and a very thin skin.

Pollinations have been made as follows :—

Male parent.	Bunches cut.	Seeds found.	Germinations.
M. Basjoo .. .. .	1	2	0
M. malaccensis B. .. .. .	25	192	14
Congo .. .. .	19	0	0
Gros Michel .. .. .	8	0	0
I.C.1 .. .. .	7	2	0
I.C.2 .. .. .	1	0	0

Of the 14 germinations, one died in the pot stage, five developed into plants of the dwarf type, of which two are already dead in the nursery, and the remaining eight are robust plants of promise, though yet too young to flower. They should prove of great interest.



**Fig. 8. Fillbasket.** The bunch shown is rather small for this variety.

*Miscellaneous.*—Pollinations on miscellaneous edible varieties have been spread over such a number, that the results from individual varieties are valueless for presentation until more have been accumulated. A few specific points are noteworthy.

(1) Attention may be drawn to the high frequency of seeds found in red varieties considered collectively (see General Table). The collection contains seven red-fruited varieties, which have not been studied sufficiently to warrant any statement about their identity, except that they are at least superficially similar. All are hardy, vigorous plants, and in view of their relatively free seed-production, seem to deserve investigation. At present no seedlings from them are older than the pot stage.

There are yellow-fruited varieties such as the Green Red and White Claret, which are generally believed to have originated from red varieties by a simple bud mutation. Red varieties are known to produce occasionally a bunch of fruit in which some of the fingers are yellow, by loss of the red factor from a sector of the apical bud. A sucker arising from a mutated sector of a vegetative bud would give rise to an apparently new variety. It is interesting to find that White Claret in our collection behaves in seed production like the red varieties.

(2) *Coccinea* is a variety received under that name from Orotava, Canary Islands, *via* Kew. It has nothing whatever to do with *Musa coccinea* Andr., but is a strikingly vigorous and productive banana, so far resistant to disease in the plots. The General Table shows that it also produces seed freely, and on several grounds its progeny are likely to be interesting. There are several now in the pot stage.

(3) A few pollinations have been made on plantains in the collection, and two seeds obtained.

#### *Breeding from Seeded Types alone.*

In October, 1926, a cross was made each way between the two fertile species then available, *M. ornata* and *M. malaccensis* B. These two are very distinct, *M. ornata* belonging to the *Rhodochlamys* section of the genus and *M. malaccensis* to *Eumusa*. It was therefore with some surprise that it was discovered that abundant seeds were set from both the reciprocal crosses. Thirty plants of *ornata* × *malaccensis* B. and thirteen of *malaccensis* B. × *ornata* were retained for study, and the rest destroyed. When the forty-three plants flowered they proved to be uniform, and intermediate in characters between their parents, which was to be expected.

In the hope that information might be obtained to throw light on the behaviour of sterile bananas, fairly extensive pollinations were made on the family, as follows :—

Pollination.	Number made.	Successful.	Unsuccessful.
Selfs .. .. .	36	4	32
× <i>ornata</i> .. .. .	21	11	10
× <i>malaccensis</i> B. .. .. .	16	9	7

When a seeded *Musa* is unsuccessfully pollinated, the fruit fails to swell, and dries up. Hence the unsuccessful attempts were entered in the pollination book as "Lost," and help to swell the losses recorded in the General Table. The proportion of unsuccessful attempts is high in all cases, but in the case of self-pollinations so abnormally so as to suggest a measure of self-sterility, which suggestion is supported by the fact that whereas the seeds obtained from the back-crosses germinated fairly freely, only one plant was raised from the four "successful" self-pollinations, and that is weakly, and has made little growth.

The back-crosses began to flower in 1930, and it was found that whereas those by *malaccensis* B. varied as might be expected, those by *ornata* were again a uniform progeny, much like the F<sub>1</sub> plants in appearance. The only explanation that can be suggested for such behaviour is that the chromosome complement of the F<sub>1</sub> has gone over without reduction into the back-cross, with consequent increase in chromosome number.

It has not yet been possible to make the necessary cytological examinations to confirm this hypothesis, but evidence is available from another source. D'Angremond (3) made a very similar cross between *M. ornata* and *M. zebrina*, and back-crossed the hybrid in the same way with pollen from each of the parents. According to the abstract, which is all that has yet been seen of his work, he found the offspring of the two back-crosses different, but both families uniform in themselves, and self-sterile, but fertile with the pollen of either parent species. He also found the diploid chromosome number increased from 22 to 33-44. None of the hybrids was parthenocarpic.

This is a highly significant result, with implications of the greatest importance for banana breeding, though the significance may not be at once obvious. The commonest chromosome number among edible bananas is 32 (White), whilst 22 occurs in several seeded species. Breeding results in a cross between the two classes have shown that

a hybrid with 43 chromosomes may produce pollen with 21, and therefore presumably may produce a second generation with 42. If species-crosses can be raised experimentally with 33, it is well within the bounds of possibility that a second generation from them may have the 32 characteristic of many edible types. D'Angremond's hybrids are not parthenocarpic, but if this sort of thing occurs at all frequently, experimentally raised polyploids from other seeded species may well prove to be parthenocarpic in some cases. The great requirement is to find the right parent-species, and herein lies the importance of the collection which is in formation.

From being a line of apparently purely academic importance, species crossing is now understood to be as promising for the solution of the main problem as crossing on Gros Michel. The complicating factor in both cases is the enormous amount of ground that has to be covered in the acquisition of information.

As the seeded types in the collection come into flower, every one is to be crossed with every other. This alone will involve some hundreds of crosses in the future, not to mention second generations and back-crosses. Results so far obtained are:—

Cross.	Result and Remarks.
M. Basjoo × malaccensis B. ..	Two bunches, both set seed, but no germination followed. M. Basjoo is prone to produce empty seeds.
M. malaccensis A. × malaccensis B.	Successful at first attempt. This cross was made to ascertain the relationship of M. malaccensis obtained from Malaya (A) to the form from Port of Spain Botanic Gardens (B).
M. malaccensis B. × Basjoo ..	Successful at second attempt. Good germination.
M. malaccensis B. × malaccensis A.	Successful at first attempt.
M. malaccensis B. × Panache ..	Two attempts unsuccessful. Panache is a red form obtained from a collection in the Canary Islands.
M. malaccensis B. × textilis ..	Two attempts unsuccessful.
M. ornata × textilis .. ..	One attempt unsuccessful.
Panache × ornata .. ..	First attempt successful.
Panache × malaccensis B. ..	First attempt successful.
Panache × Basjoo .. ..	One attempt unsuccessful.
Panache × textilis .. ..	One attempt unsuccessful.
Yella Bali × malaccensis B. ..	Two attempts unsuccessful. Yella Bali is a Sapientum type from Mysore.
M. textilis × malaccensis B. ..	Two attempts unsuccessful.

### *Outlook.*

The banana is an important food crop in many parts of the tropical Empire, and would seem likely to increase in importance as an export crop from the tropical and sub-tropical zones to the temperate countries. Panama Disease is known to be widely distributed, and is therefore a potential danger to any country which undertakes the cultivation on a considerable scale of Gros Michel or of any other susceptible variety. Further, a new disease, or increased severity of a known one, may at any time assume similar importance and render another breeding programme desirable, and yet again there is no evidence for the assumption that even the best of existing varieties cannot be improved upon in several ways. On all these counts, genetic research has a definite bearing on the economics of the crop, for there can be no systematic breeding of a sterile crop like the banana without a basis of genetic and cytological information.

The present report is admittedly fragmentary, but it is believed that it presents or cites practically all the information which is available to date, and that the outlook to be based on it is by no means unpromising. It has been shown that seeds can be obtained from a wide range of banana varieties, including several of highly desirable characters, even when the choice of male parents for crosses is very narrow, and further, that plants can be raised with new combinations of those characters. The study of related wild species has given at least a hint of a clue to the origin of the edible bananas, and if that clue can be followed up and proves correct, it may be at last possible to substitute an orderly synthesis of types for random attempts more or less in the dark.

On the other hand, the gaps to be filled are many times more conspicuous than the small amount of material gathered together, and the outlook for the investigator has no limit within sight.

In breeding on Gros Michel there appears to be great hope if the best type of pollen to use can be found. The doubling of chromosomes goes far to minimise the disadvantages of introducing the characters of "wild" types into new combinations—just as it does in sugar-cane, which presents several interesting parallel phenomena. The possibilities of breeding from seeded types alone are more speculative, but in some ways greater, as the information gained on the way is more fundamental. These, therefore, are the major lines of the immediate future, whilst survey of other types and their behaviour will continue steadily.



The general survey, if secondary in importance so far as the Panama Disease problem is concerned, has a wider significance which must keep it in the programme. Until the bananas of the world are better classified and codified, the exchange of information about varieties between Empire countries must be hampered by the confused nomenclature, and systematic studies are therefore of as direct an economic importance as any. They can best be prosecuted in conjunction with a genetic programme, where relationships as well as morphological similarities can be taken into account.

*Summary.*

The Gros Michel banana sets a few seeds when pollinated by certain other members of the genus *Musa*. A fertile species, believed to be *M. malaccensis* Ridl., has been most extensively used as male parent, and from this cross plants have been raised closely resembling Gros Michel. One of them is resistant to Panama Disease. The close resemblance to the female parent is apparently due to doubling of the chromosome complement from that side of the cross. The hybrid does not back-cross readily to Gros Michel, although it has abundant pollen, and although the back-cross has not been fully explored, the prospects of further advance in that direction are not very bright at present.

There appears to be more hope in first generation crosses by other seeded types, if the chromosome doubling proves to be a constant feature, and a collection of possible male parents is being made to this end.

Other varieties of bananas have been tried fairly extensively, and about half the varieties in a collection of eighty have shown themselves capable of producing seed. Some of these have good commercial qualities and progenies are being raised from them for study.

The small number of seeds obtained makes progress slow, and the effect is accentuated by low germination percentages, and a proportion of dwarf and weakly plants among those which do germinate. It is, however, counterbalanced to some extent by the ease of vegetative propagation of such seedlings as survive.

The work of d'Angremond, supported by the evidence from a species cross made at the Imperial College of Tropical Agriculture, indicates that the possibility of raising sterile bananas from fertile wild species is by no means remote. If success can be obtained along this line, an entirely new field of potentialities will be opened up.

Investigations are thus following three lines, any one of which may provide the solution to the main problem—the production of a new banana combining all the desirable fruit qualities with hardiness and resistance to Panama Disease.

Genetic work is absolutely dependent on an adequate variety collection on the one hand and upon cytological studies on the other. The variety collection has a secondary value, in that information is necessarily derived from it which may lead to a more satisfactory classification of the banana varieties of the world, and hence facilitate other studies of the group and exchange of results between countries.

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5

# FURTHER CHANGES IN THE DEMAND FOR BUTTER

July 1928 and July 1931

Report of an Investigation by the Economic Section  
of the Empire Marketing Board into the Retail  
Marketing of Butter in Nottingham.



MARCH, 1932

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To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:  
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X9(1311:73):731.3.N5

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*Diagrams :—*

- Fig. I. Monthly Imports of Butter, years ending July, 1928 and 1931.
- Fig. II. Weekly Sales of Butter, July, 1928 and 1931.
- Fig. III. Movements of Wholesale Prices, May, 1928-July, 1931.

## FOREWORD.

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**T**HIS report is the second in which a comparison is made between the demand for butter at different times. A previous report "Changes in the Demand for Butter" (E.M.B. 39) studied the retail position in four Midland towns in November, 1928, and November, 1930. The present report embodies the results of a similar investigation in the city of Nottingham in July, 1928, and July, 1931.

These two reports, although complete in themselves, are complementary in many respects: they each cover two distinct periods between which there had been a considerable fall in the wholesale price of butter: they show the effects of this fall on butter consumption and on the demand for different types of butter: between them they reveal not only these yearly changes but also the seasonal changes: and lastly the results of the one report are confirmed and expanded by the results of the other.

Special acknowledgment and thanks are due to members of the retail distributive trades in the area for their valuable co-operation and assistance. The Board desires to record its appreciation of the sympathetic response with which this and similar enquiries have been received by the Trade.

Economic Section,  
Empire Marketing Board.

December, 1931.

## FURTHER CHANGES IN THE DEMAND FOR BUTTER.

July 1928 and July 1931.

### I.—INTRODUCTORY.

In July, 1928, an investigation was made into the retail marketing of butter in Nottingham; 203 retailers were interviewed personally and information collected on stocks, sales and prices. On the basis of these records another survey was made in July, 1931, to ascertain what changes had occurred in the retail marketing of butter in the interim. The retailers were interviewed in the same rotation as in 1928, but it was found that in the three years' interval, sixteen of the shops had been closed, and in six instances records were incomplete so that comparable records were obtained for 181 shops. This total was made up of 102 independent or single shops and a group of 79 multiple shops, representing 20 different firms in local and national multiple organisations as well as branches of co-operative stores. Both groups included shops of all sizes and classes of trade, and the sample may be taken as representative of every type of grocery business in the area.

*Characteristics of the Area.*—The city of Nottingham is mainly industrial, but is also an agricultural centre of importance. According to the Census of 1931, the population was about 299,000. No precise figure for the population in 1928 is available, but as the average increase in the last 10 years has been less than  $\frac{1}{4}$  of 1 per cent. per annum, it does not appear that there was any change sufficient to affect materially the consumption of butter.

With regard to the state of industry, the unemployment returns give some general indication of conditions. In July, 1928, the unemployment figure for the area was 8.5 per cent. of insured work-people, as compared with 19.3 per cent. for July, 1931. The averages for the whole country at these times were 10.9 per cent. and 22.0 per cent. Unemployment was, therefore, much greater in the second period, but on both occasions was slightly below the general average for Great Britain.



## II.—IMPORTS.

Between the years ending July, 1928, and July, 1931, the total imports of butter from all sources rose from 6 million cwts. to nearly 7½ million cwts., or by 23 per cent. Imports from Australia increased by 78 per cent., New Zealand by 40 per cent., and Denmark by 20 per cent., but there was a slight diminution of supplies from the Irish Free State and Russia.

The monthly imports from the chief exporting countries during the years ending July, 1928, and July, 1931, are shown in Figure 1, which illustrates the seasonal supply of the different types. Imports during June and July from Denmark amounted to 391,000 cwts. in 1928 and 496,000 cwts. in 1931, an increase of 26 per cent., while other foreign butter increased from 377,000 to 381,000 cwts., or by only 1 per cent.

Imports of Australian in the same months rose from 129,000 to 227,000 cwts., or by 76 per cent. ; New Zealand from 145,000 to 270,000 cwts., or by 85 per cent. ; while imports from the Irish Free State declined from 196,000 to 151,000 cwts., or by 23 per cent. This marked increase in imports from the Southern Dominions tends to magnify the change in available supplies, as it is usual at that season to draw supplies from the stocks in cold storage accumulated during the period of heavier imports, whereas in 1931 there was a net addition to the stocks in cold store during July. The available information suggests that stocks of box butter at the beginning of July, 1931, were slightly below those of three years earlier (350,000–400,000 cwts., against 400,000–450,000 cwts.).



## III.—TOTAL SALES OF BUTTER.

The total estimated weekly sales of the shops visited increased from 458 cwts. in July, 1928, to 526 cwts. in July, 1931, an increase of almost 15 per cent. The average weekly butter sales per shop rose from 2·53 cwts. to 2·91 cwts., while the range of sales in both periods extended from 10 lbs. in the smallest shop to 40 cwts. in the largest.

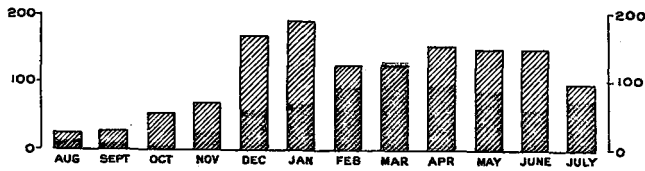
In the following table the shops visited during the two surveys are grouped according to the volume of their weekly sales. Separate figures are also given showing the comparative sales in 1931 of the same shops as were included in the various groups in 1928. In the

FIG. I.

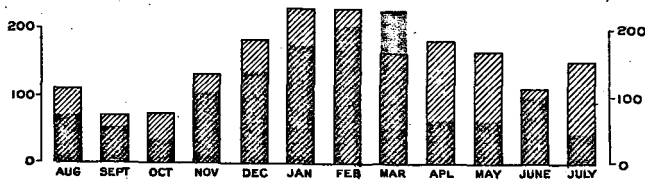
MONTHLY IMPORTS OF BUTTER INTO THE UNITED KINGDOM.  
YEARS ENDING JULY 1928 AND 1931.

YEAR 1927-28   
YEAR 1930-31 

AUSTRALIA



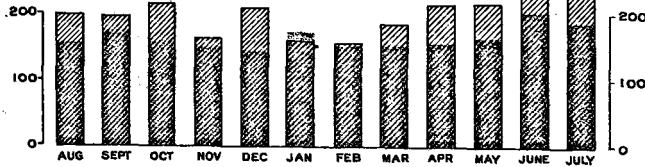
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case of one firm with a number of branches, information relating to aggregate sales was obtained from the head office. In this instance the sales recorded are the average sales per shop, thus assuming a uniformity of sales volume which possibly does not actually occur, but the error in the grouping is not likely to be large.

TABLE I.—*Number of Shops selling various quantities of Butter, with the Total Sales of each Group.*

Average Weekly Sales.	1928.			1931.	
	Number of Shops.	Weekly Sales.	Sales of same Shops in 1931.	Number of Shops.	Weekly Sales.
Less than 1 cwt. . . . .	71	Cwts. 35	Cwts. 47	69	Cwts. 36
1 cwt. and less than 2 cwts. . .	41	52	62	37	51
Less than 2 cwts. . . . .	112	87	109	106	87
2 cwts. and less than 4 cwts. . .	43	116	135	41	115
4 " " " " 6 " " . . . . .	11	49	63	17	79
6 " " " " 8 " " . . . . .	6	41	37	5	36
8 " " " " 10 " " . . . . .	2	17	18	6	54
10 " " " " 12 " " . . . . .	2	20	22	—	—
12 cwts. and over . . . . .	5	128	142	6	155
Totals . . . . .	181	458	526	181	526

It is evident that a large proportion of the butter trade was concentrated in relatively few establishments. Shops selling 4 cwts. a week or over constituted about 14 per cent. of the total number visited in 1928, and accounted for 56 per cent. of all butter sales; in 1931, owing to the larger aggregate sale of butter, 19 per cent. of the shops sold 4 cwts. per week or more, with aggregate sales representing 62 per cent. of all sales.

Although sales of butter were on the whole appreciably larger at the time of the second survey, the increase was by no means uniformly spread over all shops. Of the total of 181 shops visited, no less than 53 recorded a decrease in average sales between 1928 and 1931, and a further 25 showed no change, while at 103 shops increases were reported. Figures given in Table I suggest that on the whole

the increase was proportionately greater in the smaller establishments. Shops which were selling less than 4 cwts. weekly in 1928 increased their sales from 203 to 244 cwts. weekly between 1928 and 1931, an increase of 20 per cent. ; whereas establishments in which sales of butter were 4 cwts. and over in 1928 increased their turnover from 255 to 282 cwts. or rather less than 10 per cent.

During the three years' interval the average retail price of butter in Nottingham fell from 1s. 9·2d. per lb. to 1s. 2·8d. per lb., or 30 per cent.\* In July, 1928, 80 per cent. of the total sales were made at prices ranging from 1s. 8d. to 1s. 10d. per lb., while in July, 1931, 80 per cent. of the total sales were made at 1s. 2d. and 1s. 3d. per lb. (Table 2).

TABLE 2.—*Number of Shops selling Butter at various Retail Prices, together with the total quantities sold at each price. July 1928 and July 1931.*

Price per lb.	1928.		1931.	
	Number of Shops.	Total Weekly Sales. (cwts.)	Number of Shops.	Total Weekly Sales. (cwts.)
2/3 ..	1	2	—	—
2/2 ..	1	8	—	—
2/1 ..	—	—	—	—
2/- ..	54	32	—	—
1/11 ..	49	23	—	—
1/10 ..	48	56	—	—
1/9 ..	102	184	—	—
1/8 ..	59	142	—	—
1/7 ..	5	2	—	—
1/6 ..	6	9	11	7
1/5 ..	—	—	86	28
1/4 ..	—	—	66	33
1/3 ..	—	—	116	264
1/2 ..	—	—	87	175
1/1 ..	—	—	13	16
1/- ..	—	—	5	3
Average ..	1/9·2		1/2·8	

\* Over the same period the Ministry of Labour Index for retail prices of all food fell by 17 per cent.

Information was collected during both surveys as to the sales of margarine, in order to ascertain the relation between the demand for that commodity and butter. It was found that the rise in butter sales of 68 cwts. had been accompanied by a fall of 34 cwts. in the sales of margarine. In the 181 shops visited, margarine sales decreased from 180 cwts. per week to 146 cwts., a fall of 19 per cent. as against the 15 per cent. increase in butter sales. It was stated that the greatest decline was in the more expensive types of margarine, which at the time of the second survey did not differ greatly in price from the cheaper kinds of butter.

#### IV.—TYPES OF BUTTER STOCKED.

Throughout this report, the various butters have been classified according to country of origin, with the exception of bulk-blended and packeted butter, each of which is counted as a single type. No account has been taken in this classification of variations within types, for example, as between salted and unsalted, or as between grades. The term "packeted butter" is used to refer to butter sold in packets bearing a proprietary name or brand, whether blended or not.

It is seen from Table 3 that as between 1928 and 1931 there was some tendency for both independent and multiple shops to stock a larger variety of types. In July, 1928, 24 per cent. of the shops visited were offering a choice of three or more kinds of butter, whereas in 1931 the proportion had increased to 34 per cent.

TABLE 3.—*Number of Shops stocking One, Two, Three or more Types of Butter.*  
*July 1928 and July 1931,*

Organisation of Shop.	One Type.		Two Types.		Three Types.		Four or More Types.	
	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.
Independent .. ..	36	28	51	49	14	19	1	6
Multiple .. .. .	5	2	46	41	26	32	2	4
Total .. .. .	41	30	97	90	40	51	3	10

*Distribution of Types.*—Australian, New Zealand and Argentine butter is mainly imported through London: Irish through the West Coast ports, especially Fishguard and Liverpool; and European butters through the East coast ports such as Grimsby, Hull and Newcastle. The main markets for the different types of butter tend to be concentrated around the ports of entry,\* and Nottingham is of special interest, since it does not fall definitely within any of these areas, but is situated where they tend to overlap.

The following table shows the proportions of independent and multiple shops stocking the various types of butter. In the group "Other Bulk Types" are included Canadian, Swedish, and Finnish as well as bulk blended butters. In 1928 there were no instances of shops stocking Canadian or Swedish butters, but in 1931 they were each stocked in one instance. Finnish butter was stocked in one shop during each survey. "Bulk blended" butters were stocked only by multiple shops.

TABLE 4.—*Percentage of Independent and Multiple Shops stocking various Types of Butter.*  
July 1928 and July 1931.

Type of Butter.	Independent.		Multiple.		All Shops.	
	1928.	1931.	1928.	1931.	1928.	1931.
English Farm .. ..	2	3	—	—	1	2
Australian .. ..	5	12	13	20	8	15
New Zealand .. ..	25	31	63	61	42	44
Irish .. ..	1	—	3	4	2	2
Argentine .. ..	—	—	11	4	5	2
Danish .. ..	77	80	85	87	81	83
Other Bulk Butters ..	—	1	11	24	5	12
Packeted .. ..	70	76	47	49	60	65

\* E.M.B. 34. "Demand for Empire Butter."

The table indicates the relative extent to which the various butters were available to customers in the retail shops at the times of the two surveys. Danish butter was the type most frequently stocked in both independent and multiple shops; indeed, there were comparatively few shops among those visited in which Danish butter was not on sale. In the independent shops packeted butter was stocked almost as frequently as Danish, while Empire butter was much less frequently found. Among multiple shops considerably more than one half were stocking New Zealand butter, and slightly less than one half stocked packeted butter.

It is seen that no striking changes in practice were found as between the two surveys. The most noticeable differences are, firstly, in Australian butter, which was stocked in 8 per cent. of the shops in 1928, and 15 per cent. in 1931, the increase occurring both in independent and multiple shops; secondly, in the group "Other Bulk Butters," owing mainly to one national multiple firm having added "bulk blended" butter to the stocks in all its branches; and, thirdly, in Argentine butter, which alone was stocked in a smaller number of shops at the second survey than at the first.

On the whole, however, the increases between the two surveys are fairly uniform and reflect the general tendency, apparent from Table 3, for retail shops to offer a rather wider choice to their customers.

*Sales of Types.*—The total weekly sales of different types of butter at each period are set out in Table 5 and shown also in Figure II.

The weekly sales of Danish butter were by far the greatest of any one type in both periods. Sales of Danish butter increased by about 11 per cent. between the two surveys and the actual increase in aggregate sales, 30 cwts. per week, was equivalent to the increase in the combined sales of Australian and New Zealand butters. Calculated as a proportion of the total butter sales the Danish quota declined from 61 per cent. to 58 per cent.

There was a pronounced increase in the sales of Empire butters, Australian sales increasing by 44 per cent. and New Zealand by 25 per cent. Empire butters as a proportion of the total sales increased from 24 per cent. to 27 per cent.

TABLE 5.—*Weekly Sales (Cwts.) of the various Types of Butter in Independent and Multiple Shops.*

*July 1928 and July 1931.*

Type of Butter.	Independent.		Multiple.		All Shops.	
	1928.	1931.	1928.	1931.	1928.	1931.
English Farm .. ..	2	1	—	—	2	1
Australian .. ..	4	5	21	31	25	36
New Zealand .. ..	12	18	64	77	76	95
Irish .. ..	—	—	9	9	9	9
Argentine .. ..	—	—	8	3	8	3
Danish .. ..	78	85	200	223	278	308
Other Bulk Types ..	—	1	12	24	12	25
Packeted .. ..	37	38	11	11	48	49
All Butters ..	133	148	325	378	458	526

Weekly sales of Argentine were reduced, but there was a marked increase in the sales of "bulk-blended," reflecting the much wider stocking of this type among multiple shops at the time of the second survey. No information is available as to the kinds of butter constituting the "blended" butter found at the time of the two surveys, but there is a preponderance of Southern Hemisphere butters in blended butter generally, and the increase in the sales of "bulk blended" may not be without significance in this connection.

Sales of packeted butter showed practically no increase between 1928 and 1931 and formed a smaller proportion of total sales at the latter period. While 65 per cent. of all shops stocked packeted butter it constituted less than 10 per cent. of the aggregate sales; in the case of multiple shops, almost one half of which stocked it, sales were barely 3 per cent. of the total.

Table 6 gives the average quantity of each type of butter sold by the shops stocking that particular type.

This table shows the comparative sales of independent and multiple shops. With the exception of packeted butter, the average sales per shop for each kind of butter were considerably larger in the multiple than in the independent shops.



Fig. II.

WEEKLY SALES OF BUTTER.  
JULY 1928 & JULY 1931.  
NOTTINGHAM.  
181 SHOPS.

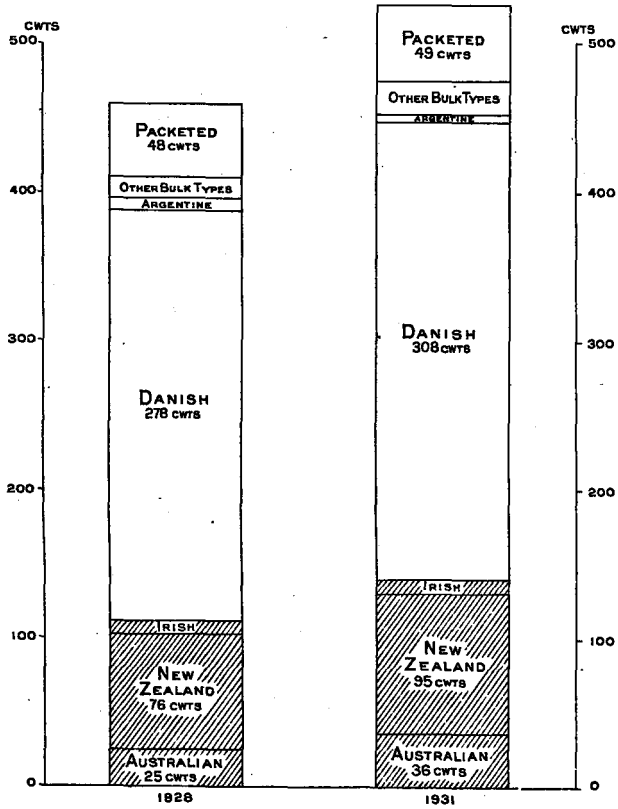


TABLE 6.—Average Weekly Sales per Shop Stocking the various Butters in Independent and Multiple Shops.  
July 1928 and July 1931.

Type of Butter.	Independent.		Multiple.		All Shops.	
	1928.	1931.	1928.	1931.	1928.	1931.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
English Farm .. ..	1.0	.3	—	—	1.0	.3
Australian .. ..	.7	.5	2.2	1.9	1.8	1.5
New Zealand .. ..	.5	.6	1.3	1.6	1.0	1.2
Irish .. ..	.2	—	4.2	3.2	2.8	3.2
Argentine .. ..	—	—	1.0	1.0	1.0	1.0
Danish .. ..	1.0	1.3	2.9	3.2	1.9	2.0
Other Bulk Types ..	—	.5	1.3	1.2	1.3	1.2
Packeted .. ..	.5	.5	.3	.3	.4	.4
All Butters .. ..	1.3	1.5	4.1	4.8	2.5	2.9

Where a type of butter was stocked in a large number of additional shops during the second survey, as in the case of Australian and bulk blended butter, it was usually offered as an additional choice to customers, rather than in substitution for a type previously stocked. The small sales of some of the new stockists, as compared with sales at shops where these butters had been longer established, had the effect of reducing the average sales per shop over all. On the other hand, Danish and New Zealand butter, already widely stocked in 1928, showed an increase in the average quantity sold in each establishment.

#### V.—RETAIL PRICES.

Table 7 shows the number of shops stocking the various types of butter, with their retail prices, and the amounts sold at each price. Butters with aggregate sales of less than 10 cwts. per week (English Farm, Irish and Argentine) have been excluded from the table. English Farm averaged 2s. 3d. per lb. in 1928, and 1s. 4d. per lb. in 1931: Irish and Argentine averaged 1s. 9d. and 1s. 8d. per lb. respectively in the first period, and both about 1s. 2d. per lb. in the second survey.

TABLE 7.—*Number of Shops with their Weekly Sales of Several Butters at various Retail Prices.*  
July 1928 and July 1931.

PRICES.	NUMBER OF SHOPS STOCKING					WEEKLY SALES (CWTS.)									
	Australian.	New Zealand.	Danish.	Other Bulk Types.	Packeted.	Australian.	New Zealand.	Danish.	Other Bulk Types.	Packeted.					
	1928. 1931.	1928. 1931.	1928. 1931.	1928. 1931.	1928. 1931.	1928. 1931.	1928. 1931.	1928. 1931.	1928. 1931.	1928. 1931.					
2/2 ..	—	—	—	—	1	—	—	—	—	8					
2/- ..	—	1	2	—	52	—	*	11	—	21					
1/11 ..	—	—	3	—	47	—	—	6	—	17					
1/10 ..	1	6	37	—	8	*	1	53	—	2					
1/9 ..	2	26	84	1	—	1	29	141	2	—					
1/8 ..	4	42	20	8	1	14	46	67	10	*					
1/7 ..	3	—	—	—	—	2	—	—	—	—					
1/6 ..	5	1	—	—	11	8	*	—	—	7					
1/5 ..	—	—	3	—	85	—	—	1	—	26					
1/4 ..	—	—	36	1	31	—	1	17	1	14					
1/3 ..	1	16	103	1	10	*	7	245	3	2					
1/2 ..	13	59	10	17	1	21	86	45	21	*					
1/1 ..	12	1	—	—	—	14	1	—	—	—					
1/- ..	2	—	—	—	—	1	—	—	*	—					
AVERAGE PRICE, 1928..						1/7-3	—	1/8-4	—	1/9-1	—	1/8-2	—	1/11-9	—
AVERAGE PRICE, 1931..						—	1/1-5	—	1/2-0	—	1/2-9	—	1/2-2	—	1/4-8

\* Less than 0.5 cwt.

In May, June and July the top price of New Zealand salted butter is usually about on a level with that of Danish, although during most months of the year there is an appreciable margin between the wholesale prices of Danish and of Australian and New Zealand butters. In 1930 and again in 1931, however, Danish butter remained at a slight premium even during the summer. Figure III shows the trend of prices from May, 1928 to July, 1931. Average quotations of the London Provision Exchange for July, 1928 and 1931, and average retail prices in Nottingham obtained at the July enquiries are given below:—

Description.	Wholesale Price (London Provision Exchange top quotation for best quality).		Retail Price in Nottingham (Average obtained at Empire Marketing Board survey).	
	July, 1928.	July, 1931.	July, 1928.	July, 1931.
	Per Cwt.	Per Cwt.	Per Lb.	Per Lb.
	s. d.	s. d.	s. d.	s. d.
Australian Salted .. ..	171 0	109 3	1 7·3	1 1·5
New Zealand Salted .. ..	182 6	114 6	1 8·4	1 2·0
Danish .. ..	181 6	119 9	1 9·1	1 2·9

There are a number of factors which tend to invalidate any exact comparison between average top quotations of 1st quality butter, wholesale, in London and average retail prices at a provincial centre in the same period, but it is of interest that the margin between the two sets of prices is narrow, amounting to no more than 1*d.* to 2*d.* per lb.

The increase in butter sales in Nottingham between 1928 and 1931 was proportionately greater in Empire than in foreign butter, and it may be of some significance that Australian and New Zealand are slightly less highly priced butters than Danish. Australian, the lowest priced butter in both periods, increased its sale by 44 per cent. ; New Zealand, which came next in order of price, increased its sales by 25 per cent. ; the sales of Danish, the highest priced of the principal imported butters, increased by 11 per cent. ; while packeted butter, which averaged from 2*d.* to 3*d.* per lb. more than Danish, barely maintained its sales between the two periods.

At the same time the larger increase in the available supplies of Empire butters was doubtless also a factor of importance governing the relative increases in consumption.

#### VI.—SOURCE AND FREQUENCY OF SUPPLY.

Information was collected during the survey as to the sources from which retailers obtained their supplies of butter and the frequency with which stocks were renewed. It may be noted here that the most common practice was for each shop to secure most of its supplies from one source.

The following table shows the various sources of supply and the percentage of shops securing their Empire, Foreign and Packeted butters from each source.

TABLE 8.—Percentage of Shops obtaining Butter from Various Sources. July 1928 and July 1931.

Source of Supply.	INDEPENDENT.						MULTIPLE.					
	Empire.		Foreign.		Packeted.		Empire.		Foreign.		Packeted.	
	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.
Wholesaler in—												
Nottingham ..	74	66	75	63	58	62	2	7	6	5	11	5
London ..	18	32	1	—	—	—	—	—	—	—	—	—
Manchester ..	8	2	4	4	—	—	—	2	—	1	—	—
Newcastle ..	—	—	4	4	—	—	—	—	—	—	—	—
Headquarters in—												
Nottingham ..	—	—	—	—	—	—	44	42	39	39	78	82
London ..	—	—	—	—	—	—	40	34	46	41	—	—
Birmingham ..	—	—	—	—	—	—	3	2	2	1	3	—
Importers in—												
London ..	—	—	—	—	—	—	10	12	—	—	—	—
Liverpool ..	—	—	—	—	—	—	1	1	—	—	—	—
Direct shipment from												
Continent ..	—	—	16	29	—	—	—	—	7	13	—	—
Direct from Blender	—	—	—	—	42	38	—	—	—	—	8	13
	100	100	100	100	100	100	100	100	100	100	100	100

Most independent shops drew their supplies from wholesalers in Nottingham. As between the two surveys, however, there was some tendency towards obtaining butter from a more direct source.

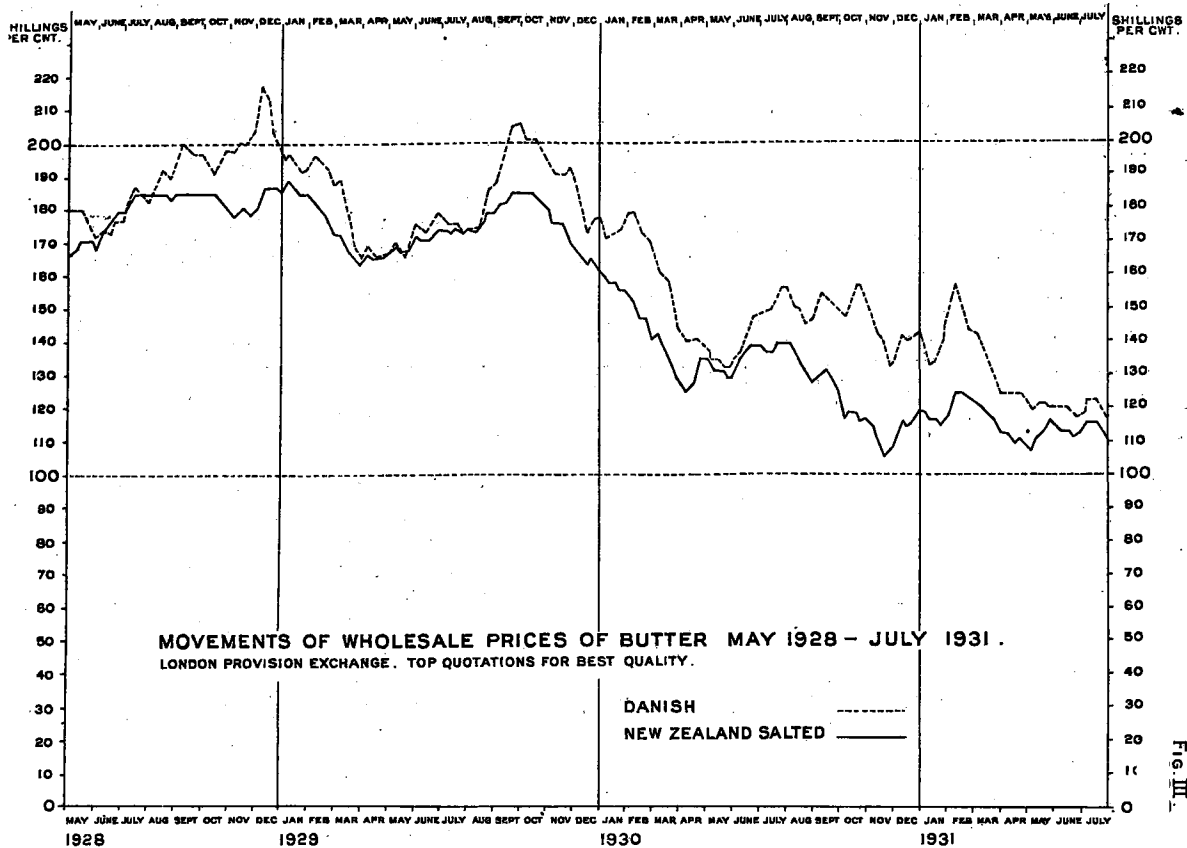


FIG. III.

Thus in 1931, 32 per cent. of retailers stocking Australian and New Zealand butter obtained their supplies from London, as compared with 18 per cent. in 1928. Similarly, the percentage of stockists receiving direct consignments of butter from the Continent rose from 16 per cent. in 1928 to 29 per cent. in 1931. In both surveys about 40 per cent. of the retailers selling packeted butter were supplied direct from the blenders.

In the case of multiple shops, the procedure was more standardised and over 80 per cent. received all supplies from their headquarters. A few shops, however, obtained butter from blenders, wholesalers in Nottingham, importers in London and by direct consignment from Denmark.

While Table 8 shows the sources from which retailers obtained their butter supplies, it takes no account of the volume of orders placed by different retailers. This aspect is considered in Table 9, which shows the percentage of the aggregate supplies of Empire, Foreign and Packeted Butters from each source of supply.

TABLE 9.—Percentage of Empire, Foreign and Packeted Butters obtained from Various Sources.  
July 1928 and July 1931.

Source of Supplies.	EMPIRE.		FOREIGN.		PACKETED.		ALL BUTTERS.	
	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.
Wholesaler in—								
Nottingham .. .. .	7	9	13	10	27	23	13	11
London .. .. .	6	6	*	—	—	—	2	2
Manchester .. .. .	1	1	1	1	—	—	1	1
Newcastle .. .. .	—	—	2	2	—	—	1	1
Headquarters in—								
Nottingham .. .. .	13	18	24	29	17	16	21	25
London .. .. .	37	29	37	19	—	—	31	20
Birmingham .. .. .	5	1	*	*	—	—	1	*
Importer in—								
London .. .. .	24	31	—	—	—	—	6	8
Liverpool .. .. .	7	5	—	—	—	—	2	1
Direct from—								
Continent .. .. .	—	—	23	39	—	—	16	25
Blender .. .. .	—	—	—	—	56	61	6	6
	100	100	100	100	100	100	100	100

\* Less than 0.5.

In both periods two-thirds of the Empire butter supplies were obtained from headquarters, importers or wholesalers in London. In 1928, 20 per cent., and in 1931, 27 per cent. of the supplies were secured from headquarters and wholesalers in Nottingham.

The supplies of Foreign butter were more evenly distributed through the various sources. In the earlier survey, 37 per cent. of the supplies were obtained from Nottingham, 37 per cent. from London sources, and 23 per cent. in direct consignments from the Continent. In the second survey a tendency to secure more supplies directly from the Continent is noticeable and 39 per cent. of the supplies came in this way. In the later period only 19 per cent. of the Foreign butter supplies came through London, probably owing to the reduction in the sales of Argentine butter.

Packeted butter supplies were chiefly obtained directly from the blender, and while 56 per cent. of the supplies came from this source in 1928, this figure had increased to 61 per cent. in 1931.

Supplies of butter were obtained once a week in the great majority of the shops visited. Packeted butter formed an exception to the general rule, so far as the independent shops were concerned, 41 per cent. receiving supplies twice weekly at the time of the first survey. In 1931, however, the corresponding figure was only 33 per cent.

In the multiple group this difference did not occur and a uniform policy was followed for all types of butter, but there was an increasing tendency towards obtaining supplies twice weekly.

TABLE 10.—*Percentage of Independent and Multiple Shops securing Supplies of Empire, Foreign and Packeted Butters, Weekly or Twice Weekly, July 1928 and July 1931.*

Frequency of Supply.	INDEPENDENT.						MULTIPLE					
	Empire.		Foreign.		Packeted.		Empire.		Foreign.		Packeted.	
	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.	1928.	1931.
Weekly .. ..	94	96	95	98	59	67	85	81	90	82	83	84
Twice Weekly ..	6	4	5	2	41	33	15	19	10	18	17	16



## VII.—SUMMARY.

1. This enquiry studies the changes in the demand for butter in Nottingham between July, 1928, and July, 1931. The survey was conducted by personal interviews with 181 retailers of all organisations and classes of trade, and on both occasions comparable information was obtained on their stocks, sales and prices of butter.

2. It is important to note that Nottingham is centrally situated in regard to the main ports of entry for the various types of butter, and that both surveys were undertaken in July, when supplies of butter from the Northern Hemisphere are about at their highest.

3. Between 1928 and 1931 the total imported supplies increased by about 23 per cent. : the greater part of this increase came from Australia and New Zealand. There was also an appreciable increase in supplies from the North European countries, with the exception of the Irish Free State and Russia.

4. During this period the Board of Trade index for wholesale food prices recorded a fall of 28 per cent., while the wholesale prices of best quality New Zealand and Danish butters fell by 38 per cent. and 35 per cent. respectively.

5. Between 1928 and 1931 the average retail price of butter in the shops visited fell from approximately 1s. 9d. per lb. to 1s. 3d. per lb. Over the same period, the weekly sales of butter in these shops increased from 458 cwts. to 526 cwts., or by 15 per cent. The proportion of these sales taken by Empire butters rose from 24 per cent. to 27 per cent. While butter sales increased by 68 cwts. per week the sales of margarine decreased by 34 cwts.

6. In 1928 and 1931, respectively, packeted butter averaged 3d. per lb. and 2d. per lb. more than the general average for bulk butters. Danish was the highest priced of the principal imported butters, with an average price of 1s. 9d. per lb. in 1928 and 1s. 3d. per lb. in 1931. Empire butters also fell in price by about 6d. per lb., the average price of New Zealand being 1s. 8½d. in 1928 and 1s. 2d., in 1931, while the corresponding prices for Australian were 1s. 7½d. and 1s. 1½d. respectively. The price of English Farm butter was above that of all the imported bulk butters, but this butter was seldom found in the retail shops visited.

7. As between the two surveys there was a pronounced tendency for both independent and multiple shops to stock a larger variety of types of butter. At both times Danish was the most widely

stocked, with packeted butter almost as commonly stocked in independent shops, and with New Zealand taking second place to Danish in multiple shops. All these butters were rather more extensively stocked in 1931. The greatest proportionate increase, however, was in Australian butter: in 1928 it was stocked in 8 per cent. of the shops but in 1931 this figure had increased to 15 per cent. and the change was equally apparent in both independent and multiple shops. There was also a considerable increase in the number of multiple shops stocking "bulk-blended" butter. The only butter stocked less frequently at the time of the second survey was Argentine.

8. Sales of Danish butter were by far the greatest of any one type and accounted for 61 per cent. of the total in 1928 and 58 per cent. in 1931. There was a definite increase in the sales of Empire butters, Australian increasing by 44 per cent. and New Zealand by 25 per cent. Empire butters as a proportion of the total increased from 24 per cent. to 27 per cent. Sales of "bulk-blended" butter also increased appreciably, but there was a fall in the sales of Argentine. Sales of packeted butter remained constant, but were very small in relation to the number of shops in which this butter was stocked.

TABLE 11.—*Number of Shops stocking the chief Types of Butter, together with Total Weekly Sales and average Retail Prices.*

*July 1928 and July 1931.*

Type of Butter.	Number of Shops Stocking.		Total Weekly Sales (cwts.).		Average Retail Price per lb.	
	1928.	1931.	1928.	1931.	1928.	1931.
English Farm.. ..	2	3	2	1	s. d. 2 2½	s. d. 1 4
Packeted .. ..	108	117	48	49	2 0	1 4½
Danish .. ..	146	151	278	308	1 9	1 3
Irish .. ..	3	3	9	9	1 9	1 2½
New Zealand .. ..	76	80	76	95	1 8½	1 2
Argentine .. ..	9	3	8	3	1 8½	1 2
Other Bulk Butters .. ..	9	20	12	25	1 8½	1 2½
Australian .. ..	15	28	25	36	1 7½	1 1½

9. In conclusion it may be advantageous to note some general points that are common to this report and to the previous report on the changes in the demand for butter in four Midland towns.

(1) In both reports a large decrease in the retail price of butter is accompanied by a correspondingly large increase in consumption. In the earlier survey\* a 25 per cent. fall in price was accompanied by a 12 per cent. rise in butter sales: in the present survey there was a 30 per cent. fall in price and a 15 per cent. increase in sales.

(2) At the earlier enquiry carried out in the winter season it was found that sales of Empire butter increased by 42 per cent. while the proportion of Empire to total butter sales rose from 28 per cent. in 1928 to 36 per cent. in 1930. In the summer enquiry, with which this Report is mainly concerned, sales of Empire butter increased by 27 per cent., and represented 24 per cent. of the total sales in 1928 and 27 per cent. in 1931. The higher proportion of the total sales represented by Empire butters in the two surveys in November is due to the normal seasonal change in the butter supplies between July and November, Australian and New Zealand butter being more plentiful in the autumn and winter than in the summer, and European butter more plentiful in the summer than in the winter months.

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\* E.M.B. 39. "Changes in the Demand for Butter."

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\* E.M.B. 39. "Changes in the Demand for Butter."

## DAIRY PRODUCE INTELLIGENCE.

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The Board issues for the benefit of producers and traders in the Empire "Weekly Dairy Produce Notes" giving early information as to actual and prospective supplies and shipments of butter, cheese, eggs and pig products; imports week by week into the chief ports in Great Britain; latest market quotations and tendencies; outlook and general trends in producing and consuming countries, etc.

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6

## FRUIT SUPPLIES IN 1931

PREPARED IN THE STATISTICS  
AND INTELLIGENCE BRANCH OF  
THE EMPIRE MARKETING BOARD



APRIL, 1932

LONDON:

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:

Adastral House, Kingsway, London W.C.2; 120, George Street, Edinburgh;

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1932

Price 1s. od. Net.

70-221-49.

X9(J37):732-8.N3

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## FOREWORD.

"FRUIT Supplies in 1930," which was issued in April last year brought together all the available statistical information about supplies of fruit in the United Kingdom. The present volume, reviewing the supply position in the year 1931, follows exactly similar lines. The statistics for the preceding year have been revised, and figures of home production, consumption and imports for 1931 have been added, but throughout the volume the statistics for 1931 are provisional and subject to revision.

STATISTICS AND INTELLIGENCE BRANCH,  
EMPIRE MARKETING BOARD.

*April, 1932.*

## FRUIT SUPPLIES IN 1931.

### FRUIT PRODUCTION IN THE UNITED KINGDOM.

Very wide fluctuations occur in the fruit crops in the United Kingdom, and these changes far outweigh the variations in imports from year to year. Hence it is the home crops which exert the chief influence on fruit consumption. Between 1926 and 1929 the English crop of apples and pears rose from 1,500,000 to nearly 7,000,000 cwts., falling again to 1,770,000 cwts. two years later. Annual figures of fruit production in Scotland and Northern Ireland are not available, but comparison of the results by the census of 1925 with that of 1930 indicates some striking changes, due mainly to the weather.

#### *England and Wales.*

The volume of production of fruit in England and Wales during the past year shows a considerable decline in the aggregate by comparison with the year 1930. The regular sequence of alternate light and heavy apple crops during the years 1924 to 1930 has now been broken, as production in 1931, instead of increasing, was about 60 per cent. smaller than in the preceding year. The estimated total of 1,529,000 cwts. was in fact less than in any year since 1923 when annual estimates were first compiled by the Ministry of Agriculture and Fisheries, with the exception of 1926, when the yield was only 1,116,000 cwts.

The cider apple crop is estimated at 859,000 cwts., or 259,000 cwts. less than in 1930. The crop has shown a decline each year since 1927, when production totalled 1,846,000 cwts.

Pears, plums and cherries, all declined from the previous year's figures. Pears and cherries were below the average yield of the preceding eight years, while the plum crop, following the very heavy production in 1930 was smaller than in any year since 1923.

With regard to soft fruits an increase over the 1930 crops is shown in the case of strawberries and raspberries, while a decline is recorded in the production of currants, although the currant crops, both black and red, were above the average for the preceding eight years. The production of strawberries, estimated at 717,000 cwts., was nearly twice as heavy as in 1930, and, as in the case of raspberries, has not been exceeded since 1924. Gooseberries, which show a decline in 1931 by comparison with the previous year, were about an average crop.

The following table shows the estimated aggregate yields of the more important fruit crops from 1924 to 1931 compiled by the Ministry of Agriculture and Fisheries.

TABLE I.—*Fruit Crops in England and Wales, 1924-31.*

Description of Fruit.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Apples—								
Dessert and cooking ..	2,380	6,520	1,116	5,947	2,906	6,415	3,831	1,529
Cider ..	1,140	1,160	1,035	1,846	1,335	1,145	1,118	859
Pears—								
Dessert and cooking ..	485	82	378	688	320	513	369	241
Perry ..	430	18	74	40	90	99	47	19
Plums ..	640	801	1,318	999	937	1,215	2,427	612
Cherries ..	214	349	195	304	209	296	405	232
Red and White Currants ..	75	66	63	84	53	74	89	79
Black Currants	275	188	177	212	210	254	260	218
Strawberries ..	830	705	667	404	395	340	379	717
Gooseberries ..	600	590	646	677	585	645	852	637
Raspberries ..	170	145	104	115	96	102	156	162

*Scotland.*

Estimates of fruit production in Scotland are made by the Department of Agriculture at five-year intervals in connection with the Census of Agricultural Production, and a statement has recently been issued by the Department giving preliminary estimates of the production in 1930 of small fruit and fruit grown in orchards respectively.

Of the small fruits grown in Scotland, raspberries are by far the most important, and, by comparison with 1925, both acreage and production in 1930, show a substantial increase; the total area under raspberries rose from 3,152 acres to 4,561 acres, while the acreage in bearing increased from 2,732 to 4,030, and the estimated production nearly doubled, having risen from 84,500 cwts. to 155,400 cwts. Strawberries, with a total acreage of 2,106, show some

decline from the acreage in 1925, and the area in bearing, 1,663 acres, has decreased by over 300 acres ; the production in 1930 is estimated at 42,500 cwts. as against 51,500 cwts. in 1925. There has also been a decline in both the acreage and production of gooseberries ; the estimated crop of 8,000 cwts. in 1930 compares with 13,850 cwts. in 1925. Black currants show a marked increase in production, and the acreage has more than doubled, while an increase is shown in the estimated production of red and white currants and mixed small fruits in spite of reduced acreages under these crops.

In studying these figures it should be borne in mind that, according to the October, 1930, quarterly Horticultural Report of the Department of Agriculture, the yield of all kinds of small fruit in 1930 was unusually good, and raspberries were an exceptionally heavy crop.

Table I shows the acreage and production of small fruit in 1930 with comparative figures for 1925.

TABLE II.—*Acreage and Production of Small Fruit in Scotland.*

Description of Fruit.	Total Acreage.		Acreage in Bearing.		Total Produce.	
	1925.	1930.	1925.	1930.	1925.	1930.
Strawberries .. ..	2,477	2,106	1,990	1,663	51,500	42,500
Raspberries .. ..	3,152	4,561	2,732	4,030	84,500	155,400
Black currants .. ..	310	622	235	570	1,570	7,200
Red or white currants	210	134	179	123	2,080	3,400
Gooseberries .. ..	606	389	551	380	13,850	8,000
Other kinds .. ..	—	19	—	18	—	170
Mixed small fruit ..	434	401	412	393	5,150	9,800

Orchard fruit is of comparatively small importance in Scotland, and, with the exception of plums, a general decline in acreage was recorded in 1930 by comparison with 1925. The estimated production in 1930, however, shows a substantial increase except in the case of cherries. The crop of apples, estimated at 11,300 cwts., compares with only 4,650 cwts. in 1925, and mixed orchard fruit at 9,150 cwts. is nearly four times as heavy. The October, 1930, Horticultural Report stated that the yield of apples was generally heavy in that year.

In Table II are shown the acreage and production of orchard fruits in 1930 with comparative figures for 1925.

TABLE III.—*Acreage and Production of Orchard Fruit in Scotland.*

Description of Fruit.	Acreage.		Total Produce.	
	1925.	1930.	1925.	1930.
Apples .. .. .	350	291	4,650	11,300
Pears .. .. .	120	128	1,085	1,300
Cherries .. .. .	113	40	350	—
Plums .. .. .	146	220	3,150	3,700
Other kinds .. .. .	—	15	—	240
Mixed orchard fruit ..	434	310	2,375	9,150

In 1931 the production of strawberries was lighter than in the previous year, but the yield of raspberries, gooseberries, and black currants was about up to the average. The apple crop was very light, while the yield of pears and plums was moderate.

*Northern Ireland.*

An estimate of the acreage and production of fruit in Northern Ireland in 1930 has been furnished by the Ministry of Agriculture, Belfast, but the figures are preliminary and liable to subsequent revision. Estimates of fruit production in Northern Ireland are made at intervals of five years in connection with the Census of Agricultural Production, and the latest figures with which the 1930 estimates may be compared are for the year 1925.

Full details of the estimated acreage under fruit are not available, but the area in 1930, excluding certain fruits of minor importance, totalled 8,383 acres, as compared with an aggregate acreage for all fruits of 9,346 in 1925.

Apples are by far the most extensively produced fruit, occupying an estimated area of 7,450 acres in 1930. The yield in 1930 was very heavy by comparison with 1925, being estimated at 640,000 cwts., as against 27,000 cwts. Strawberries and other berry fruits and black currants also showed substantial increases in production.

The following table shows the estimated acreage and production of fruit in Northern Ireland in 1930, together with the production in 1925.

TABLE IV.—*Acreage and Production of Fruit in Northern Ireland.*

Description of Fruit.	Acreage in 1930.	Production.	
		1925.	1930.
		cwts.	cwts.
Gooseberries .. ..	138	4,853	8,500
Black currants .. ..	124	1,924	3,900
Red and white currants	(a)	493	(a)
Raspberries .. ..	86	1,490	2,600
Strawberries .. ..	585	7,970	32,000
Other bush fruits .. ..	(a)	926	(a)
Apples .. ..	7,450	27,380	640,000
Other tree fruits .. ..	(a)	612	(a)

(a) Not available.

In connection with these figures it should be borne in mind that, on account of bad weather conditions in the early part of the year, the fruit crop in Northern Ireland in 1925 was a very poor one. On the other hand, in 1930, according to the Ministry of Agriculture's Monthly Reports, favourable conditions resulted in heavy yields. The production of apples was well above average, and soft fruits gave very good results.

In 1931 the yield of tree fruits was generally much below average, only a quarter or one-third crop being reported in some districts. The production of soft fruits was about the average.

#### IMPORTS OF RAW FRUIT.

Following the record volume of imports of raw fruit into the United Kingdom in 1930, a still higher level was reached last year. Total imports in 1931 amounted to nearly 29 million cwts., excluding nuts, as compared with 26 million cwts. in the previous year and 25 million cwts. in 1929. The declared value of the imports amounted to £31,698,000, a slight increase over each of the preceding two years and only £100,000 short of the value of raw fruit imports in 1920, when prices were of course very much higher.

The total quantities of raw fruit imported, according to the official trade returns, are shown in Table I.

TABLE I.—*Imports of Raw Fruit into the United Kingdom, 1926-31.*

Description of Fruit.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
Apples .. ..	8,284	6,161	6,089	5,758	6,172	7,601
Apricots .. ..	93	130	73	109	111	89
Bananas .. ..	(a)13,546	(a)12,696	(a)12,966	(a)14,937	(a)14,990	(a)16,162
Cherries .. ..	195	125	80	144	60	59
Currants .. ..	126	128	109	141	123	103
Gooseberries .. ..	77	57	32	16	29	17
Grapefruit .. ..	208	379	473	543	556	897
Grapes .. ..	506	718	839	864	695	945
Lemons .. ..	1,316	1,243	1,128	1,361	1,477	1,408
Limes and unspecified Citrus.	—	1	1	5	1	(d)
Oranges .. ..	7,973	7,898	7,761	9,264	10,207	10,397
Peaches .. ..	25	37	31	37	51	94
Pears .. ..	1,429	1,078	860	1,078	1,029	1,239
Pineapples .. ..	(c)	(c)	45	56	58	67
Plums .. ..	435	597	480	505	389	513
Strawberries .. ..	52	71	79	80	68	88
Other fruits .. ..	416	356	411	376	381	416
Total Imports .. ..	(b) 25,246	(b) 22,833	(b) 22,427	(b) 24,871	(b) 25,958	(b) 28,839

(a) Thousand bunches. (b) Including bananas estimated at 34 lbs. of fruit per bunch. (c) Included in "Other fruits." (d) Less than 500 cwts.

New records were created in 1931 in imports of bananas, pineapples, peaches, oranges, grapefruit and strawberries. Imports of bananas, which have advanced each year since 1927, increased to over 16 million bunches, or more than a million bunches in excess of the total in 1930, and oranges advanced another 200,000 cwts. beyond the record figure in that year to a new high level of nearly 10,400,000 cwts. Grapefruit imports after a fairly steady annual increase for many years past rose sharply to 897,000 cwts. Imports of peaches totalled 94,000 cwts., pineapples 67,000 cwts., and strawberries 88,000 cwts., each of these figures being well above any previous total.



Imports of apples amounted to 7,601,000 cwts., or 1,429,000 cwts. more than in 1930, and the heaviest quantity in any year since 1926. Pears and plums were imported in heavier quantities than since 1926 and 1927, respectively, while the total for grapes has not been exceeded since 1925. Imports of lemons were above those of 1929, but did not quite reach the record total established in 1930. In contrast to the general upward trend, imports of cherries and currants were on a lower level than for several years previously, while imports of gooseberries, although not quite so light as in 1929, were, apart from that year, the smallest since 1918.

Table II shows the total values of raw fruit imported, as given in the official trade returns.

TABLE II.—*Value of Imports of Raw Fruit, 1926-31.*

Description of Fruit.	1926.	1927.	1928.	1929.	1930.	1931.
	£000.	£000.	£000.	£000.	£000.	£000.
Apples .. .. .	9,561	7,272	7,838	7,062	7,552	7,882
Apricots .. .. .	231	291	221	306	322	242
Bananas .. .. .	6,048	5,750	5,612	5,646	5,664	5,551
Cherries .. .. .	431	276	172	316	132	149
Currants .. .. .	329	324	275	355	262	227
Gooseberries .. .. .	103	47	28	12	20	12
Grapefruit .. .. .	395	667	791	902	903	1,235
Grapes .. .. .	1,623	1,937	2,018	2,018	1,842	1,888
Lemons .. .. .	1,101	1,186	1,251	1,423	1,414	1,260
Limes and unspecified Citrus	1	1	1	5	2	1
Oranges .. .. .	7,664	8,593	7,898	9,806	9,548	9,550
Peaches .. .. .	99	169	125	177	199	258
Pears .. .. .	2,061	1,460	1,428	1,666	1,723	1,758
Pineapples .. .. .	*	*	90	138	131	134
Plums .. .. .	829	1,079	906	1,043	790	921
Strawberries .. .. .	153	209	201	253	191	218
Other fruits .. .. .	542	469	469	462	402	412
Total .. .. .	31,171	29,730	29,324	31,590	31,097	31,698

\* Included in "Other descriptions."

In Table III are shown average declared values of each fruit imported during the past six years.

TABLE III.—Average Value per cwt. of Imports of Raw Fruit into the United Kingdom, 1926-31.

Description of Fruit.	1926.	1927.	1928.	1929.	1930.	1931.
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Apples .. ..	23 1	23 7	25 9	24 6	24 6	20 9
Apricots .. ..	49 10	44 11	60 6	55 10	58 0	54 9
Bananas .. ..	(a) 8 11	(a) 9 1	(a) 8 8	(a) 7 7	(a) 7 6	(a) 6 11
Cherries .. ..	44 3	44 2	43 3	43 11	44 4	50 9
Currants .. ..	52 1	50 7	50 5	50 3	42 9	44 0
Gooseberries ..	26 10	16 6	17 10	16 1	13 9	14 0
Grapefruit ..	37 11	35 3	33 6	33 3	32 6	27 6
Grapes .. ..	64 1	53 11	48 1	46 9	53 0	40 0
Lemons .. ..	16 9	19 1	22 2	20 11	19 2	17 11
Oranges .. ..	19 3	21 9	20 4	21 2	18 8	18 4
Peaches .. ..	79 10	89 11	81 5	96 11	77 5	54 10
Pears .. ..	28 10	27 1	33 2	30 11	33 6	28 5
Pineapples ..	(c)	(c)	39 9	49 6	45 9	40 3
Plums .. ..	38 1	36 2	37 9	41 4	40 7	35 11
Strawberries ..	58 11	58 6	51 1	63 1	56 6	49 6
Other fruits ..	26 1	26 4	22 10	24 6	21 1	19 9
All raw fruits ..	(b) 24 8	(b) 26 0	(b) 26 2	(b) 25 4	(b) 24 0	(b) 22 0

(a) Average value per bunch. (b) Including bananas estimated at 34 lbs. of fruit per bunch. (c) Included in "Other fruits."

Average declared values per cwt. showed a general decline in 1931, although cherries, currants and gooseberries were rather higher in value. To some extent the changes in average values are due to changes in the relative proportions of fruit imported from the various countries. The fall of over 15 per cent. in the average value of apples is largely accounted for by the smaller proportion of Australian and New Zealand apples in the total, and to the increased proportion of the cheaper United States apples, and, perhaps, even more to the large imports of cider apples from France. Similarly, the pronounced fall in the average value of grapes may be attributed to the heavier supplies of Spanish grapes in 1931, and the very marked decline in the average value of peaches is explained by the increase in imports from Italy.

On the whole, however, the fall in prices reflects the greatly increased imports for the year. Comparison of Tables I and III indicates a fairly close relation between the value of imports and the average declared value, and the establishment of a new high record in the volume of imports in 1931 was accompanied by a new low record in post war years for the average value per cwt. of fruit imported.

Table IV shows re-exports of fruit in each of the past six years.

TABLE IV.—*Re-exports of certain Imported Fruits, 1926-31.*

Description of Fruit.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
Apples .. ..	425	371	346	258	350	312
Bananas .. ..	(a) 316	(a) 381	(a) 515	(a) 656	(a) 615	(a) 494
Grapefruit ..	6	8	14	16	23	30
Grapes .. ..	34	36	35	40	29	30
Lemons .. ..	33	36	34	62	43	48
Oranges .. ..	201	255	272	308	615	426
Peaches .. ..	1	2	1	3	5	5
Pears .. ..	24	20	31	37	89	80
Pineapples ..	(c)	(c)	7	10	9	12
Plums .. ..	4	7	6	9	11	18
Other fruits ..	13	12	10	10	8	10
Total .. ..	(b) 837	(b) 863	(b) 912	(b) 952	(b) 1,369	(b) 1,121

(a) Thousand Bunches. (b) Including bananas at 34 lbs. of fruit per bunch.

(c) Included in "Other fruits."

#### EMPIRE FRUIT IMPORTS.

The Empire had accounted for an exceptionally large proportion of the fruit imports into the United Kingdom in 1930. The increase in total fruit imports in 1931 was almost entirely due to larger supplies of fruits of various kinds from foreign countries, and the imports from the Empire fell back slightly from the high 1930 level, but were still heavier than in any year prior to 1930. But the slight fall in the Empire total, combined with a further pronounced increase in supplies from all sources, reduced the Empire share from 33 per cent. in 1930,

to 28 per cent. in 1931; but as in the years 1925 to 1929 Empire fruit accounted for only 23 per cent. of all imports, the Empire has still, in 1931, retained a large proportion of the increased trade recorded in 1930.

In the following table are shown aggregate imports of each kind of fruit from Empire countries in 1930 and the previous five years.

TABLE I.—*Imports of Raw Fruit consigned from British Countries.*

Description of Fruit.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
Apples .. ..	3,183	1,936	3,035	2,326	3,823	3,157
Apricots .. ..	(a)	(a)	(a)	(a)	1	(a)
Bananas .. ..	(b) 3,608	(b) 1,971	(b) 2,741	(b) 4,015	(b) 5,924	(b) 6,978
Cherries .. ..	(a)	—	(a)	(a)	(a)	—
Currants .. ..	(a)	(a)	(a)	(a)	(a)	(a)
Gooseberries ..	1	(a)	(a)	1	(a)	(a)
Grapefruit ..	42	52	55	75	90	137
Grapes .. ..	57	77	62	71	80	87
Lemons .. ..	6	5	3	18	4	9
Limes and unspeci- fied Citrus ..	—	(a)	1	5	1	(a)
Oranges .. ..	1,472	1,952	1,673	1,483	2,427	2,267
Peaches .. ..	8	23	14	20	26	20
Pears .. ..	169	110	240	120	322	252
Plums .. ..	16	31	35	25	36	46
Strawberries ..	(a)	(a)	(a)	1	(a)	—
Pineapples ..	} 52	} 36	7	11	6	4
Other fruits ..			19	26	13	16
Total .. ..	(c) 6,101	(c) 4,820	(c) 5,975	(c) 5,395	(c) 8,627	(c) 8,115

(a) Less than 500 cwts.

(b) Thousand bunches.

(c) Including bananas estimated at 34 lbs. of fruit per bunch.

Table II shows for each of the above fruits the proportion of all imports that were accounted for by imports from Empire countries.

TABLE II.—Imports of Raw Fruit: Proportion consigned from British Countries.

Description of Fruit.	1926.	1927.	1928.	1929.	1930.	1931.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Apples .. ..	38·4	31·4	49·9	40·4	61·9	41·5
Apricots .. ..	0·4	0·4	0·6	0·4	0·7	0·5
Bananas .. ..	26·6	15·5	21·1	26·1	39·5	43·2
Cherries .. ..	0·2	—	(a)	(a)	(a)	—
Currants .. ..	0·1	(a)	0·1	0·2	(a)	0·3
Gooseberries ..	0·8	0·4	1·4	5·0	1·2	1·6
Grapefruit ..	20·2	13·8	11·6	13·8	15·8	15·3
Grapes .. ..	11·0	10·8	7·4	8·2	11·5	9·2
Lemons .. ..	0·5	0·4	0·2	1·3	0·3	0·7
Limes and unspeci- fied Citrus ..	—	48·0	95·0	99·5	97·3	77·1
Oranges .. ..	18·5	24·7	21·6	16·0	23·7	21·8
Peaches .. ..	30·3	61·0	45·3	53·0	51·3	21·1
Pears .. ..	11·8	10·2	27·9	11·1	31·4	20·3
Plums .. ..	3·7	5·2	7·4	5·0	9·3	9·0
Strawberries ..	(a)	(a)	0·1	0·9	(a)	—
Pineapples ..	} 12·5	} 10·2	15·1	19·5	9·9	6·5
Other fruits ..			4·7	7·0	3·3	3·9
Total .. ..	24·2	21·1	26·7	21·7	33·2	28·1

(a) Less than 0·05 per cent.

The most pronounced reductions in the Empire share of United Kingdom imports in 1931 were in apples, peaches, pears and limes (including unclassified citrus fruit), although this last category is of very minor importance. The big reduction in apples was mainly due to a sharp increase in imports from the United States, while the poor crop of cider apples in the United Kingdom led to a heavy importation of cider apples from the continent. At the same time imports from Australia and New Zealand were rather lighter than in 1930, and imports from Canada also declined from the very high level of the preceding year.

Imports of peaches from Empire sources show little reduction, but the marked increase in supplies coming from Italy was responsible for a sharp fall in the proportion of the total represented by the Empire supply. In the case of pears, the South African crop was

lighter and imports fell considerably, while imports from foreign countries, especially the United States, rose to the highest figure since 1926.

Less pronounced reductions in the Empire share of imports were recorded by oranges, of which fruit California and Brazil shipped very heavy quantities; by grapes, due to increased imports from Spain, as the total from the Empire actually showed an increase; and by pineapples, owing to larger imports from the Azores and reduced supplies from South Africa.

Bananas were the only fruit in which the Empire share showed an appreciable rise, the increase of over one million bunches in total imports being almost entirely due to larger shipments to the United Kingdom from Jamaica.

#### FRUIT CONSUMPTION IN THE UNITED KINGDOM.

The figures of home production of fruit and of imports and re-exports given on pages 7-12 and 15, supply material for approximate calculations of the total quantity of raw fruit available for consumption in the United Kingdom from year to year. In Scotland and Northern Ireland official estimates of fruit production are only made every fifth year, and in other years it is necessary to include approximate figures in these calculations, but the quantity of fruit produced in these countries is normally small as compared with the production in England and Wales, and smaller still by comparison with total fruit imports. Thus no significant error is likely to arise from assuming Scotland's and Northern Ireland's output from 1925 to 1929 at the 1925 volume. A further allowance must be made for the carry-over of fruit from one year to another; no information is available as to the carry-over of imported fruit, but the Ministry of Agriculture and Fisheries estimates that on the average some 16 per cent. of the home apple crop is marketed after the end of December, and a net addition or deduction has to be made accordingly to represent fruit grown, but not consumed, in the calendar year.

Furthermore, although cider apples and perry pears are excluded from all calculations, no similar adjustment is possible for imported apples, although some part of the apples imported consist of cider fruit, but again the error is not likely to be of importance.

The results of the calculations during the past seven years are shown in the following table :—

TABLE I.—*Fresh Fruit Supplies and Consumption.*

	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Net imports (a).. ..	20,973	24,409	21,967	21,515	23,919	24,589	27,718
Home production less exports (b) .. ..	9,620	4,820	9,590	5,875	10,020	9,555	4,684
Add or deduct to allow for carry-over of apples	-662	+863	-773	+488	-561	+413	+368
Net supplies .. ..	29,931	30,092	30,784	27,878	33,378	34,557	32,970
Consumption per head	lbs. 74·4	lbs. 74·5	lbs. 75·9	lbs. 68·5	lbs. 81·8	lbs. 84·3	lbs. 79·7

(a) Excluding nuts, but including bananas at 34 lbs. of fruit per bunch.

(b) Excluding cider apples and perry pears.

According to these figures the high level of fruit consumption in 1930 was not maintained last year, the apparent consumption per head having declined by about  $4\frac{1}{2}$  lbs. to 79·7 lbs. This total is, however, considerably higher than in any year previous to 1929. The figures of course include fruit used for all purposes, not only for household consumption, but also for preserving, and they take no account of consumption of imported canned and dried fruits and of fruit pulp used for jam making, imports of which have also tended to increase in recent years.

The estimated quantity of raw fruit available per head of the population in each of the past seven years is given in Table II. The figures have been arrived at on the same basis as the per caput consumption figures in Table I (home production and imports, less exports and re-exports, with an adjustment for carry-over of the home apple crop).

TABLE II.—*Estimated Quantity of Raw Fruit available per head of Population, 1925-31.*

Description of Fruit.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Apples .. ..	28.6	24.4	27.0	22.5	27.8	25.9	22.2
Bananas .. .	8.8	9.9	9.2	9.3	10.6	10.6	11.7
Cherries .. .	1.2	1.0	1.1	0.7	1.1	1.1	0.7
Currants .. .	0.9	0.9	1.1	0.9	1.2	1.2	1.0
Gooseberries ..	1.7	1.8	1.8	1.6	1.7	2.2	1.6
Grapefruit ..	0.4	0.5	0.9	1.1	1.3	1.3	2.1
Grapes .. .	2.3	1.2	1.7	2.0	2.0	1.6	2.2
Lemons & Limes	3.1	3.2	3.0	2.7	3.2	3.5	3.3
Oranges .. .	18.7	19.2	18.8	18.4	21.9	23.4	24.3
Pears .. .	1.7	4.4	4.3	2.8	3.8	3.2	3.4
Plums .. .	3.2	4.3	3.9	3.5	4.2	6.8	2.7
Raspberries ..	0.6	0.5	0.5	0.4	0.5	0.8	0.8
Strawberries ..	2.0	1.9	1.3	1.3	1.2	1.3	2.1
Other fruits ..	1.2	1.3	1.3	1.3	1.3	1.4	1.6
Total .. .	74.4	74.5	75.9	68.5	81.8	84.3	79.7

Of the fruits grown in this country it may be said that apparent consumption is influenced far more by the volume of the home output than by imports. When crops are light imports may be increased, but not to a sufficient extent to make up the deficiency as compared with a good crop; similarly, when crops are heavy imports are likely to be reduced, but by a much smaller proportion. Moreover, a very heavy home crop may lead to some part of the output being unsaleable, and consequently left ungathered, and to the extent that such waste occurs the consumption figures given above may be exaggerated, as for example, in the case of apples in 1927 and 1929 and plums and gooseberries in 1930, appreciable quantities of which were reported to have been left on the trees and bushes.

In 1931 the decline in consumption by comparison with the preceding year was chiefly due to decreased supplies of apples and plums, but the upward trend in the consumption of bananas, oranges and grapefruit, continued. For the first time on record the apparent consumption of apples has been surpassed by that of another fruit,



the supplies of oranges last year representing about 2 lbs. per head more than the supplies of apples other than cider apples.

#### IMPORTS OF APPLES.

Imports of apples, which had shown a moderate recovery in 1930 from the low level of the preceding year, made a further pronounced advance in 1931, bringing the total to the highest point since 1926. Imports from the Empire fell by nearly 700,000 cwts., although they were still larger than in any year since 1926, while imports from foreign countries increased by over 2,000,000 cwts.

TABLE I.—Imports of Apples into the United Kingdom, 1926-31.

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
Canada .. ..	1,606	1,185	1,247	1,707	2,086	1,773
Australia .. ..	1,301	557	1,442	352	1,351	1,033
New Zealand .. ..	260	187	342	253	380	337
South Africa .. ..	1	2	1	3	3	11
Other Empire Countries .. ..	15	5	3	6	3	3
United States .. ..	4,581	3,825	2,955	3,089	2,235	3,533
France .. ..	296	128	34	95	65	657
Belgium .. ..	103	104	25	59	3	69
Netherlands .. ..	22	30	4	68	6	83
Russia .. ..	18	28	24	20	10	5
Portugal .. ..	15	88	5	66	14	40
Italy .. ..	48	15	4	18	(a)	5
Germany .. ..	6	1	3	10	10	41
Other Foreign Countries .. ..	12	6	(a)	7	5	11
Total Empire Countries .. ..	3,183	1,936	3,035	2,326	3,823	3,157
Total Foreign Countries .. ..	5,101	4,225	3,054	3,432	2,348	4,444
Total .. ..	8,284	6,161	6,089	5,758	6,172	7,601

(a) Less than 500 cwts.

The sharp advance in imports of apples from Empire sources in 1930 had been due to the large crop in Nova Scotia in the autumn of 1929, heavy shipments being carried on well into 1930; to good crops in Australia and New Zealand, although in the case of Australia barely up to the 1928 level; and to a good yield in British Columbia in the autumn of 1930, combined with a particularly early movement of the Nova Scotia crop, which was, however, lighter than in 1929.

The Australian and New Zealand apple crops in 1931 were smaller than in the preceding year and imports into the United Kingdom from those Dominions fell correspondingly. The rapid movement of the 1930 crop in Canada left only relatively small quantities for shipment in the early months of 1931, and although imports from Canada in the closing months of the year, following the good harvest in Nova Scotia, were considerably heavier than in the corresponding period of 1930, the total imports from Canada for the year 1931 as a whole failed by a substantial margin to reach the record set in the preceding year.

The decline in imports of apples from the Empire coincided with a material increase in imports from foreign countries. Fairly heavy shipments from the United States in the early months of the year, from the good crop gathered in 1930, and fairly heavy shipments also in the closing months, from the 1931 crop, brought about an increase of 1,300,000 cwts. in imports from the United States, due very largely to the better apple crops in Europe, which made it unnecessary for European countries to import quantities as large as in 1930.

The European crop conditions, combined with very light crops in the United Kingdom of both table and cider apples, led to an exceptionally heavy importation of apples from the continent in 1931, total imports from Europe amounting to over 900,000 cwts. as compared with only 100,000 cwts. in 1930. Probably the bulk of these imports were cider apples, especially those coming from France, which accounted for much the greater part of the total. Altogether imports from the continent accounted for the unusually high proportion of 12 per cent. of all apple imports, as compared with less than 2 per cent. in 1930 and 6 per cent. in 1929.

In Table II are shown imports in each month during the past six years.

TABLE II.—Imports of Apples into the United Kingdom in each Month, 1926-31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	572	682	453	720	609	531
February .. ..	533	851	443	667	487	419
March .. ..	543	755	401	435	506	385
April .. ..	529	506	346	521	422	481
May .. ..	446	450	504	435	474	466
June .. ..	682	332	522	229	554	596
July .. ..	231	203	413	167	457	303
August .. ..	142	121	279	117	145	121
September ..	486	345	371	241	160	554
October .. ..	1,609	566	1,024	673	900	1,336
November ..	1,541	755	845	909	761	1,464
December ..	970	595	488	644	697	945
Total ..	8,284	6,161	6,089	5,758	6,172	7,601

The effect of the heavy shipments from Canada and the United States from September onwards, together with the large imports from France, made imports of apples in the last four months an unusually large proportion of the total for the year. Imports during that period accounted for nearly 60 per cent. of the year's total, as compared with only 40 per cent. in 1930, and only slightly over 50 per cent. in 1926, which was another light year for English apples and a bumper year for the United States. Imports of apples during the four months May to August totalled only 1,486,000 cwts., as against 1,630,000 cwts. in the same period in 1930, while the proportion of the total fell from 26 per cent. to less than 20 per cent.

In Table III are shown imports from each of the chief countries of consignment in 1931. The light entries from Canada in the early months of the year are particularly noticeable, imports from Canada from January to May amounting to only 292,000 cwts., as compared with 1,413,000 cwts. from the United States. In the corresponding period of 1930 imports from Canada had totalled 929,000 cwts. and those from the United States 896,000 cwts.

TABLE III.—*Imports of Apples into the United Kingdom in each Month of 1931, showing the Principal Countries whence Consigned.*

Month.	Canada.	Australia.	New Zealand.	United States.	France.	Other countries.	Total.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January	147	—	—	378	—	6	351
February	92	—	—	326	—	1	419
March ..	36	—	—	346	—	3	385
April ..	17	137	30	286	—	11	481
May ..	—	304	82	77	—	3	466
June ..	—	433	142	17	—	4	596
July ..	2	155	79	9	—	58	303
August ..	8	2	2	95	1	13	121
September	133	2	2	255	67	95	554
October ..	590	—	—	475	245	26	1,336
November	495	—	—	708	243	18	1,464
December	253	—	—	561	101	30	945
Total ..	1,773	1,033	337	3,533	657	268	7,601

#### IMPORTS OF APRICOTS.

After two years, in which the totals had appreciably exceeded 100,000 cwts., imports of apricots in 1931 showed a decline of about 20 per cent. Imports from Spain declined only slightly, but there was a sharp fall in supplies from France, bringing the total from that country to the lowest it has been since 1919, when imports of apricots and peaches combined, from all sources, amounted to only 600 cwts.

The change which has occurred in the country of consignment of raw apricots since the war is very striking. In 1921 France accounted for 33,000 cwts. out of a total of 34,000 cwts. imported; after that for several years the two countries were on fairly level terms; but since 1927 Spain has definitely gone ahead, and in 1931 accounted for nearly 90 per cent. of the total.

Imports from South Africa are small in comparison with the totals from Spain and France, although last year's figures showed a substantial increase.

Table I shows imports during the past six years.

TABLE I.—*Imports of Apricots into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
South Africa .. ..	201	251	362	253	246	487
Australia .. .. .	149	155	40	138	520	—
Other Empire Countries..	—	52	1	—	—	—
France .. .. .	41,120	36,379	15,886	23,430	26,312	8,483
Spain .. .. .	50,914	92,564	55,961	80,624	82,849	78,401
Other Foreign Countries..	276	110	699	5,026	1,022	1,190
Total Empire Countries	350	458	403	391	766	487
Total Foreign Countries	92,310	129,053	72,546	109,080	110,183	88,074
Total .. .. .	92,660	129,511	72,949	109,471	110,949	88,561

Table II shows imports of apricots by months during the past six years.

TABLE II.—*Imports of Apricots into the United Kingdom in each Month, 1926-31.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. .. .	182	176	363	83	194	360
February .. .. .	—	8	1	6	—	4
March .. .. .	1	—	1	—	—	—
April .. .. .	148	—	—	8	—	—
May .. .. .	5,242	13,121	9,789	1,090	4,306	15,304
June .. .. .	45,113	80,164	50,866	49,496	77,764	64,300
July .. .. .	39,709	35,746	11,474	56,187	28,630	8,307
August .. .. .	2,239	—	410	2,437	3	163
September .. .. .	—	177	—	—	—	—
October .. .. .	8	—	—	—	—	—
November .. .. .	—	1	5	—	—	—
December .. .. .	18	118	40	164	52	123
Total .. .. .	92,660	129,511	72,949	109,471	110,949	88,561

Imports of raw apricots from the Continent begin towards the end of May, but June and July see the bulk of the imports. Generally, the greater proportion of imported supplies arrives in June, but in years when the season is late, as for example in 1929, the peak of the

season is naturally delayed, and July imports may approach or even exceed those of June. The 1931 season was early, with May accounting for some 17 per cent. of the total imports, as against only 4 per cent. in 1930.

The South African raw apricot supplies arrive during December and January, but the trade shows little development. In contrast with the steady growth in imports of other fruits from South Africa during the winter months, the demand for fresh apricots is apparently not sufficient to encourage larger consignments.

There is little difference in the seasons of the two chief continental shippers of fresh apricots, the imports from France and Spain showing much the same variations between the different months. Table III shows imports by months for 1931, separating the figures for the principal countries of consignment. But the table should be read in conjunction with that showing imports of apricot pulp in 1931, given on page 67. Imports of apricot pulp come almost entirely from Spain, and the season is at its height in July, August and September, although apricot pulp, unlike raw apricots, is shipped throughout the year.

TABLE III.—*Imports of Apricots during each Month of 1931, showing Countries whence consigned.*

Month.	South Africa.	France.	Spain.	Other countries.	Total.
	cwts.	cwts.	cwts.	cwts.	cwts.
January.. .. .	360	—	—	—	360
February .. .. .	4	—	—	—	4
March .. .. .	—	—	—	—	—
April .. .. .	—	—	—	—	—
May .. .. .	—	843	14,461	—	15,304
June .. .. .	—	6,972	57,139	189	64,300
July .. .. .	—	668	6,723	916	8,307
August .. .. .	—	—	78	85	163
September .. .. .	—	—	—	—	—
October .. .. .	—	—	—	—	—
November .. .. .	—	—	—	—	—
December .. .. .	123	—	—	—	123
Total .. .. .	487	8,483	78,401	1,190	88,561

#### IMPORTS OF BANANAS.

Imports of bananas in 1929 were nearly 1½ million bunches larger than had ever before been recorded. This record was just surpassed in 1930, and a further increase of over 1,000,000 bunches in 1931

brought the total increase since 1925 to some 4,000,000 bunches or 34 per cent. The very rapid development of the trade in bananas since the beginning of the century has raised imports from an average of 2,660,000 bunches in the five years 1900-04, and 6,710,000 bunches in the quinquennium immediately preceding the war, to the striking figures which are shown in Table I below. Somewhat similar increases have been shown in imports into other European countries and into the United States, where imports in 1931 reached a total of nearly 56,000,000 bunches.

TABLE I.—*Imports of Bananas into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand bunches.	Thou- sand bunches.	Thou- sand bunches.	Thou- sand bunches.	Thou- sand bunches.	Thou- sand bunches.
British West Indies ..	3,581	1,971	2,741	4,015	5,924	6,970
British Honduras ..	27	—	—	—	1	8
Canary Islands .. ..	2,591	1,809	1,599	1,224	967	892
Honduras .. .. .	1,400	2,645	1,572	2,916	985	2,700
Costa Rica .. .. .	2,175	2,044	2,204	1,669	2,189	1,622
Colombia .. .. .	3,710	3,771	3,957	3,748	3,352	1,675
Brazil .. .. .	—	455	885	1,351	1,429	1,472
Panama .. .. .	—	—	—	2	10	594
Other Foreign countries..	62	1	8	12	133	229
Total Empire Countries	3,608	1,971	2,741	4,015	5,925	6,978
Total Foreign Countries	9,938	10,725	10,225	10,922	9,065	9,184
Total .. .. .	13,546	12,696	12,966	14,937	14,990	16,162

The rapid increase in imports from Empire sources is the most striking feature of the figures in the above table. Jamaica is practically the sole Empire source of supply of bananas to the United Kingdom market, and imports from that source last year showed an increase of over 1,000,000 bunches, following even more striking increases in the years from 1927 to 1930. This brought the total from Empire sources to little less than seven million bunches, or over 43 per cent. of the imports from all countries. Until 1930 the Empire share of banana imports had never reached 30 per cent. in any year, except 1918 and 1919 when imports were on a very restricted scale. This result may be attributed to two causes, first the operations of the recently formed Jamaica Banana Producers' Association and the arrangements for direct shipments to the United Kingdom market of bananas handled by that Association; and

secondly the allocation of a larger proportion of Jamaica bananas to this country by other interests importing bananas, with a larger proportion of the Colombian and Central American supplies going to Europe and the United States. The distribution of Jamaica bananas in 1931 by the various agencies handling the fruit is shown in the following table, which is based on figures supplied by the West India Committee.

TABLE II.—*Exports of Bananas from Jamaica in 1931.*

Destination.	United Fruit Company.	Jamaica Banana Producers Association.	Other Companies.	Total.
	Stems (a).	Stems (a).	Stems (a).	Stems (a).
United States .. ..	3,388,000	2,475,000	3,994,000	9,857,000
Canada .. .. .	1,522,000	1,803,000	271,000	3,596,000
United Kingdom and Continent .. ..	5,493,000	3,358,000	—	8,851,000
Total .. .. .	10,403,000	7,636,000	4,265,000	22,304,000

(a) Bunches are approximately 30 per cent. less.

Apart from the increase in imports from Jamaica, there have been other significant developments in the banana trade in recent years. The chief of these has been the rise in imports of bananas from Brazil. This trade started during the first half of 1927, and has expanded rapidly, although the rate of expansion during the past two years has been much slower than in the first two years of the trade. The very moderate increase in imports of bananas from Brazil last year brought the proportion of the total slightly below that of 1930.

Imports from the Canary Islands have been declining steadily for several years past, and Canary bananas are more and more finding a market on the Continent, especially in Spain and France. In the space of five years imports of Canary bananas into the United Kingdom have fallen from over 2½ million to less than 900,000 bunches, and last year's total was the smallest recorded in any year during the present century. Up to 1905 the Canary Islands were the chief source of supply of bananas for the British market, furnishing well over one-half the total; in 1931 the proportion of all imports obtained from the Canary Islands was only 5½ per cent.

The group of countries comprising Honduras, Costa Rica and Colombia still account for a large proportion of the total imports of bananas. The rise in imports from these sources between the beginning



of the century and the War was extraordinarily rapid, and up to 1928 they were regularly furnishing over 60 per cent. of the total imports. Last year there was a sharp decline of about 50 per cent. in imports from Colombia and a smaller decrease from Costa Rica. Imports from Honduras, which had fallen to very small dimensions in 1930, recovered almost to their 1929 level and there was a pronounced advance in imports from Panama, a newcomer to the United Kingdom market. On the whole the group furnished only 40 per cent. of all banana imports, as compared with 56 per cent. in 1929 and 44 per cent. in 1930. In 1929 Colombia was displaced by Jamaica from its position as chief individual source of supply of bananas to the United Kingdom market; last year Jamaica went still further ahead, and supplied more bananas than the combined imports from the three largest foreign sources of supply.

The change in the sources of Britain's banana imports during the present century are clearly shown in the following table. The change in the countries constituting the United Kingdom in 1923 has no important bearing upon the figures, as the Irish Free State obtains practically the whole of its imports from the United Kingdom.

TABLE III.—Imports of Bananas into the United Kingdom, 1900-31.

Period.	British West Indies.		Colombia and Central America.		Canary Islands.		Brazil.		Total Imports*
	Thou- sand bunches	Per cent. of total.	Thou- sand bunches	Per cent. of total.	Thou- sand bunches	Per cent. of total.	Thou- sand bunches	Per cent. of total.	Thou- sand bunches
<i>Quinquennial average:</i>									
1900-04 ..	535	20.1	361	13.6	1,767	66.3	—	—	2,664
1909-13 ..	584	8.7	4,186	62.3	1,932	28.8	—	—	6,713
1922-26 ..	2,459	20.6	6,959	58.4	2,500	21.0	—	—	11,918
<i>Year.</i>									
1927 ..	1,971	15.5	8,460	66.6	1,809	14.3	455	3.6	12,696
1928 ..	2,741	21.2	7,733	59.7	1,599	12.3	885	6.8	12,966
1929 ..	4,015	26.9	8,333	55.8	1,224	8.2	1,351	9.0	14,937
1930 ..	5,924	39.5	6,526	43.6	967	6.4	1,429	9.4	14,990
1931 ..	6,970	43.1	6,754	41.8	892	5.5	1,472	9.0	16,162

\* Including small quantities from other sources.

Imports of bananas are registered throughout the year, although imports during the summer months are rather heavier than during the winter. The peak of imports is usually in July, and the six months May to October consistently account for approximately 60 per cent. of the annual imports. Figures of monthly imports during the past six years are shown in Table IV.

TABLE IV.—Imports of Bananas into the United Kingdom in each Month, 1926–31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.
January .. ..	861	850	972	933	886	1,026
February .. ..	809	771	670	667	883	1,035
March .. ..	879	910	961	872	1,026	948
April .. ..	1,276	924	1,040	988	1,147	1,176
May .. ..	935	959	1,174	1,423	1,384	1,348
June .. ..	1,003	1,110	1,403	1,354	1,477	1,643
July .. ..	1,670	1,414	1,201	1,550	1,737	1,820
August .. ..	1,620	1,114	1,494	1,876	1,478	1,480
September .. ..	1,393	1,357	1,250	1,482	1,415	1,673
October .. ..	1,274	1,205	1,223	1,528	1,682	1,603
November .. ..	1,067	1,006	977	1,336	943	1,265
December .. ..	759	1,076	601	928	932	1,145
Total .. ..	13,546	12,696	12,966	14,937	14,990	16,162

In Table V are shown imports of bananas during each month of 1931 from the principal sources of supply.

TABLE V.—Imports of Bananas in each month of 1931, showing Countries whence Consigned.

Month.	British West Indies.	Canary Islands.	Honduras.	Costa Rica.	Colombia.	Brazil.	Other Countries.	Total.
	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.	Thousand bunches.
January .. ..	440	26	126	179	139	115	1	1,026
February .. ..	371	22	168	161	206	83	4	1,035
March .. ..	364	33	19	163	259	106	4	948
April .. ..	440	59	351	22	169	132	3	1,176
May .. ..	624	64	64	50	366	176	4	1,348
June .. ..	684	109	248	129	237	144	92	1,843
July .. ..	645	179	271	204	212	166	143	1,820
August .. ..	468	131	491	140	—	132	118	1,480
September .. ..	652	135	489	150	—	111	136	1,673
October .. ..	832	63	308	139	—	99	162	1,603
November .. ..	777	31	92	136	17	123	89	1,265
December .. ..	673	40	53	149	70	85	75	1,145
Total .. ..	6,970	892	2,700	1,622	1,675	1,472	831	16,162

## IMPORTS OF CHERRIES.

Although there were good crops of cherries in most countries of Europe in 1931, following a year of light crops in 1930, the continuance of regulation of imports to prevent the introduction of the Cherry Fruit Fly again restricted imports from France and Italy and also those from Germany, and a moderate crop in the Netherlands brought about a further reduction in imports from that country.

The general result of these influences is seen in the table of imports over the past six years, given below. The total imports for the year reached only 58,500 cwts., which is even less than the low figure recorded in 1930, and the year's total was the smallest recorded since the War, when imports were very severely restricted.

Of the five countries from which imports are mainly derived three showed material decreases as compared with 1930, imports from Holland and Italy being reduced by between 40 and 50 per cent., and those from Belgium by about 7 per cent. France showed some recovery from the 1930 figure, but imports from France were only a fraction of what had been imported in earlier years.

TABLE I.—*Imports of Cherries into the United Kingdom, 1926-31.*

Country whence Consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Germany .. .. .	810	157	10,969	1,098	493	1,965
Netherlands .. .. .	11,416	5,153	6,074	13,263	6,694	3,542
Belgium .. .. .	49,710	36,702	44,921	66,116	30,914	28,796
France .. .. .	124,968	72,501	15,575	55,220	16,697	19,822
Spain .. .. .	6,290	37	210	—	—	1,342
Italy .. .. .	1,109	10,359	1,906	8,091	4,677	2,779
Other Countries .. .. .	472	—	2	19	36	287
Total Empire Countries..	382	—	2	19	1	—
Total Foreign Countries..	194,393	124,909	79,655	143,788	59,510	58,533
Total .. .. .	194,775	124,909	79,657	143,807	59,511	58,533

The season last year was moderately early, and the peak of imports occurred in June, as in 1930, whereas the late seasons of 1928 and 1929 delayed the peak of imports in those years until the following month. Table II shows imports by months during each of the past six years.

TABLE II.—*Imports of Cherries into the United Kingdom in each Month, 1926-31.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
April .. .. .	102	—	—	—	—	—
May .. .. .	24,113	11,895	5,202	10,680	6,703	7,400
June .. .. .	103,291	69,299	18,033	54,735	29,393	27,285
July .. .. .	58,302	42,432	41,420	60,221	23,126	22,466
August .. .. .	6,208	1,280	12,116	17,669	289	1,382
September .. .. .	2,759	—	2,886	483	—	—
October .. .. .	—	3	—	—	—	—
November .. .. .	—	—	—	—	—	—
December .. .. .	—	—	—	19	—	—
Total .. .. .	194,775	124,909	79,657	143,807	59,511	58,533

The final table shows imports in 1931 by months from each of the chief countries of supply. France and Italy started shipping in May, with the peak of shipments in June, while Belgium and Holland commenced in June, with the peak occurring early in July. The seasonality of supplies is, however, affected by the embargo on imports from France and Italy after certain dates (varying with the districts), which tends to advance the peak of the season of importation from these countries.

TABLE III.—*Imports of Cherries in each Month of 1931, showing Countries whence consigned.*

Month.	France.	Belgium.	Nether-lands.	Italy.	Other Countries	Total.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
May .. .. .	7,028	—	—	—	372	7,400
June .. .. .	11,999	9,774	1,194	2,775	1,543	27,285
July .. .. .	795	18,633	2,042	4	992	22,466
August .. .. .	—	389	306	—	687	1,382
Total .. .. .	19,822	28,796	3,542	2,779	3,594	58,533

### IMPORTS OF RAW CURRANTS.

The largest total of imports of raw currants ever recorded was in 1914, when the total reached 144,000 cwts. The post-war record of 1929 closely approached this figure, but the following years have seen a decline, and total imports in 1931 were the smallest since 1925, and represent a decrease of 27 per cent. from the 1929 total.

France, Holland and Belgium have always accounted for the bulk of the imports of raw currants, and the order of importance has remained unchanged over a fairly long period, with France furnishing over one half the total. Last year there were reductions, as compared with 1929, in imports from all three countries, but the reduction in imports from Holland was more than counterbalanced by an increase in the supplies of black currant pulp from that country. Imports from Norway fell for the third successive year, and smaller quantities were also received from Spain. Imports of raw currants from Empire sources are almost negligible, small quantities only coming from the Irish Free State.

In Table I are shown annual imports of raw currants in each of the past six years. British trade returns do not differentiate between black and red currants, but there is little doubt that the bulk of the imports consist of black currants.

TABLE I.—*Imports of Currants into the United Kingdom, 1926-31.*

Country whence Consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Channel Islands .. ..	—	—	—	5	2	7
Irish Free State .. ..	98	51	114	229	44	24
Norway .. .. .	3,987	3,442	5,561	3,066	2,095	1,839
Germany .. .. .	704	186	507	345	93	249
Netherlands .. ..	21,319	26,811	21,512	20,570	28,770	24,968
Belgium .. .. .	9,919	11,171	14,830	17,494	15,834	12,507
France .. .. .	89,447	86,106	66,680	99,577	72,123	62,670
Spain .. .. .	608	391	—	—	3,651	808
Other Foreign Countries	24	19	—	9	2	131
Total Empire Countries..	98	51	114	234	46	31
Total Foreign Countries..	126,008	128,126	109,090	141,061	122,568	103,172
Total .. .. .	126,106	128,177	109,204	141,295	122,614	103,203

In addition to imports of raw currants, there are considerable imports of pulp, especially black currant pulp. The Netherlands is the chief source of supply of the pulp, but France, Belgium and Russia also ship moderate quantities. Shipments of black currant pulp from Holland to the United Kingdom were exceptionally large in 1931. Imports of pulp are dealt with in a separate article (see page 65).

The season of importation of fresh currants is a short one, extending only from June to September, while the bulk of the imports are registered in July. (Some imports recorded in September are probably delayed entries for June arriving earlier in the season.) The figures of imports by months over the past six years are shown in Table II. On the whole July accounts for from 53 to 90 per cent. of the total imports, the lower proportion occurring in 1927 when the French crop was particularly early.

TABLE II.—*Imports of Currants into the United Kingdom in each Month, 1926-31.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
May .. ..	1	—	2	102	46	—
June .. ..	42,227	50,150	19,956	21,511	10,710	17,485
July .. ..	76,735	67,319	78,875	106,707	104,311	80,590
August .. ..	6,433	10,128	10,164	12,975	7,547	4,038
September .. ..	710	580	207	—	—	1,090
Total .. ..	126,106	128,177	109,204	141,295	122,614	103,203

Table III shows monthly imports from the different countries.

TABLE III.—*Imports of Currants in each Month of 1931, showing Countries whence consigned.*

Month.	France.	Nether-lands.	Belgium.	Spain.	Norway.	Other Countries.	Total.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
June .. ..	16,659	3	70	738	—	15	17,485
July .. ..	45,923	23,066	11,285	70	3	223	80,590
August .. ..	88	1,840	324	—	1,631	155	4,038
September .. ..	—	39	828	—	205	18	1,090
Total .. ..	62,670	24,968	12,507	808	1,839	411	103,203

The first currants to arrive are those from the more southerly districts of France, which usually begin to arrive in May. During June French currants from the Côte d'Or are arriving, with early arrivals from Belgium and the Netherlands towards the end of the month. Norwegian currants are later, the season opening in July and extending to September, the bulk of supplies arriving in August.

#### IMPORTS OF GOOSEBERRIES.

Imports of gooseberries into the United Kingdom fell rapidly from 1926, Dutch exports going increasingly to Germany. The total imports for 1929 were barely one-fifth of the 1926 figure, and although good crops in the Netherlands and Belgium in 1930 and a reduction in demand from Germany led to a recovery in imports into the United Kingdom in that year the total for 1931 again fell to a level which was barely above that of 1929. Both the Netherlands and Belgium showed a decrease in 1931, and these two countries, as usual, accounted for over 95 per cent. of total imports. Imports during the past six years are shown in Table I.

TABLE I.—*Imports of Gooseberries into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Netherlands ..	63,911	46,194	19,983	10,384	20,638	13,451
Belgium .. ..	10,769	10,484	10,845	4,279	6,629	3,043
Other Foreign Countries ..	1,599	372	252	122	929	34
Total Foreign Countries ..	76,279	57,050	31,080	14,785	28,196	16,528
Total Empire Countries .. ..	641	215	439	763	342	269
Total ..	76,920	57,265	31,519	15,548	28,538	16,797

There is a substantial importation of gooseberry pulp, as of other soft fruits, particularly from the Netherlands, Dutch exports of pulp exceeding in volume their exports of raw fruit. Dutch exports of gooseberry pulp have also decreased in recent years, but there was a striking recovery in 1931, and although no precise figures are available, Dutch export returns suggest that the total imports of gooseberries and gooseberry pulp from Holland was in 1931 about at the level of imports in 1928. The decrease in imports of gooseberries from Belgium does not appear to have been counterbalanced by any increase

in imports of pulp. Imports of gooseberries, either whole fruit or pulp, bear a much smaller ratio to home production than in the case of other soft fruits, home production averaging nearly 700,000 cwts. annually.

The season for imported gooseberries is practically limited to June and July, these months accounting for all but a very small proportion of the total. The lateness or otherwise of the season is responsible for whether the peak of the season occurs in June or July; last year, as in 1930, the season was fairly early, but the large percentage of imports falling in June was perhaps due more to the decline in demand as the season progressed, than to the earliness of the season.

Table II shows imports by months during the past six years. The small imports recorded in the first four months of 1927 were in January and February, and were shown as coming from South Africa.

TABLE II.—*Imports of Gooseberries into the United Kingdom in each Month, 1926-31.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January-April ..	—	17	—	—	—	—
May .. ..	946	1,209	53	2	225	44
June .. ..	63,472	39,825	23,246	7,264	23,689	11,854
July .. ..	11,535	16,777	7,417	7,923	4,511	4,573
August .. ..	967	2	803	328	113	326
September ..	—	—	—	31	—	—
Total ..	76,920	57,830	31,519	15,548	28,538	16,797

#### IMPORTS OF GRAPEFRUIT.

The very rapid increase in imports of grapefruit, which has proceeded unchecked throughout the post-war period, continued in 1931 at an even more rapid rate. Between 1921 and 1925 imports of grapefruit rose from 21,000 cwts. to 168,000 cwts.; by 1930 they had reached 557,000 cwts. and in the following year they jumped to 897,000 cwts., an increase of over 60 per cent. in a single year.

Imports from all sources increased last year, but although the largest absolute increase was in imports from the United States, the quantities credited to that country again declined relative to total imports, accounting for only 64 per cent. of the total as compared with 78 per cent. in 1929 and 70 per cent. in 1930. Fruit shown as coming from the United States includes a fair proportion of fruit originating in other countries, particularly Jamaica, Porto Rico



and the Isle of Pines, and shipped to the United Kingdom *via* New York. Direct consignments from Cuba (Isle of Pines) and Porto Rico increased sharply in 1930 and showed a further big increase in 1931, and aggregate imports from the United States and these two countries combined, accounted for 81.6 per cent. of all imports, or precisely the same proportion as in the preceding two years.

Increases were also recorded in imports from South Africa, the British West Indies and Palestine. Imports from both South Africa and Palestine reached a level far above any ever before recorded, but the increase in imports from the West Indies is to some extent offset by a decline in imports credited to Canada, which probably include West Indian grapefruit. Imports of grapefruit shown as coming from Egypt should, perhaps, be added to the Palestine total.

On the whole, the Empire barely maintained its share of the import trade of 16 per cent., although this is a larger proportion than was recorded up to a few years ago.

TABLE I.—Imports of Grapefruit into the United Kingdom, 1926-31.

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
South Africa .. ..	13	17	19	26	47	65
British West Indies ..	27	30	32	41	25	34
Palestine .. .. .	(a)	(a)	(a)	3	10	36
Canada .. .. .	(a)	4	2	2	7	1
British Honduras .. .	1	(a)	1	1	(a)	1
British Guiana .. .	(a)	—	—	1	—	—
Other Empire Countries..	1	1	1	1	1	(a)
United States .. ..	150	314	371	420	391	572
Porto Rico .. .. .	1	6	—	7	26	79
Cuba .. .. .	12	2	38	16	37	81
Portuguese East Africa ..	(a)	2	4	7	5	12
Egypt .. .. .	(a)	—	(a)	3	3	7
Honduras .. .. .	2	2	(a)	(a)	(a)	—
Other Foreign Countries..	1	1	5	15	5	9
Total Empire Countries..	42	52	55	75	90	137
Total Foreign Countries..	166	326	418	468	467	760
Total .. .. .	208	379	473	543	557	897

(a) Less than 500 cwts.

Table II shows imports by months over the last six years. There is no markedly seasonal movement, the relative proportions of fruit coming from the different sources in the various years accounting for the greater part of the changes in imports from month to month. Last year supplies were particularly heavy during the summer months, total imports during the six months from April to September accounting for practically 60 per cent. of the year's total, with the figure for August rising to over 100,000 cwts.

TABLE II.—Imports of Grapefruit into the United Kingdom in each Month, 1926-31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	10	22	31	29	24	45
February .. ..	16	25	35	38	60	51
March .. ..	27	45	44	57	78	52
April .. ..	15	28	53	66	30	87
May .. ..	7	29	53	58	47	94
June .. ..	11	39	33	53	47	92
July .. ..	16	36	24	46	56	114
August .. ..	23	19	35	51	25	67
September .. ..	13	14	40	32	49	81
October .. ..	33	57	21	28	54	78
November .. ..	22	35	55	69	39	58
December .. ..	15	30	49	16	48	78
Total .. ..	208	379	473	543	557	897

Most of the United States grapefruit shipped to the United Kingdom is grown in Florida, where the harvesting season starts about September and continues to about May, with peak supplies about March or April. Texas supplies come at about the same season, although the peak occurs about December or January, while California, which is not a large producer of grapefruit in comparison with Florida, but yet shipped considerable quantities to this country last year, produces grapefruit throughout the year, the Southern Californian peak occurring in the summer months (June or July) and other Californian in the winter.

Other countries whose grapefruit shipments are largely indistinguishable in British import returns from those of the United States are Jamaica, Porto Rico and Cuba (Isle of Pines). In each case the earliest fruit is ready some weeks before the Florida season opens, and every effort is made to get the fruit on to the markets at an early date. Jamaica exports run from September to about March; Porto Rico, with three distinct crops in the year, shows peak shipments in September or October, and secondary peaks in the spring and early summer according to the size of the respective crops; while the Isle of Pines covers much the same period. But each of these countries actually produces grapefruit throughout the year.

In the Union of South Africa, the harvesting season is in the summer, and imports run from June to September, with a peak about July—about the time of year when imports from most other sources are at their minimum.

Table III shows imports by months and countries of consignment, during 1931.

TABLE III.—Imports of Grapefruit during each Month of 1931, showing Countries whence consigned.

Month.	South Africa.	British West Indies.	Palestine.	United States, Porto Rico and Cuba.	Portuguese East Africa.	Other Countries.	Total.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January	—	3	4	38	—	—	45
February	—	2	3	45	—	1	51
March	—	4	2	45	—	1	52
April	—	1	1	85	—	—	87
May	1	—	—	93	—	—	94
June	11	1	—	76	4	—	92
July	19	1	—	90	2	2	114
August	15	—	—	45	4	3	67
September	10	—	—	69	—	2	81
October	8	3	2	62	2	1	78
November	1	5	8	36	—	8	58
December	—	14	16	47	—	1	78
Total	65	34	36	731	12	19	897

### IMPORTS OF GRAPES.

Following a decline in 1930, imports of grapes in 1931 showed a marked recovery, and continued the upward movement that had been recorded from 1926 to 1929. The total for the year, however, was still rather below the figure recorded in 1925, when 979,000 cwts. of grapes were imported. Empire countries accounted for only 9 per cent. of the 1931 total, this being a marked decrease from the 11·5 per cent. recorded in 1930. In 1928 and 1929 the Empire accounted for only 7·4 and 8·2 per cent. respectively of all imports. Table I shows imports annually since 1926.

TABLE I.—*Imports of Grapes into the United Kingdom, 1926–31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
South Africa ..	31	50	44	49	48	59
Channel Islands ..	19	20	15	15	27	21
Australia ..	6	5	2	7	4	5
Other Empire Countries ..	1	2	1	(a)	1	1
Spain ..	299	444	597	591	412	569
Belgium ..	54	50	54	57	53	58
Netherlands ..	47	51	48	68	66	86
Portugal ..	32	78	34	41	38	70
Argentina ..	2	9	20	18	17	28
United States ..	4	2	9	5	16	16
Russia ..	—	1	7	3	1	1
Italy ..	5	5	7	4	11	18
France ..	3	1	1	1	(a)	(a)
Crete ..	—	—	—	—	(a)	3
Other Foreign Countries ..	3	(a)	1	5	1	9
Total Empire Countries ..	57	77	62	71	80	86
Total Foreign Countries ..	449	641	778	793	615	858
Total ..	506	718	840	864	695	944

(a) Less than 500 cwts.

The annual figures of imports of grapes into this country are very largely influenced by the size of the Almeria grape crop. Imports from Spain comprise the bulk of the total, the proportion in recent years ranging from 59 per cent. in 1926 and 1930 to 80 per cent. in 1924. Last year the Spanish share of the total imports was 60 per cent., for although the Almeria crop was fairly good, imports from other continental sources increased considerably. Indeed, foreign countries other than Spain accounted for over 30 per cent. of all grape imports, as compared with only 24 per cent. in 1930 and 21 per cent. in 1929.

Imports from the Netherlands, which takes second place to Spain, showed a further marked advance in 1931, gaining by 30 per cent. over 1930. The imports from this source during the past two years have increased steadily in recent years as area under glass-houses in the Netherlands has been extended. Imports from Belgium rose slightly last year; during the past five years supplies of grapes from Belgium have shown remarkably little variation, ranging only between 50,000 and 60,000 cwts. Portuguese supplies were much heavier than in the preceding three years, although falling rather short of the totals which have been reached in some years. Imports from Argentina established a new high record, and there was a further increase in imports from Italy.

The Union of South Africa is the chief Empire country shipping grapes to the United Kingdom. Last year's total marked a further advance in imports from the Dominion, and allowed the Dominion to retain fourth place in the volume of grape imports. There was a decrease in imports from the Channel Islands, and with small imports from Australia, the total of supplies from the Empire reached a figure of 86,000 cwts., establishing a new high record, although as stated above, the proportion of total imports which it represents was rather below that of 1930.

The predominance of Spain in this country's grape imports is clearly reflected in the season of maximum imports. The last five months of the year normally account for nearly 90 per cent. of the imports for the whole year, but the development of imports from South Africa and Argentina is tending to raise the proportion received in the earlier half of the year. February, June and July are the months of minimum imports, supplies during those months being very small. Table II shows imports by months during the past six years.

TABLE II.—Imports of Grapes into the United Kingdom in each Month, 1926-31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	39	6	7	15	13	18
February .. ..	8	5	10	7	9	14
March .. .. .	18	21	17	19	20	30
April .. .. .	13	27	21	30	19	33
May .. .. .	6	18	17	22	28	26
June .. .. .	10	6	15	8	9	6
July .. .. .	9	7	8	8	7	10
August .. .. .	19	68	45	67	39	61
September .. .	82	173	125	145	117	216
October .. ..	186	208	291	272	198	307
November .. .	93	154	174	212	174	171
December .. .	23	25	110	59	62	52
Total .. .. .	506	718	840	864	695	944

In Table III are shown imports during each month of 1931 from the principal countries of consignment. The countries can be divided into two groups, with pronounced seasonal movements, but Belgium ships grapes throughout the year. South Africa and Argentina account for the bulk of the supplies from February to June; the end of July normally sees the opening of the Channel Islands and Netherlands seasons, and from then until the end of the year grapes are received from these countries, with Spain, Portugal and the United States.

TABLE III.—Imports of Grapes in each Month of 1931, showing Countries whence consigned.

Month.	British South Africa.	Channel Islands.	Spain.	Portugal.	Belgium.	Nether- lands.	Argen- tina.	Other Coun- tries.	Total.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
January	—	—	5	—	6	—	—	7	18
February	5	—	—	—	6	—	1	2	14
March ..	24	—	—	—	3	—	3	—	30
April ..	22	—	—	—	1	—	8	2	33
May ..	6	—	—	—	1	—	16	3	26
June ..	2	—	—	—	3	—	—	1	6
July ..	—	—	2	—	5	2	—	1	10
August ..	—	2	16	25	6	10	—	2	61
September	—	4	125	44	7	20	—	16	216
October	—	10	245	1	6	33	—	12	307
November	—	4	141	—	4	3	—	5	171
December	—	1	35	—	10	3	—	3	52
Total	59	21	569	70	58	85	28	54	944

### IMPORTS OF LEMONS.

Imports of lemons into the United Kingdom in 1931 fell somewhat below the record established in 1930, but with the exception of that year were the highest ever reached. Imports from Italy, the chief source of supply, showed a further increase to the new high record of 1,155,000 cwts., but imports from Spain fell from the 300,000 cwts. recorded in 1929 and 1930, and there was also a marked fall in imports from Syria.

Imports of lemons from "other foreign countries" consist of fruit shipped from continental countries (mainly Germany) which have previously imported their fruit from Italy and Spain.

Table I shows imports of lemons during the past six years.

TABLE I.—*Imports of Lemons into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Palestine .. ..	2.6	4.8	1.8	13.8	1.4	2.6
South Africa .. ..	—	—	0.6	0.7	2.4	3.9
Cyprus .. ..	—	—	0.3	1.0	—	2.6
Other Empire Countries .. ..	3.4	—	—	2.0	—	.3
Italy .. ..	998.5	1,014.0	868.8	999.6	1,076.1	1,155.1
Spain .. ..	252.1	165.9	165.4	300.1	301.4	186.0
Syria .. ..	28.8	22.2	44.2	15.4	53.5	9.2
Egypt .. ..	4.4	10.1	11.1	3.6	1.4	1.9
United States .. ..	0.6	0.4	5.4	1.4	4.5	1.5
Other Foreign Countries .. ..	25.7	25.8	29.9	23.2	35.8	45.1
Total Empire Countries .. ..	6.0	4.8	2.7	17.5	3.8	9.4
Total Foreign Countries .. ..	1,310.1	1,238.4	1,124.8	1,343.3	1,473.7	1,398.8
Total .. ..	1,316.1	1,243.2	1,127.5	1,360.8	1,477.5	1,408.2

Italy and Spain continue to supply over 90 per cent. of the country's imports of lemons, and in 1931 accounted for about 95 per cent. of the total.

Palestine had in 1929 shown marked progress in shipments of lemons to the United Kingdom, but in 1930 and 1931 imports declined to small proportions. Imports from South Africa again increased slightly, and there were some imports of lemons from Cyprus, but the Empire does not figure prominently in the lemon import trade.

In Table II are shown monthly imports of lemons from 1925. The figures show no special feature, the imports being fairly well distributed over the year. Variation occurs in the seasons from year to year according as the early and late lemon crops vary in magnitude. Imports were usually at a minimum in May and again in August and September.

TABLE II.—*Imports of Lemons into the United Kingdom in each Month, 1926–31.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
January .. ..	101	96	97	134	124	107
February .. ..	91	129	109	132	108	119
March .. ..	124	149	114	139	110	176
April .. ..	94	108	123	132	142	156
May .. ..	97	80	114	97	108	92
June .. ..	174	166	116	126	159	136
July .. ..	123	87	57	117	186	134
August .. ..	112	49	46	106	67	72
September .. ..	85	73	56	53	88	86
October .. ..	113	83	122	116	134	136
November .. ..	79	133	104	91	90	84
December .. ..	123	90	70	118	161	110
Total .. ..	1,316	1,243	1,128	1,361	1,477	1,408

Table III shows imports of lemons during each month of 1931 from the principal countries of consignment.



TABLE III.—Imports of Lemons in each month of 1931, showing Countries whence consigned.

Month.	Italy.	Spain.	Other Countries.	Total.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	91	13	3	107
February .. ..	111	3	5	119
March .. .. .	161	6	9	176
April .. .. .	141	10	5	156
May .. .. .	88	3	3	92
June .. .. .	120	12	4	136
July .. .. .	107	21	6	134
August .. .. .	54	13	5	72
September .. ..	65	19	2	86
October .. .. .	66	57	13	136
November .. ..	57	18	9	84
December .. ..	96	11	3	110
Total .. .. .	1,155	186	67	1,408

#### IMPORTS OF LIMES.

British trade returns classify limes with "other citrus fruits not elsewhere specified", that is with citrus fruits other than oranges, lemons and grapefruit. The British West Indies account for the bulk of the totals and these are undoubtedly mainly limes. Other imports in 1931 were recorded from South Africa and the United States, but no information is available as to the kinds of fruit included. In the following table are shown imports of limes and other miscellaneous citrus fruit in the past six years.

Imports of Limes and other Citrus Fruit not elsewhere specified, 1926-31.

Year.	From British West Indies.	From other Countries.	Total.
	cwts.	cwts.	cwts.
1926 .. .. .	—	226	226
1927 .. .. .	249	282	531
1928 .. .. .	1,193	96	1,289
1929 .. .. .	4,878	31	4,909
1930 .. .. .	861	329	1,190
1931 .. .. .	208	133	341

## IMPORTS OF ORANGES.

During the four years from 1925 to 1928 imports of oranges into the United Kingdom showed little variation, the total being consistently between 7,700,000 and 8,000,000 cwts. There has since been an increase every year, and although the advance in 1931 was of very moderate dimensions, it was enough to establish a new high record for imports of oranges into the United Kingdom. Imports in the past two years have exceeded by over 30 per cent. the average imports for the four years 1925-28, giving clear proof of the recent striking increase in orange consumption. Table I shows imports of oranges during the past six years.

TABLE I.—*Imports of Oranges into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Palestine .. .. .	1,004	1,359	1,103	791	1,323	1,287
South Africa .. .. .	378	524	534	670	1,100	969
British West Indies .. .. .	86	61	29	1	1	1
Australia .. .. .	1	2	4	1	(a)	6
Other Empire Countries..	3	6	3	20	3	4
Spain .. .. .	6,096	5,291	5,750	6,243	7,206	5,921
United States .. .. .	156	431	106	979	38	847
Italy .. .. .	54	92	45	50	44	52
Brazil .. .. .	(a)	19	86	250	351	1,119
Argentina .. .. .	13	12	8	48	1	25
Syria .. .. .	55	3	3	1	4	7
Portuguese East Africa ..	1	9	7	10	11	34
Other Foreign Countries..	126	89	83	200	125	125
Total Empire Countries..	1,472	1,952	1,673	1,483	2,427	2,267
Total Foreign Countries..	6,501	5,946	6,088	7,781	7,780	8,130
Total .. .. .	7,973	7,898	7,761	9,264	10,207	10,397

(a) Less than 500 cwts.

Imports in 1931 from the two principal Empire sources, South Africa (which includes Southern Rhodesia) and Palestine, each showed a slight decline as compared with the preceding year, and the Empire share of total imports fell from 24 per cent. in 1930 to 22 per cent. in 1931. Exports of oranges from South Africa had increased sharply in 1930, and the slight decline in shipments in 1931 was not unexpected; imports were some 300,000 cwts. or 45 per cent. larger than in any other year, except 1930. The total included 136,000 boxes (equivalent to about 85,000 cwts.) of oranges from Southern Rhodesia, shipped either through Union ports or through Beira.

Exports of Palestine oranges in the 1930-31 season fell appreciably short of the 1929-30 total, and the United Kingdom took a rather smaller share of the total, the Continent increasing its purchases. As a result, imports of oranges from Palestine and Egypt (nearly all the oranges credited to Egypt are Palestine produce) in the later part of the 1930-31 season, or from January to April, 1931, amounted to only 929,000 cwts., as compared with 1,167,000 cwts. in the corresponding period in 1930. The 1931-32 season has been much better than 1930-31, and shipments both to the United Kingdom and to the Continent, but especially to the former, have been running very much heavier than in any previous season. As may be seen from Table III, imports registered from Palestine and Egypt in the closing months of 1931 totalled 379,000 cwts., whereas in the corresponding period in 1930, the total had been only 206,000 cwts. It is to this improvement in shipments, in the early part of the 1931-32, season that the relatively slight reduction in imports of oranges from Palestine is attributable.

Imports from Spain were also lower than in 1930, and even fell short of the 1929 total. As in the case of Palestine, all imports during the calendar year comprise the figures for the later (and major) part of one season and the first part of the next. In 1930-31 the season closed early, and while imports throughout were running appreciably below those of the preceding season, in the months of May, June and July, 1931, total imports from Spain and Italy totalled only 820,000 cwts. as compared with 1,731,000 cwts. in the same months of 1930.

While imports from South Africa, Spain and Palestine, generally the chief sources of supplies of oranges, were lower in 1931 than in 1930, there was a striking increase in imports from Brazil and the United States.

Imports from the former country, which five years ago were only just commencing, jumped from 351,000 cwts. in 1930 to 1,119,000 cwts. in 1931. The phenomenal growth in the orange trade between Brazil and the United Kingdom is perhaps the most important happening in the post-war fruit trade. It was foreshadowed in the Empire Marketing Board's report on World Production of Oranges\* three years ago, when the trade was just starting ; in that report it was estimated that shipments of oranges from Brazil to Europe would considerably exceed a million boxes annually within a decade, but the rapidity of the development was not foreseen.

Hardly less striking than the increase in imports from Brazil, has been the expansion in shipments from the United States. Until 1926 the total imports from the United States into the United Kingdom had never in any year exceeded 80,000 cwts. Since that year they have only fallen below 100,000 cwts. once, and in 1929 and 1931 have been not far short of 1,000,000 cwts. Actually the increase in imports from the United States in 1931 and the preceding year was larger in volume than the increase in imports from Brazil, and total imports from South Africa, Brazil and the United States, which are the main sources of orange supplies during the summer months, totalled 2,935,000 cwts. as compared with only 1,489,000 cwts. in 1930 and 1,899,000 cwts. in 1929.

The seasons for Brazilian and South African oranges approximately coincide, although there is a tendency for the Brazilian season to lengthen both at the beginning and at the end. Last year the first shipment from Brazil arrived at the end of March, whereas the first shipment in 1930 did not arrive until the end of April. At the other end of the season Brazilian oranges were arriving in 1931 right up to the 18th December.

Shipments from the United States are made all through the year but only small quantities are sent during the height of the Spanish and Palestine seasons, and it is not until supplies from those sources are nearing their end that Florida and California begin to send large quantities, and Californian late Valencias comprise the bulk of the oranges coming from the United States.

Table II shows imports of oranges by months since 1926.

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\* Oranges : World Production and Trade (E.M.B. 15).

TABLE II.—Imports of Oranges into the United Kingdom in each Month, 1926-31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	1,214	916	1,106	1,301	1,424	1,464
February .. ..	863	1,104	1,266	909	1,258	958
March .. ..	1,429	1,232	1,031	1,232	1,465	1,323
April .. ..	884	814	1,110	806	1,262	983
May .. ..	596	575	767	594	1,007	801
June .. ..	698	428	434	607	702	623
July .. ..	391	304	183	347	484	661
August .. ..	164	144	128	448	270	477
September .. ..	91	172	130	430	295	378
October .. ..	98	228	182	308	387	547
November .. ..	223	503	421	537	312	553
December .. ..	1,322	1,478	1,003	1,745	1,344	1,629
Total .. ..	7,973	7,898	7,761	9,264	10,207	10,397

The development of the import of oranges to the United Kingdom from South Africa, California, and Brazil, has greatly increased the consumption of oranges during the summer months, especially in years like 1931, when all three of these countries shipped heavily. It has spread consumption more evenly over the year; and to this more even distribution the extension of the Spanish orange season is to some extent a contributing factor. Even so short a time ago as 1924 the four months, December to March, accounted for 56 per cent. of the year's imports, while the four months from July to October accounted for only 6½ per cent. In 1931 the four months July to October accounted for 20 per cent. of all imports, although over half the total for the year was still recorded in January to March and December.

Table III shows, for each of the chief countries whence supplies were drawn in 1931, the imports into the United Kingdom in each month.

TABLE III.—*Imports of Oranges during each Month of 1931, showing Countries whence consigned.*

Month.	Palestine and Egypt.	South Africa.	Spain and Italy.	United States.	Brazil.	Portuguese East Africa.	Other Countries.	Total.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	324	—	1,119	15	—	—	6	1,464
February .. ..	207	—	733	13	—	—	5	958
March .. ..	285	—	997	37	—	—	4	1,323
April .. ..	113	—	815	40	10	—	5	983
May .. ..	—	1	605	94	93	—	8	801
June .. ..	—	75	215	154	169	—	10	623
July .. ..	1	271	—	169	188	—	32	661
August .. ..	—	148	—	168	135	—	23	477
September .. ..	—	148	—	90	98	14	28	378
October .. ..	1	275	5	65	178	13	10	547
November .. ..	54	50	273	1	163	4	8	553
December .. ..	324	1	1,211	1	85	—	7	1,629
Total .. ..	1,909	969	5,973	847	1,119	34	148	10,397

IMPORTS OF PEACHES.

The increasing importation of raw peaches, which has been a feature of the fruit trade ever since shortly after the end of the war, was continued with greater vigour than ever in 1931, when total imports were larger than in any two previous years combined. Imports each year from 1926 are shown in Table I below :—

TABLE I.—*Imports of Peaches into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Canada .. ..	328	1,449	851	—	27	163
South Africa .. ..	7,209	21,094	11,030	18,868	25,706	19,672
Other Empire Countries	9	351	2,017	557	665	40
Germany .. ..	1,146	12	59	89	73	732
Netherlands .. ..	238	379	236	203	281	625
Belgium .. ..	1,373	728	874	1,034	1,461	1,387
France .. ..	1,256	1,132	678	770	1,398	2,804
Italy .. ..	9,415	10,347	10,069	13,982	21,441	60,183
Spain .. ..	259	383	211	—	—	3
United States .. ..	3,606	1,550	4,641	1,084	321	7,711
Argentina .. ..	11	9	—	—	—	59
Other Foreign Countries	6	62	—	20	51	640
Total Empire Countries..	7,546	22,894	13,898	19,425	26,398	19,875
Total Foreign Countries..	17,310	14,602	16,768	17,182	25,026	74,144
Total .. ..	24,856	37,496	30,666	36,607	51,424	94,019

Imports of peaches from Italy increased rapidly from 1925 to 1930, and in 1931 showed an astonishing expansion. Before 1926 imports of Italian peaches into the United Kingdom had never reached 1,000 cwts., but in that year they rose to 9,400 cwts., and successive increases brought the 1930 total to 21,441 cwts. In 1931 this figure was nearly trebled and Italy, which in 1925 accounted for less than 6 per cent. of imports, supplied in 1931 almost two-thirds of the total from all sources.

Beside this increase the development in the import trade in raw peaches from other foreign countries is unimportant, but in 1931 imports from the United States (where the peach crop was very heavy) were 66 per cent. larger than in any previous year, and imports from France were twice as heavy as in the preceding year.

Last year the Union of South Africa was definitely displaced from its position as chief source of supply of raw peaches. In 1922 imports from France exceeded those from South Africa and in 1926 imports from Italy were slightly the higher, but last year imports from South Africa were less than one-third of the quantity coming from Italy, and the Empire share of the imports fell to 21 per cent., the smallest proportion recorded since peaches were first separately classified in the United Kingdom trade returns in 1920.

In Table II are shown imports by months in the past six years.

TABLE II.—Imports of Peaches into the United Kingdom in each Month, 1926-31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. .. .	2,789	3,477	1,903	2,418	8,061	4,795
February .. .. .	3,350	6,379	5,817	7,756	14,796	8,791
March .. .. .	880	10,461	3,142	7,416	2,561	5,432
April .. .. .	121	212	92	273	30	39
May .. .. .	55	492	212	1,724	152	57
June .. .. .	964	946	891	856	1,419	630
July .. .. .	3,209	3,608	3,278	3,631	6,007	11,842
August .. .. .	9,807	7,229	6,955	6,963	11,659	29,750
September .. .. .	3,146	3,325	2,737	4,016	5,450	27,892
October .. .. .	293	635	3,441	947	1,047	3,330
November.. .. .	133	134	1	—	1	492
December.. .. .	109	598	2,197	607	241	969
Total .. .. .	24,856	37,496	30,666	36,607	51,424	94,019

There are two well defined seasons of imports, the winter months of December, January, February and March and the summer months July to October. These, of course, reflect the supplies from the two chief sources, South African peaches arriving in the winter, and Italian, United States and other European peaches in the summer. In the interval between the seasons imports are very small. Supplies from South Africa on the one hand and Italy on the other may show further considerable development; the seasons are sufficiently distinct to eliminate any degree of competition, at any rate so far as the fresh peach market is concerned, and it is not unlikely that the dual source of supplies, by bringing peaches on to the market almost throughout the year, may be definitely advantageous to both. Table III below gives imports in 1931 from the chief countries of consignment, and clearly shows the season of supply.

TABLE III.—*Imports of Peaches during each Month of 1931, showing Countries whence consigned.*

Month.	South Africa.	Italy.	France.	Netherlands.	Belgium.	United States.	Other Countries.	Total.
January .. ..	4,795	—	—	—	—	—	—	4,795
February .. ..	8,779	—	—	—	1	—	11	8,791
March .. ..	5,242	—	—	—	—	145	45	5,432
April .. ..	31	—	—	—	8	—	—	39
May .. ..	—	—	—	5	47	—	5	57
June .. ..	—	211	55	237	122	2	3	630
July .. ..	22	9,492	349	91	279	932	677	11,840
August .. ..	—	22,877	1,523	24	222	5,104	—	29,750
September .. ..	—	24,707	619	267	676	999	624	27,892
October .. ..	—	2,498	258	1	30	363	180	3,330
November .. ..	—	398	—	—	2	—	92	492
December .. ..	803	—	—	—	—	166	—	969
Total .. ..	19,672	60,183	2,804	625	1,387	7,711	1,637	94,019

#### IMPORTS OF PEARS.

An increase in imports of pears into the United Kingdom was recorded in 1931, bringing the total to the highest figure recorded since 1926. Imports from Empire sources were lower than in 1930, but



were otherwise the heaviest ever recorded; the Empire proportion of the total fell to about 20 per cent., as compared with 31·3 per cent. in 1930. Table I shows imports during the past six years.

TABLE I.—Imports of Pears into the United Kingdom, 1926-31.

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Canada .. .. .	55	31	60	30	64	46
Australia .. .. .	45	31	58	48	130	145
New Zealand .. .. .	4	11	18	15	19	20
South Africa .. .. .	62	35	101	24	108	40
Other Empire Countries..	3	2	3	3	1	1
Belgium .. .. .	622	554	275	543	231	349
France .. .. .	189	139	47	145	19	36
United States .. .. .	241	199	225	217	434	492
Italy .. .. .	34	24	24	11	9	47
Netherlands .. .. .	53	26	30	28	8	22
Germany .. .. .	100	17	9	5	—	36
Spain .. .. .	15	5	5	8	2	1
Russia .. .. .	3	2	4	—	—	—
Other Foreign Countries	3	1	1	1	4	4
Total Empire Countries..	169	110	240	120	322	252
Total Foreign Countries..	1,260	967	620	958	707	967
Total .. .. .	1,429	1,077	860	1,078	1,029	1,239

Both Australia and New Zealand established new high records for imports of pears in 1931, but South Africa had a light crop and imports from that country fell by three-fifths from the record figure of 1930, and imports from Canada also fell.

Belgium and France showed some recovery from the low level to which imports had fallen in 1930, but the increase last year still left

the figures at a much lower point than in most years from 1926 onwards. Italy, Holland and Germany all increased their shipments, but aggregates from these sources are small. The United States, which had in 1930 assumed the place of chief overseas source of supply of pears on the British market, further strengthened its position and again accounted for nearly 40 per cent. of the total imports. In fact, for the second year in succession, imports of pears from the United States exceeded in volume the estimated production in the United Kingdom.

In Table II below are shown imports during each month of the past six years. Imports in the first six months of the year accounted last year for 28 per cent. of the total, as compared with 27 per cent. in 1930 and less than 10 per cent. in 1926. This more even distribution of supplies over the year is due partly to the increase in the proportion coming from the southern hemisphere, and partly to the more prominent place taken by the United States, as imports from that country, which begin in July, extend right up to April in the following year.

TABLE II.—*Imports of Pears in each Month, 1926–31.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	13	25	12	32	18	50
February .. ..	18	21	16	19	22	39
March .. .. .	30	25	47	26	50	83
April .. .. .	19	13	50	21	54	59
May .. .. .	25	26	45	35	79	71
June .. .. .	26	10	22	17	54	40
July .. .. .	95	57	30	20	33	60
August .. .. .	475	340	282	334	205	257
September.. ..	360	306	159	279	169	288
October .. .. .	235	163	95	177	145	157
November.. ..	107	56	55	72	78	60
December .. ..	26	35	47	46	122	75
Total .. .. .	1,429	1,077	860	1,078	1,029	1,239

This is clearly shown in Table III, which gives imports in 1931 from each country by months. The South African season runs from February to May, and Australian and New Zealand supplies come forward one or two months later (partly accounted for by the longer voyage). The Belgian season runs from August to October, but in good crop years October and November are more important months relatively to August than Table III would suggest. France (not shown in the Table) usually precedes Belgium, first shipments arriving in July and the peak of the season occurring in August, whereas September is as important a month as August for Belgian pears. The peak of the United States imports falls in October, but usually December shows a fairly large total, and substantial shipments may continue right up to March. Indeed in 1931 the last shipment from the 1930 crop arrived on the 8th June and the first shipment from the 1931 crop early in July.

TABLE III.—*Imports of Pears in each Month of 1931, showing Countries whence consigned.*

Month.	Australia and New Zealand.	Canada.	South Africa.	Belgium.	Italy.	United States.	Other Countries.	Total.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
January	—	3	—	—	—	46	1	50
February	—	2	5	—	—	31	1	39
March ..	15	2	14	—	—	51	1	83
April ..	30	—	18	—	—	11	—	59
May ..	66	—	3	—	—	2	—	71
June ..	39	—	—	—	—	1	—	40
July, ..	11	6	—	7	2	28	6	60
August ..	1	8	—	143	30	38	37	257
September	3	13	—	152	14	75	31	288
October ..	—	6	—	35	1	97	18	157
November	—	4	—	12	—	40	4	60
December	—	2	—	—	—	72	1	75
Total..	165	46	40	349	47	492	100	1,239

### IMPORTS OF PINEAPPLES.

Fresh pineapples were not separately distinguished in the British trade returns before the year 1928. Since that year imports have risen from 45,100 to 66,700 cwts. with the bulk of the total coming from the Azores. Of other sources of supply, the Union of South Africa is the most important and small quantities are credited to a number of less important sources.

Imports from the Azores have shown a steady expansion, but those from South Africa, after reaching a peak of over 10,000 cwts. in 1929 have since declined by about 60 per cent.

TABLE I.—*Imports of Pineapples into the United Kingdom, 1928–31.*

Country whence consigned.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.
South Africa .. .. .	6,394	10,315	5,413	4,253
Straits Settlement .. .. .	125	460	258	40
British West Indies .. .. .	165	58	12	—
Australia .. .. .	—	—	35	—
Other Empire Countries .. .. .	149	29	1	27
Azores .. .. .	37,769	41,433	49,461	57,050
Brazil .. .. .	288	—	259	629
Hawaii .. .. .	19	—	144	83
United States .. .. .	5	—	420	3,130
Porto Rico .. .. .	—	—	1,579	442
Other Foreign Countries .. .. .	201	3,471	3	1,088
Total Empire Countries .. .. .	6,833	10,862	5,719	4,320
Total Foreign Countries .. .. .	38,282	44,904	51,866	62,422
Total .. .. .	45,115	55,766	57,585	66,742

Last year witnessed a material increase in pineapples credited to the United States, but these probably originate in Porto Rico. Brazil also shipped larger quantities last year.

Imports from the Azores are received throughout the year, but tend to concentrate upon the winter months, December or January

being the peak month for imports, while a secondary peak occurs about May or June. The South African season runs from February to August.

The distribution of imports over the year 1931 is shown in Table II.

TABLE II.—*Imports of Pineapples in each Month of 1931, showing Countries whence consigned.*

Month.	South Africa.	Azores.	United States and Porto Rico.	Other Countries.	Total.
	cwts.	cwts.	cwts.	cwts.	cwts.
January.. .. .	—	12,360	—	40	12,400
February .. .. .	246	2,102	1,622	21	3,991
March .. .. .	1,344	2,466	25	83	3,918
April .. .. .	978	2,329	100	90	3,497
May .. .. .	870	4,591	187	18	5,666
June .. .. .	409	2,642	348	61	3,460
July .. .. .	200	3,246	1,187	386	5,019
August .. .. .	198	1,688	—	8	1,894
September .. .. .	8	5,321	7	29	5,365
October .. .. .	—	5,104	—	—	5,104
November .. .. .	—	6,555	—	761	7,316
December .. .. .	—	8,646	96	370	9,112
Total .. .. .	4,253	57,050	3,572	1,867	66,742

#### IMPORTS OF PLUMS.

Imports of plums and greengages in 1931 rose by over 30 per cent. from the very low figure of 1930, and the total was the largest since 1927. Imports from France continued the decline of the previous year, and were the lowest on record except for the years 1916-19. Imports from Belgium and Spain also declined. Imports from Italy showed a slight increase, while increases of greater magnitude were recorded in respect of Holland, Germany, the United States and Hungary, the last named country appearing for the first time as a source of supply of raw plums to the United Kingdom. Imports from Holland and the United States established new high records in 1931. Figures are shown in Table I below.

TABLE I.—Imports of Plums into the United Kingdom, 1926–31.

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
South Africa .. ..	7,648	17,721	15,142	16,764	27,318	29,144
Canada .. .. .	6,608	11,482	18,171	6,601	6,227	12,939
Irish Free State .. ..	1,183	2,068	2,158	1,419	2,670	375
Australia .. .. .	509	71	—	791	180	3,613
New Zealand .. .. .	—	—	—	—	—	7
France (including Algeria)	231,400	288,913	120,539	208,483	162,217	95,356
Belgium .. .. .	61,664	66,952	68,469	74,139	25,824	19,796
Germany .. .. .	50,216	69,016	121,115	64,690	5,357	110,925
Italy .. .. .	15,635	31,429	44,733	50,464	65,589	77,708
Netherlands .. .. .	7,277	13,996	11,527	12,565	2,404	37,261
United States .. .. .	17,190	40,123	42,610	21,458	37,006	63,782
Spain .. .. .	34,407	52,990	31,179	45,795	54,128	36,130
Hungary .. .. .	—	—	—	—	—	23,762
Denmark .. .. .	—	—	3,973	1,444	—	86
Other Foreign Countries..	1,005	2,637	640	643	184	2,781
Total Empire Countries	15,948	31,342	35,471	25,575	36,415	46,078
Total Foreign Countries	418,794	566,056	444,785	479,681	352,716	467,587
Total .. .. .	434,742	597,398	480,256	505,256	389,131	513,665

South African supplies of plums in 1931 were rather higher than in 1930, which had set up a new record for South African plums. The Empire share was again about 9 per cent. of all supplies.

In Table II are shown monthly imports during the past six years. The main season is usually concentrated around the months of July and August, but the relative importance of the different months varies with the earliness or lateness of the season and with the varying supplies contributed by the different countries. Thus in 1931 the heavy contributions from Germany and Hungary made September second only in importance to August, whereas July was the peak month in 1930 owing to the dominating position occupied by France in the imports, and to the fact that the crops in the earlier districts in France turned out to be better than those in the more northerly districts, from which supplies are received later.

TABLE II.—Imports of Plums into the United Kingdom in each Month, 1926-31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. ..	3,834	3,911	3,781	4,098	14,661	8,968
February .. ..	2,242	5,160	4,269	7,378	6,835	6,363
March .. .. .	1,814	7,650	6,386	5,212	5,513	12,013
April .. .. .	530	905	498	1,272	435	4,819
May .. .. .	690	592	742	648	50	686
June .. .. .	19,635	23,898	18,796	28,860	21,077	38,303
July .. .. .	122,168	189,405	102,954	149,703	162,916	118,249
August .. .. .	199,235	183,183	142,201	180,670	141,502	153,894
September .. .	51,497	132,873	112,467	67,137	13,278	131,897
October .. .. .	31,474	49,887	77,256	53,462	21,588	34,160
November .. ..	1,272	310	6,588	4,037	1,193	3,680
December .. .	351	47	4,328	2,779	83	633
Total .. .. .	434,742	597,821	480,266	505,256	389,131	513,665

Table III shows monthly imports in 1930 by countries of consignment. During the early months of the year the Union of South Africa has almost a clear field, but there are increasing supplies from Argentina, which last year commenced to ship plums on a commercial scale. The earliest plums from the Continent are the Algerian and those from Southern France, together with Italian plums and Spanish greengages. Each of the three countries (France, Spain and Italy) reach their peak in July, although in normal years August is as important as July for French plums. Belgian plums reach their peak in August, German and Hungarian in September, while the United States ships plums to arrive from June to October.

TABLE III.—Imports of Plums in each Month of 1931, showing Countries whence consigned.

Month.	South Africa.	Algeria, France, Spain, Italy.	Belgium, Holland.	Germany, Hungary.	United States.	Argentina.	Other Countries.	Total.
January .. ..	8,968	—	—	—	—	—	—	8,968
February .. ..	6,354	—	—	—	—	9	—	6,363
March .. ..	11,755	—	—	—	—	25	233	12,013
April .. ..	1,433	—	4	—	—	147	3,235	4,819
May .. ..	1	381	45	—	25	89	145	686
June .. ..	—	25,270	20	—	11,554	—	1,459	38,303
July .. ..	—	96,856	2,609	454	14,776	—	3,554	118,249
August .. ..	—	84,213	26,607	33,705	7,396	—	1,973	153,894
September .. ..	—	2,314	22,079	88,717	15,039	—	3,748	131,897
October .. ..	—	—	4,609	10,478	14,805	—	4,268	34,160
November .. ..	—	160	1,084	1,333	187	—	916	3,680
December .. ..	633	—	—	—	—	—	—	633
Total .. ..	29,144	209,194	57,057	134,687	63,782	270	19,531	513,665

IMPORTS OF STRAWBERRIES.

After increasing steadily for three years imports of fresh strawberries in 1930 showed a pronounced decline, but in 1931 the trade again increased to the highest total ever recorded.

TABLE I.—Imports of Strawberries into the United Kingdom, 1926-31.

Country whence Consigned.	1926.	1927.	1928.	1929.	1930.	1931.
Irish Free State .. ..	10	14	113	195	2	—
Other Empire Countries	—	3	—	550	47	—
Netherlands .. ..	18,704	29,130	29,323	23,956	33,004	33,793
France .. ..	33,044	42,066	48,904	55,076	34,322	55,694
Other Foreign Countries ..	91	214	263	440	305	405
Total Empire Countries	10	17	113	745	49	—
Total Foreign Countries	51,839	71,410	78,490	79,472	67,631	89,892
Total .. ..	51,849	71,427	78,603	80,217	67,680	89,892

France accounted for the increase in imports in 1931, the total from that country being rather above the record established in 1929, while



the Netherlands, which is the other chief source of supply, showed a further slight advance over the preceding year's record. These two countries share the import trade, supplies from other sources being negligible.

Imports of fresh strawberries are much smaller than imports of strawberry pulp. Particulars given on pages 70-72 show that exports of strawberry pulp to the United Kingdom from the Netherlands alone amount to an average of 148,000 cwts. annually, and in 1931 they actually reached 274,000 cwts. These are gross weights and the real quantity of pulp was rather less. There are also some imports of pulp from other sources (France, Belgium, Russia) although not comparable with the imports from Holland, and it is evident that supplies of imported strawberries and strawberry pulp combined in 1931 must have exceeded 350,000 cwts.

The heavy imports of fruit and pulp are the more striking when it is realised that the English strawberry crop last year was the largest since 1924.

The earliest strawberries are grown under glass and come from Holland, while the first outdoor strawberries are from France. The Dutch outdoor season is slightly later. Imports are mainly concentrated within the two months June and July. Details are shown in Table II.

TABLE II.—*Imports of Strawberries into the United Kingdom in each Month, 1926-31.*

Month.	1926	1927	1928	1929	1930	1931
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. .. .	—	4	—	—	—	—
February .. .. .	—	—	—	—	—	—
March .. .. .	—	—	—	—	41	—
April .. .. .	17	5	9	1	11	5
May .. .. .	993	1,928	877	758	1,572	1,462
June .. .. .	32,740	41,485	50,256	49,741	50,048	61,518
July .. .. .	16,110	26,564	25,634	28,706	15,515	25,083
August .. .. .	1,989	1,441	1,577	464	29	1,821
September .. .. .	—	—	—	532	121	3
October .. .. .	—	—	250	15	343	—
Total. . . . .	51,849	71,427	78,603	80,217	67,680	89,892

### IMPORTS OF UNCLASSIFIED FRUITS.

Imports of fruits not separately distinguished in the United Kingdom trade returns totalled 416,000 cwts. in 1931. Particulars are shown in Table I below, but figures for 1928-31 are not comparable with those for earlier years, which include imports of pineapples. This accounts for the fall of about 36,000 cwts. in imports from the Azores and of 18,000 cwts. from South Africa between 1927 and 1928.

Of the unclassified fruit 69 per cent. was imported in 1931 from Spain, with Germany, Netherlands, France, the Irish Free State and Norway next in order of importance. Although no particulars are available from British trade returns as to the different kinds of fruit going to make up the total of 416,000 cwts. in 1931, a reasonably accurate analysis can be compiled from information received from the ports where the fruit is imported. These particulars are published week by week in the "Weekly Fruit Intelligence Notes".

TABLE I.—*Imports of Unclassified Fruits into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Channel Islands .. ..	1,641	1,781	1,449	1,705	2,483	2,368
Irish Free State .. ..	10,106	10,486	12,893	16,946	5,440	9,487
South Africa .. ..	22,891	20,138	2,333	3,414	1,850	2,415
Other Empire Countries	17,236	3,772	2,434	4,418	2,795	2,088
Norway .. ..	7,350	6,781	10,166	13,808	10,341	5,599
Germany .. ..	28,099	11,898	18,827	28,859	30,325	50,241
Netherlands .. ..	19,911	13,699	12,987	22,025	25,555	22,766
Belgium .. ..	4,934	5,311	6,071	5,890	2,319	3,524
France .. ..	19,292	20,196	24,529	19,843	15,571	17,352
Azores .. ..	36,840	36,829	897	4	36	64
Spain .. ..	233,948	206,511	306,268	242,977	272,218	287,565
United States .. ..	6,015	6,939	3,066	2,885	1,856	3,382
Other Foreign Countries	7,749	11,961	8,624	13,425	9,877	9,282
Total Empire Countries..	51,874	36,177	19,109	26,483	12,568	16,358
Total Foreign Countries..	364,138	320,125	391,435	349,716	368,098	399,775
Total.. ..	416,012*	356,302*	410,544	376,199	380,666	416,133

\* Years 1926 and 1927 include pineapples.

*Spain.*—Of the imports from Spain, the particulars received by the Board indicated that about 185,000 cwts. were melons and 100,000 cwts. pomegranates. Shipments of melons from Spain last year were rather larger than in the preceding year, shipments from Valencia and Cartagena, which account for the great bulk of the total, being 156,000 cases as against 135,000 in 1930. On the other hand exports of pomegranates fell from 196,000 cases in 1930 to 160,000 in 1931. The United Kingdom is almost the only market for both these fruits, and they account for the whole of the unclassified fruit imports from Spain.

*Germany.*—Imports from Germany consist almost entirely of bilberries, returns received by the Board fully accounting for the imports of 50,240 cwts. of unclassified fruit in 1931. A few cwts. of cranberries and blackberries were also imported.

*Netherlands.*—Imports into the various ports from the Netherlands in 1931 included slightly under 13,000 cwts. of melons, while the remaining 10,000 cwts. consisted of some 8,000 cwts. of bilberries and 2,000 of cranberries, with a few cwts. of blackberries and raspberries.

*France.*—Melons and figs account for the greater part of the imports from France, returns received by the Board showing about 8,500 cwts. of melons and 4,000 of figs. Other fruits imported in fair quantities are bilberries and blackberries, imports of each of these totalling about 1,700 cwts., with small quantities of other fruits, such as medlars and quinces.

*Norway.*—Imports from Norway consist of bilberries, with very small quantities of cranberries. Returns of imports of bilberries received by the Board account for almost the whole of the 5,600 cwts. imported.

*Irish Free State.*—The Board's returns of imports from the Irish Free State show only about 350 cwts. of bilberries and 2,400 cwts. of blackberries. The difference between these figures and the total imports may well be accounted for by imports into Northern Ireland across the land boundary, regarding which the Board receives no corresponding particulars. Bilberries and blackberries may be taken as making up the major part of the total of 9,500 cwts. of unclassified fruit imported in 1931.

*Channel Islands.*—Melons and figs make up the bulk of imports of unclassified fruit from the Channel Islands. Weekly figures

obtained by the Board total 1,500 cwts. of melons and 400 cwts. of figs, and there is little doubt that the remaining quantity of nearly 500 cwts. is also made up of imports of these fruits.

*Belgium.*—The bulk of the imports of unclassified fruit from Belgium, according to the Board's information, consists of bilberries, with small quantities of melons.

*Other Countries.*—Imports from other countries consist of a variety of fruits, which the Board's returns are insufficient wholly to classify. A fair proportion of the total is made up of melons from Italy, Portugal, South Africa, Hungary, and other countries; cranberries from the United States, Sweden, Estonia, Finland, and Russia; bilberries from Poland and Finland; pomegranates from Cyprus and Italy; and cranberries from Portugal. South Africa also sent small quantities of several minor fruits such as grenadillas, quinces, mangoes, pomegranates, avocado pears and persimmons and similar fruits were imported from Maderia. The fact that the bulk of the South African imports are recorded in June, July and August suggests that some naartjes may have been included in the category of unclassified fruit.

On the whole it is evident that of the 416,000 cwts. of fruit not separately distinguished imported in 1931, melons accounted for approximately 210,000 cwts. or about 50 per cent.; pomegranates for slightly over 100,000 cwts. or 24 per cent., and bilberries for about 72,000 cwts. or 17 per cent. The remaining 9 per cent. comprised some 4,000 or 5,000 cwts. each of cranberries and figs, fully 10,000 cwts. of blackberries and small quantities of a large number of less important fruits from various sources.

The different fruits included in the miscellaneous group are reflected in the seasonal imports as shown in Table II. Imports of blackberries from the Irish Free State occur between July and November with the peak in October, and the same months account for the bulk of the imports from all countries. Melons from the Channel Islands arrive from May onwards and figs start about June or July, while the French season for each of these fruits is slightly later. Bilberries come in from all countries from July to about October, and cranberries from October to December. The Spanish melon season opens in July and runs to September, while shipments of pomegranates start about the end of August and continue into November, imports being recorded into December.

TABLE II.—Imports of Unclassified Fruits in each Month of 1931, showing Countries whence consigned.

Month.	Irish Free State.	Chan-nel Islands.	Ger-many.	Nether-lands.	France.	Spain.	Other Coun-tries.	Total.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January ..	48	—	—	1	61	169	539	818
February ..	5	—	—	274	330	94	688	1,391
March ..	—	—	9	184	1	2	696	892
April ..	—	4	10	16	—	45	449	524
May ..	—	183	6	25	78	—	404	696
June ..	—	546	233	797	1,442	7	929	3,954
July ..	623	570	29,278	6,051	4,902	63,455	3,494	108,373
August ..	691	615	16,140	7,346	4,628	91,817	4,080	125,317
September ..	870	246	3,692	4,969	3,339	96,616	7,164	116,896
October ..	5,912	149	628	1,891	1,835	31,454	2,108	43,977
November ..	1,336	41	188	806	669	2,607	4,810	10,457
December ..	2	14	57	406	67	1,299	993	2,838
Total ..	9,487	2,368	50,241	22,766	17,352	287,565	26,354	416,133

#### IMPORTS OF FRUIT PULP IN 1931.

Except for negligible quantities recorded as imported "preserved in syrup" (amounting to only 1,264 cwts. in 1930), fruit pulp is not separately distinguished in the Trade Returns of the United Kingdom, and the large consignments of pulp annually imported are included, together with fruit in other forms and not necessarily pulped, under the heading "Fruit preserved without sugar," which is further sub-divided into "Canned or Bottled" and "Other than Canned or Bottled."

It is not possible to determine with precision how much of the fruit included in these categories consists of fruit pulp, and how much of fruit in other forms, nor can the proportion of the different varieties of fruit be obtained with any exactitude. An examination of the trade returns of the exporting countries, of the seasons of the year when shipments are made and of other records, together with knowledge of the varieties of fruit grown in the particular countries concerned, affords some guidance as to the quantities and varieties of fruit involved.

Imports of fruit preserved without sugar, canned or bottled, during the past six years and the principal consigning countries are given in Table I; and similar imports, other than canned or bottled, in Table V.

TABLE I.—Imports of Fruits, Preserved without Sugar  
(Canned or Bottled).

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thous- sand cwts.	Thous- sand cwts.	Thous- sand cwts.	Thous- sand cwts.	Thous- sand cwts.	Thous- sand cwts.
Canada .. .. .	12·0	4·9	5·3	3·3	3·2	16·7
Australia .. .. .	34·7	8·4	20·5	13·7	8·2	1·1
Other Empire countries ..	3·0	1·3	1·4	3·7	3·1	1·5
United States .. .. .	112·4	130·6	150·4	217·3	132·4	154·3
Spain .. .. .	143·1	125·3	93·0	130·7	119·0	131·8
Netherlands .. .. .	15·6	24·0	14·6	13·6	13·7	17·3
France .. .. .	28·1	16·8	16·3	20·0	13·1	11·1
Belgium .. .. .	4·8	4·1	5·7	7·7	8·1	7·2
Italy .. .. .	10·4	2·1	1·9	6·0	5·6	1·5
Other foreign countries ..	2·5	6·2	4·7	15·1 (a)	17·4 (b)	16·2 (c)
Total Empire countries	49·7	14·6	27·2	20·7	14·5	19·3
Total Foreign countries	316·9	309·1	286·6	410·4	309·3	339·4
Total .. .. .	366·6	323·7	313·8	431·1	323·8	358·7

(a) Including Russia, 8·5; Germany, 4·0.

(b) Including Russia, 10·6; Austria, 2·8; Germany, 1·6.

(c) Including Russia, 12·9.

Imports of canned and bottled fruit, preserved without sugar, in 1931, showed an appreciable recovery from the 1930 level, and at 359,000 cwts. were rather above the average of 352,000 cwts. for the previous five years.

Only about 5 per cent. of these imports are obtained from Empire countries. Canada was the chief Empire source in 1931, imports from that country having advanced sharply to nearly 17,000 cwts., after declining for some years. Imports from Canada consist in the main of canned apples, together with small quantities of soft fruit pulp. Until 1931, Australia was the principal Empire source of supply, shipping fairly large quantities of raspberry pulp, but imports from that country have declined from 35,000 cwts. (or 9 per cent. of total imports) in 1926 to 1,000 cwts. in 1931. Imports from the Straits Settlements, which comprise most of the remainder of the Empire supplies, probably consist of crushed pineapple.

About 95 per cent. of canned and bottled fruits preserved without sugar is imported from foreign countries, the two most important being the United States and Spain, which between them contribute about 80 per cent. of the total. From both these countries imports

increased appreciably in 1931. Imports from the United States consist mainly of canned apples, while those from Spain are nearly all apricot pulp. Among countries of lesser importance, imports from the Netherlands, Russia, France and Belgium, consisting largely of soft fruit pulp, showed little variation in 1931 from those of the preceding year.

For 1930 and 1931 particulars of imports of fruit preserved without sugar, canned or bottled, have been sub-divided into two classes, namely, "Apricots and Apricot Pulp" and "Other sorts." Details of the countries of consignment for these two classes in 1930 and 1931 are given in Table II below. The table shows that about 40 per cent. of the imports detailed in Table I consist of apricots and apricot pulp, and that 95 per cent. of the imports of the canned and bottled fruit from Spain are apricots and apricot pulp. Apricot pulp is not of material importance in the imports from any country except Spain.

TABLE II.—Imports of Canned or Bottled Fruit, Preserved without Sugar, in 1930 and 1931.

Country whence consigned.	1930.	1931.
<i>Apricots and apricot pulp—</i>	Thousand cwts.	Thousand cwts.
Spain .. .. .	111.4	125.9
Russia .. .. .	0.2	3.4
United States .. .. .	2.3	1.8
Italy .. .. .	1.9	1.4
Belgium .. .. .	0.2	1.0
Austria .. .. .	2.8	1.0
Other countries .. .. .	1.9	1.0
Total .. .. .	120.7	134.5
<i>Other sorts—</i>		
Canada .. .. .	3.2	16.6
Australia .. .. .	8.1	1.1
Straits Settlements .. .. .	1.5	0.9
Other Empire countries .. .. .	1.2	0.6
United States .. .. .	130.2	152.5
Netherlands .. .. .	13.6	17.1
France .. .. .	12.5	11.0
Russia .. .. .	10.4	9.5
Belgium .. .. .	7.9	6.2
Spain .. .. .	7.7	5.9
Italy .. .. .	3.7	0.1
Other Foreign countries .. .. .	3.1	2.7
Total .. .. .	203.1	224.2

Imports of apricots and apricot pulp, preserved without sugar, occur throughout the year, but with the largest quantities recorded from July to September, immediately after the Spanish apricot harvest. Thus in 1930 nearly 50 per cent. of the imports were recorded in those three months. In 1931 relatively heavy imports were made throughout the later months of the year, and imports in the last quarter totalled 39,000 cwts., or nearly 30 per cent. of the year's total. The figures are shown in Table III.

TABLE III.—*Monthly Imports of Apricots and Apricot Pulp, Preserved without Sugar (Canned or Bottled).*

Month.	1930.			1931.		
	Spain.	Other Countries.	Total.	Spain.	Other Countries.	Total.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	7.3	1.1	8.4	5.5	0.8	6.3
February .. ..	3.7	0.4	4.1	1.8	0.1	1.9
March .. ..	4.0	4.1	8.1	6.2	0.1	6.3
April .. ..	6.3	0.5	6.8	7.3	0.1	7.4
May .. ..	5.7	0.6	6.3	12.1	0.5	12.6
June .. ..	4.8	1.4	6.2	9.6	0.4	10.0
July .. ..	25.4	0.3	25.7	19.8	0.9	20.7
August .. ..	16.2	—	16.2	20.9	1.4	22.3
September .. ..	16.4	—	16.4	7.1	1.2	8.3
October .. ..	5.7	—	5.7	16.8	1.2	18.0
November .. ..	7.8	0.1	7.9	10.3	1.2	11.5
December .. ..	8.1	0.8	8.9	8.5	0.7	9.2
Total .. ..	111.4	9.3	120.7	125.9	8.6	134.5

The main seasons of imports of canned fruit (without sugar), other than apricots, reflect to some extent the variety of the fruit. Imports from Canada and the United States, consisting largely of canned apples, are at their heaviest after the apple harvest is finished, from November or December to April or May. On the other hand imports from the Continent, consisting mainly of soft fruit pulp, are heaviest in the late summer and autumn, although these, like the supplies from the United States, are spread throughout the year. Table IV below shows the seasonal increase of imports during the past two years.



TABLE IV.—*Monthly Imports of Fruit, Preserved without Sugar, other than Apricots and Apricot Pulp (Canned or Bottled).*

Month.	Canada.	Other Empire Countries.	United States.	France.	Netherlands.	Russia.	Other Foreign Countries.	Total.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
1930.								
January ..	0.4	0.1	22.8	1.4	1.7	—	1.9	28.3
February ..	0.1	—	17.2	1.2	1.4	0.7	2.6	23.2
March ..	0.4	2.3	17.6	1.1	2.0	2.1	3.1	28.6
April ..	0.8	3.1	25.0	0.2	0.5	—	1.2	30.8
May ..	—	3.1	8.6	0.6	0.3	—	3.1	15.7
June ..	0.1	0.6	8.0	1.0	1.1	—	1.2	12.0
July ..	0.1	0.6	3.4	0.7	1.5	0.1	1.9	8.3
August ..	—	0.4	1.2	1.9	0.5	—	1.1	5.1
September ..	0.2	0.2	3.2	1.0	1.5	—	2.7	8.8
October ..	0.2	0.3	2.0	1.5	1.0	5.1	1.2	11.3
November ..	0.4	0.1	1.4	0.7	0.9	—	1.0	4.5
December ..	0.5	—	19.8	1.2	1.2	2.4	1.4	26.5
Total ..	3.2	10.8	130.2	12.5	13.6	10.4	22.4	203.1
1931.								
January ..	1.1	—	20.6	1.3	1.0	1.6	0.8	26.4
February ..	0.9	0.5	11.8	0.4	2.1	—	1.0	16.7
March ..	0.5	0.6	7.8	0.2	1.1	4.4	0.9	15.5
April ..	0.6	0.2	13.8	0.6	0.3	1.0	0.9	17.4
May ..	2.0	0.1	7.0	0.6	0.6	—	0.6	10.9
June ..	1.0	0.1	11.7	0.5	0.3	—	1.1	14.7
July ..	0.7	0.3	15.9	0.7	1.8	0.5	1.4	21.3
August ..	0.5	0.2	8.7	1.7	0.8	—	1.2	13.1
September ..	0.3	0.2	4.3	1.2	1.5	2.0	1.1	10.6
October ..	0.1	0.1	3.4	2.7	3.3	—	1.4	11.0
November ..	4.9	0.3	7.9	0.8	3.0	—	2.7	19.6
December ..	4.1	—	39.6	0.4	1.3	—	1.6	47.0
Total ..	16.7	2.6	152.5	11.0	17.1	9.5	14.8	224.2

In contrast with canned or bottled fruit, imports of which have shown little signs of increase, imports of fruit not canned or bottled have tended upwards in recent years. In 1931 imports reached the high total of 706,000 cwts., an advance of 134,000 cwts. on the previous year, despite a sharp decline in supplies from Italy. The average total imports for the five years ended 1931 was 636,000 cwts. as compared with 458,000 cwts. for the five years ended 1926. Over 80 per cent. of the total imports (not canned) come from two countries, the Netherlands and Italy. Empire countries contributed about 1 per cent. in 1931 of the total and show no signs of increasing.

Imports of fruit, preserved without sugar, not canned or bottled, from the chief consigning countries during the last six years, are shown in Table V.

TABLE V.—Imports of Fruit, Preserved without Sugar (Not Canned or Bottled).

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
India .. .. .	2·7	1·1	4·1	3·8	3·8	4·6
Australia .. .. .	6·2	2·8	3·1	1·1	—	0·2
Other Empire Countries..	4·0	1·5	1·4	2·1	3·3	2·2
Netherlands .. .. .	234·1	283·6	385·8	244·7	240·6	413·1
Italy .. .. .	198·5	216·5	215·5	235·1	220·0	166·7
Russia .. .. .	0·4	—	1·2	44·8	34·7	55·1
Spain .. .. .	20·7	46·0	24·8	22·5	27·1	20·1
France .. .. .	12·9	24·1	16·8	20·8	18·9	19·3
Crete .. .. .	7·1	5·7	3·6	3·4	6·0	3·4
Greece .. .. .	3·8	4·0	1·4	3·2	3·9	2·6
United States .. .. .	4·4	6·0	11·6	5·7	0·5	1·1
Other Foreign Countries..	5·6	10·8	24·0	18·8	13·4	17·8
Total Empire Countries	12·9	5·4	8·6	7·0	7·1	7·0
Total Foreign Countries	487·5	596·7	684·7	599·0	565·1	699·2
Total .. .. .	500·4	602·1	693·3	606·0	572·2	706·2

Of the imports shown in the above table those from Italy, Spain, Crete and Greece were appreciably lower in 1931 than in 1930. Imports from these countries consist mainly of citrus products—orange pulp from Spain, orange and lemon peel in brine from Italy, and citron peel from Crete and Greece—although some soft fruit pulp may be included also.

The imports from the remaining countries consist mainly of fruit pulp. Holland is by far the most important supplier, and imports in 1931 were exceptionally large, representing an increase of over 70 per cent. over the preceding year. Imports from Russia also showed a big advance, but those from France were about on a level with the imports of recent years.

No direct information is available as to the varieties of fruit pulp imported. The imports from Russia are understood to be largely made up of strawberry pulp, and those from France of blackcurrant and strawberry pulp, but there are no figures to indicate the actual proportions.

As regards the Netherlands, which accounts for over 80 per cent. of the imports other than those believed to be citrus fruit products, some information is available from the Dutch export returns. Particulars of recorded exports to the United Kingdom from Holland, of both fruit and pulp, in the past six years are shown in Table VI. The figures are gross weights and thus overstate the exports by about 10 per cent.

TABLE VI.—*Exports of Fruit and Fruit Pulp from Netherlands to United Kingdom.*

Raw Fruit.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Apples .. ..	14·5	28·3	2·0	37·6	1·2	71·5
Pears .. ..	32·4	19·7	21·3	19·3	6·6	11·8
Cherries .. ..	11·5	4·5	5·3	13·4	6·7	4·5
Plums .. ..	5·3	12·7	11·2	12·3	1·7	6·9
Blackcurrants ..	9·0	17·1	7·9	11·5	20·0	20·2
Redcurrants ..	9·8	8·4	9·8	8·8	9·7	8·4
Gooseberries ..	59·8	38·5	15·5	9·6	21·5	12·6
Strawberries ..	13·9	29·3	23·9	22·2	34·6	35·8
Raspberries ..	—	0·1	—	—	—	—
<b>Fruit Pulp.</b>	<b>1926.</b>	<b>1927.</b>	<b>1928.</b>	<b>1929.</b>	<b>1930.</b>	<b>1931.</b>
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Apples .. ..	3·6	5·8	1·9	1·8	—	—
Pears .. ..	—	—	—	—	—	—
Cherries .. ..	0·0	0·4	0·7	0·7	—	—
Plums .. ..	8·6	22·4	27·6	26·9	22·9	13·9
Blackcurrants ..	37·4	50·4	45·3	61·4	44·2	85·0
Redcurrants ..	3·1	2·8	3·9	3·6	(a)	(a)
Gooseberries ..	31·4	39·0	35·5	25·7	24·7	38·6
Strawberries ..	135·3	151·2	171·1	132·6	151·6	274·2
Raspberries ..	58·2	61·4	41·8	34·6	28·0	48·0

(a) Figures not available.

Fully 60 per cent. of the exports of pulp from Holland to the United Kingdom in 1931 consisted of strawberry pulp, this being much the same proportion as in 1930, but appreciably higher than in other years. The volume of shipments of strawberry pulp was amazingly high in view of the record imports of raw strawberries in 1931 and a strawberry crop in England and Wales heavier than in any year since 1924.

Very sharp increases were also recorded in Dutch exports of black-currant, raspberry and gooseberry pulp, but imports of plum pulp were the smallest since 1926, in spite of the light English plum crop.

The seasons of maximum imports of fruit preserved without sugar, not canned, are very clearly shown in Table VII, which gives monthly imports during the past two years. Imports from Italy and Spain are heaviest during the first six months of the year, thus reflecting the citrus fruit season, while imports from Holland are normally heaviest from June to August, when the soft fruits are gathered. Last year, however, the season of heavy imports from Holland was prolonged into September, October and even November.

TABLE VII.—*Monthly Imports of Fruit, Preserved without Sugar (Not Canned or Bottled).*

Month.	Nether-lands.	Italy.	Spain.	France.	Russia.	Other Countries.	Total.
	Thous. cwts.	Thous. cwts.	Thous. cwts.	Thous. cwts.	Thous. cwts.	Thous. cwts.	Thous. cwts.
1930.							
January ..	10·7	10·8	2·4	2·9	0·1	3·2	30·1
February ..	9·7	14·7	1·0	1·3	—	2·1	28·8
March ..	15·1	48·6	8·4	0·6	—	3·7	76·4
April ..	12·8	48·2	1·6	0·7	—	2·3	65·6
May ..	17·4	39·2	3·8	0·5	—	1·4	62·3
June ..	25·8	25·1	3·8	2·0	—	2·8	59·5
July ..	81·8	3·6	0·7	1·5	8·0	5·0	100·6
August..	26·6	2·8	0·5	2·1	7·1	6·6	45·7
September ..	9·0	3·9	1·0	3·6	6·6	0·7	24·8
October ..	9·7	3·9	0·8	1·4	1·8	0·6	18·2
November ..	8·1	7·3	0·8	1·1	6·1	0·3	23·7
December ..	14·9	11·9	2·3	1·2	5·0	2·2	37·5
Total ..	240·6	220·0	27·1	18·9	34·7	30·9	572·2
1931.							
January ..	7·4	5·7	0·6	1·1	4·3	1·8	20·9
February ..	12·6	12·9	1·5	2·0	0·1	2·0	31·1
March ..	17·7	17·9	0·9	0·2	—	0·3	37·0
April ..	20·8	48·4	5·5	0·3	0·1	0·6	75·7
May ..	14·7	31·8	2·0	0·2	—	1·3	50·0
June ..	31·5	21·8	3·7	2·8	—	2·2	62·0
July ..	76·5	10·3	2·9	2·2	8·6	6·6	107·1
August..	49·5	1·5	0·4	2·4	10·3	4·8	68·9
September ..	77·8	1·6	0·1	2·9	19·3	2·1	103·8
October ..	69·7	5·6	0·4	2·5	9·0	4·0	91·2
November ..	21·4	7·4	1·0	2·4	2·1	3·1	37·4
December ..	13·5	1·8	1·1	0·3	1·3	3·1	21·1
Total ..	413·1	166·7	20·1	19·3	55·1	31·9	706·2

### IMPORTS OF ONIONS.

Between the years 1924 and 1931 the area of onions harvested ripe in England and Wales has declined from 1,880 acres to 740 acres, and production from 12,000 to 4,200 tons. In the same period the Scottish onion acreage has declined from 161 to 142, and although production figures in Scotland are not published annually, the aggregate output of onions for the whole of Great Britain can be set at about 5,000 tons in 1931 as against about 13,000 tons in 1924.

In contrast with this output, imports of onions into the United Kingdom (reckoning 50 bushels to the ton) have averaged over 200,000 tons annually during the past five years, and it is probable that for no other agricultural product, grown in this country, is the British market so dependent upon imported supplies. Moreover, almost the whole of the imports are obtained from foreign sources.

In Table I are shown imports from the chief countries of consignment during the past six years.

TABLE I.—*Imports of Onions into the United Kingdom, 1926-31.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand bushels.	Thou- sand bushels.	Thou- sand bushels.	Thou- sand bushels.	Thou- sand bushels.	Thou- sand bushels.
Spain .. .. .	5,304	4,518	4,255	4,526	5,127	4,609
Netherlands .. .. .	2,532	2,507	2,459	2,981	3,247	3,109
Egypt .. .. .	1,685	1,802	2,734	2,438	1,657	1,820
France .. .. .	413	571	376	400	434	370
Russia .. .. .	—	26	101	73	5	5
Germany .. .. .	40	55	55	67	218	171
Portugal .. .. .	18	101	58	86	21	17
Belgium .. .. .	200	112	55	63	42	35
Other Foreign Countries..	17	166	45	42	20	20
Empire Countries ..	6	37	17	10	13	15
Total .. .. .	10,215	9,895	10,155	10,686	10,784	10,171

Imports from the three chief sources fluctuate individually, but in the aggregate account for well over 90 per cent. of imported supplies.

The order of importance of these three countries in 1931 was unchanged, Spain accounting for 45 per cent. of the total (as against

nearly 50 per cent. in 1930), Holland for 30 per cent., as in 1930, and Egypt for 18 per cent. (16 per cent. in 1930). Imports from Spain and Holland, which had increased in 1930, fell last year, while those from Egypt, which had declined in 1930, showed a slight recovery.

Imports from France vary about a mean of 450,000 bushels annually, but last year's total was the smallest in any year since 1924. Other minor sources of supply are Portugal, Germany, Belgium and Russia. First imports from Russia in post-war years were recorded in 1927, with a total of only 26,000 bushels, but in the same year Estonia was credited with 150,000 bushels, although subsequent imports from that country have been insignificant. The very modest imports from Empire sources are from the Irish Free State, Malta and Gozo, the Channel Islands and Palestine.

Onions are imported throughout the year, with maxima in the spring and autumn, when the Egyptian, and the Spanish and Dutch seasons are respectively at about their highest point, while imports are at their lowest in May, June and July. Table II shows imports during the past six years by months.

TABLE II.—Imports of Onions into the United Kingdom in each Month, 1926–31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.
January .. ..	890	936	954	1,034	1,099	982
February .. ..	964	951	743	650	982	851
March .. ..	871	675	596	932	834	987
April .. ..	804	787	1,295	1,210	798	756
May .. ..	780	953	1,151	772	771	595
June .. ..	554	370	453	388	509	625
July .. ..	499	522	464	540	493	619
August .. ..	1,081	892	871	846	1,074	778
September .. ..	946	684	753	998	798	1,093
October .. ..	986	1,401	1,134	1,331	1,288	1,104
November .. ..	1,048	962	840	1,172	1,054	962
December .. ..	792	762	901	813	1,084	819
Total .. ..	10,215	9,895	10,155	10,686	10,784	10,171

The main Spanish onion season opens in July, reaches its height from September to November, and runs until May, when the *babosas* (summer onions) come into the market for a short period. The Dutch season is much the same as the Spanish, opening in July and reaching its peak about October, and tailing off to negligible proportions in May and June, while the Portuguese, French and Belgian seasons are also somewhat similar, although the peak of the season occurs earlier in August. Egyptian onions usually begin to arrive in February, reach their peak in April, and by the end of July are about finished. Table III shows imports from the main sources by months during 1931.

TABLE III.—Imports of Onions into the United Kingdom in each Month of 1931, showing Countries whence consigned.

Month.	Spain.	Netherlands.	Egypt.	France.	Germany	Belgium.	Other Countries.	Total.
	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.	Thousand bushels.
January ..	492	453	—	16	20	—	1	982
February ..	412	417	—	8	13	—	1	851
March ..	349	441	183	3	8	1	2	987
April ..	42	75	635	—	3	1	—	756
May ..	79	44	471	—	1	—	—	595
June ..	192	48	376	1	2	—	6	625
July ..	340	42	147	54	2	7	27	619
August ..	531	127	8	97	2	8	5	778
September ..	611	360	—	83	35	2	2	1,093
October ..	568	402	—	78	38	15	3	1,104
November ..	561	337	—	25	33	1	5	962
December ..	432	363	—	5	15	—	4	819
Total ..	4,609	3,109	1,820	370	172	35	56	10,171

#### IMPORTS OF POTATOES.

Imports of potatoes fluctuate from year to year according to the size of the home crop. Only supplies of early potatoes remain fairly constant.

Imports by calendar years do not adequately reflect the import position, as large imports resulting from a light crop in Great Britain

are spread over parts of two calendar years. Hence the heavy imports of the current season are only partly shown by the increased imports, shown in Table I below, as coming from Germany, Holland and Belgium. Actually the 1931 total was the heaviest that has ever been recorded, for added to fairly large imports in the early months of the year, to supplement the moderate home crop of 1930, imports in the closing months were extraordinarily heavy, following the exceptionally light crops in Great Britain.

TABLE I.—Imports of Potatoes into the United Kingdom, 1926–31.

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Irish Free State .. ..	366	569	913	370	214	780
Channel Islands .. ..	1,358	854	1,021	1,288	1,033	910
Malta and Gozo .. ..	16	18	15	5	—	14
Other Empire Countries..	—	—	7	—	—	2
Estonia .. .. .	1	55	—	—	—	108
Norway .. .. .	23	30	—	1	—	102
Denmark .. .. .	2	2	1	—	—	389
Poland (including) Dantzig	8	6	35	—	—	375
Germany .. .. .	128	26	818	4	268	4,602
Netherlands .. .. .	1,363	564	1,054	430	911	3,509
Belgium .. .. .	75	28	442	22	25	1,882
France .. .. .	2,598	2,760	3,865	2,510	2,208	2,076
Algeria .. .. .	28	18	24	17	16	1
Spain .. .. .	663	749	986	1,041	939	1,547
Canary Islands .. .. .	123	95	265	171	151	224
Italy .. .. .	17	31	66	4	12	24
Other Foreign Countries..	9	29	10	8	4	43
Total Empire Countries..	1,740	1,441	1,956	1,661	1,247	1,706
Total Foreign Countries..	5,036	4,391	7,565	4,208	4,534	14,882
Total .. .. .	6,776	5,832	9,521	5,869	5,781	16,588

Both the 1928 and the 1929 potato crops in this country had been sufficient to keep prices at a low level and to restrict imports during the 1928–29 and 1929–30 main crop seasons. Hence neither in the early nor in the late months of 1929 were there appreciable imports of



old crop potatoes from the continent. And this condition lasted right through the early months of 1930, as can be seen from the figures in Table II, showing imports by months. But the lighter crop of 1930, combined with a heavy surplus in Germany, brought out large supplies during October, November and December of that year from Germany and the Netherlands, although Belgium had no surplus for export.

Heavy imports of old potatoes continued throughout the early months of 1931, the total in the months from January to May, excluding imports from Spain and other countries shipping early potatoes during that period, amounting to 3,460,000 cwts., as compared with less than 150,000 cwts. in the same period in 1930.

Imports of early potatoes from March to August were slightly larger than in 1930, increases in arrivals from Spain and Holland being partly offset by reduced imports from the Channel Islands and France. But the very light home crop of potatoes in the autumn of 1931 brought in extraordinarily heavy supplies from the continent from September to December and the total imports recorded during those four months amounted to 7,051,000 cwts., as compared with 882,000 cwts. in 1930, 383,000 cwts. in 1929 and 227,000 cwts. in 1928.

TABLE II.—Imports of Potatoes into the United Kingdom in each Month, 1926-31.

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
January .. ..	130	171	215	61	36	449
February .. ..	96	134	195	54	27	585
March .. ..	129	160	543	136	80	543
April .. ..	414	240	1,447	185	163	1,342
May .. ..	1,039	1,363	1,816	868	974	1,958
June .. ..	2,809	2,160	3,580	2,279	2,428	2,835
July .. ..	964	863	1,177	1,571	987	1,489
August .. ..	179	138	321	332	204	336
September.. ..	108	34	75	138	66	761
October .. ..	200	183	28	87	272	1,833
November.. ..	470	186	69	93	245	2,823
December .. ..	238	200	55	65	299	1,634
Total .. ..	6,776	5,832	9,521	5,869	5,781	16,588

The effect of the exceptionally light crop in the United Kingdom was not exhausted by the end of the year, and imports in the early months of 1932 have continued on an abnormally heavy scale from the Irish Free State, Germany, Holland, Belgium, Poland, Denmark and other countries in Europe which are able to take advantage of the unusually high prices ruling in the English market, at a period when most agricultural products are so depressed in value. Imports in the first three months of 1932 have amounted to 5,823,000 cwts., including 1,308,000 cwts. from Germany, and 2,045,000 from Holland. Table III shows monthly imports in 1931, together with figures for the first three months of 1932.

TABLE III.—Imports of Potatoes during each Month of 1931, and from January to March, 1932, showing Countries whence consigned.

Month.	Germany.	Netherlands.	France.	Spain.	Canary Islands.	Channel Islands.	Other Countries.	Total.
1931	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January..	102	269	1	—	—	(a)	77	449
February..	269	182	1	—	15	(a)	118	585
March ..	243	124	—	13	33	2	128	543
April ..	544	386	16	122	67	1	206	1,342
May ..	502	121	67	1,018	44	22	184	1,958
June ..	79	127	1,284	310	62	815	158	2,835
July ..	10	349	644	83	2	69	332	1,489
August ..	3	248	16	(a)	—	—	70	338
September	93	373	27	—	—	(a)	268	781
October..	868	463	19	—	—	—	483	1,833
November	1,311	519	3	(a)	—	(a)	990	2,823
December	577	348	(a)	—	1	(a)	708	1,634
Total, 1931	4,602	3,509	2,076	1,547	224	910	3,720	16,588
1932								
January..	469	1,212	44	—	1	(a)	1,318	3,044
February..	547	504	29	—	—	1	507	1,588
March ..	291	329	5	16	23	1	526	1,191

(a) Less than 500 cwts.

#### IMPORTS OF TOMATOES.

Imports of raw tomatoes in 1913 amounted to 1,582,000 cwts. and after the interruption caused by the war the total in 1920 was at about the same level, the figure for that year being 1,617,000 cwts.

There has since been a fairly consistent increase. By 1924 imports had risen to 2,138,000 cwts. and although there have been some slight set backs, total imports had reached over 3,000,000 cwts. by 1930. In 1931, although not reaching quite the same level, the total was larger than for any year other than 1930. Production of tomatoes in Great Britain amounted to 980,000 cwts. in 1925, and although there are no later figures available, the output has certainly increased materially since that year.

TABLE I.—*Imports of Tomatoes into the United Kingdom, 1926–31.*

Country whence Consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
Channel Islands ..	731	652	870	741	863	768
Other Empire Coun- tries .. ..	2	5	(a)	(a)	2	(a)
Netherlands ..	432	444	492	611	665	728
Belgium .. ..	3	6	7	4	3	4
France .. ..	59	54	77	39	27	20
Portugal .. ..	3	3	1	2	(a)	5
Spain .. ..	146	155	150	114	89	92
Canary Islands ..	897	995	1,199	1,218	1,394	1,298
Italy .. ..	25	16	7	17	5	5
Other Foreign Coun- tries .. ..	4	2	2	6	4	17
Total Empire Countries ..	733	657	870	741	865	768
Total Foreign Countries ..	1,569	1,675	1,935	2,011	2,187	2,169
Total ..	2,302	2,332	2,805	2,752	3,052	2,937

(a) Less than 500 cwts.

Three countries are mainly responsible for the development in the import trade, and account for 95 per cent. of all imports. In 1920 imports from the Channel Islands totalled 541,000 cwts., from the

Canary Islands, always the United Kingdom's chief source of imported tomatoes, 587,000 cwts., and from the Netherlands, 278,000 cwts. Imports from the Channel Islands and Canary Islands showed a slight fall last year, but the year's totals represented increases of 44 per cent. and 121 per cent. respectively since 1920, whilst Holland's contribution has increased 162 per cent.

Imports of tomatoes are at their greatest between May and October, which is precisely the season when home-grown supplies are at their height. During these six months practically two-thirds of the imports are registered. Monthly figures for the past six years are shown below.

TABLE II.—*Imports of Tomatoes into the United Kingdom in each Month, 1926–31.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January .. ..	105	106	103	164	143	124
February .. ..	81	120	118	151	131	136
March .. ..	105	177	152	160	184	135
April .. ..	166	171	211	209	230	234
May .. ..	208	206	290	237	365	300
June .. ..	286	261	312	256	361	355
July .. ..	253	304	286	319	364	353
August .. ..	271	251	326	311	366	345
September .. ..	356	259	421	408	348	323
October .. ..	229	223	287	224	285	265
November.. ..	155	123	174	179	133	205
December.. ..	87	131	125	133	142	162
Total .. ..	2,302	2,332	2,805	2,751	3,052	2,937

The Canary Islands are almost the only source of supply of imported tomatoes during the winter months. The season opens in October, when the main continental supplies are finishing, and runs through to June or July, overlapping the Channel Islands and Dutch seasons, which start about May and June respectively and continue into October.

TABLE III.—Imports of Tomatoes in each Month of 1931, showing Countries whence consigned.

Month.	Channel Islands.	Netherlands.	France.	Spain.	Canary Islands.	Other Countries.	Total.
	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.	Thousand cwts.
January	(a)	—	(a)	(a)	123	1	124
February	—	(a)	—	—	136	—	136
March ..	(a)	(a)	—	(a)	135	—	135
April ..	2	(a)	—	(a)	226	6	234
May ..	47	11	(a)	1	240	1	300
June ..	152	80	2	46	73	2	355
July ..	132	169	4	38	3	7	353
August..	88	243	3	1	(a)	10	345
September	153	159	9	1	—	1	323
October	170	53	2	3	36	1	265
November	23	9	(a)	1	171	1	205
December	1	4	(a)	1	155	1	162
Total..	768	728	20	92	1,298	31	2,937

(a) Less than 500 cwts.

#### IMPORTS OF MISCELLANEOUS FRESH VEGETABLES.

Potatoes, onions, and tomatoes are the only raw vegetables separately distinguished in the United Kingdom trade returns, and are by far the most important vegetables imported. The average value of imports of potatoes during the five years 1927 to 1931 amounted to £4,326,000 per annum, of onions to £2,030,000 per annum, and of tomatoes to £4,400,000 per annum. The declared value of imports of all other raw vegetables amounted to £1,691,000 last year and has averaged over £1,600,000 during the past five years.

France and the Netherlands provide much the greatest proportion of the miscellaneous vegetables imported, these two countries together accounting for about 85 per cent. of total imports by value. Imports from Italy showed a striking increase last year as compared with previous years, but amounted to only about 5 per cent. of the total value, while imports from the Channel Islands accounted for little more than 2½ per cent. Imports by value in the six years 1926 to 1931 are shown in Table I. No information is available as to the volume of imports.

TABLE I.—Imports of Raw Vegetables (other than Potatoes, Onions and Tomatoes) into the United Kingdom, 1926–31.

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	£000.	£000.	£000.	£000.	£000.	£000.
France .. .. .	891	924	800	864	965	905
Netherlands .. .. .	472	438	603	521	582	540
Germany .. .. .	38	27	28	34	34	26
Madeira .. .. .	16	27	47	41	30	37
Belgium .. .. .	23	22	24	23	30	34
Italy .. .. .	13	7	18	18	17	89
Other Foreign Countries..	11	7	13	18	11	13
Channel Islands .. .. .	53	56	27	47	40	45
Irish Free State .. .. .	2	3	4	7	2	2
Other Empire Countries	—	—	—	3	2	—
Total .. .. .	1,519	1,511	1,564	1,576	1,713	1,691

Although no figures are available in the United Kingdom trade returns as to the volume of the various vegetables going to make up the totals shown in the above table, it is possible to get some indication of the relative proportions from the export returns of the chief foreign countries of supply.

Table II shows exports of raw vegetables (other than potatoes, onions and tomatoes) from France, distinguishing the three principal countries of consignment, viz. :—the United Kingdom, Germany and Switzerland, in the past two years. The figures throughout are gross weights; net weights are about 10 per cent. less.

TABLE II.—Exports of Raw Vegetables (other than Potatoes, Onions and Tomatoes) from France.

Description.	1930.				1931.			
	United Kingdom.	Germany.	Switzerland.	Total Exports.	United Kingdom.	Germany.	Switzerland.	Total Exports.
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
Asparagus ..	1,590	300	940	2,890	1,690	380	980	3,100
Cauliflowers ..	23,610	8,780	3,650	47,090	33,290	5,720	3,390	50,440
Salads ..	3,760	10,780	5,550	21,750	3,580	6,340	5,200	16,620
Artichokes ..				320				220
French beans ..	(a)	(a)	(a)	2,860	(a)	(a)	(a)	2,040
Green peas ..				2,820				2,100
Other descriptions	4,270	9,560	6,040	22,330	3,060	7,780	5,750	19,490
Total ..	(b)	(b)	(b)	100,050	(b)	(b)	(b)	94,010

(a) Figures not yet available. The figures for 1929 were :—(tons)—Artichokes, United Kingdom 50, total 320; French beans, United Kingdom 130, total 4,460; green peas, United Kingdom 1,410, total 1,970. (b) Not available.

Although the total exports of miscellaneous raw vegetables from France showed a decline last year as compared with 1930, exports to the United Kingdom were higher mainly owing to the increase in exports of cauliflowers to this country.

From the above figures it is clear that cauliflowers form the bulk of the imports of unclassified fresh vegetables into this country from France, followed by salads, asparagus and green peas.

Table III shows exports of raw vegetables (other than potatoes, onions and tomatoes) from the Netherlands, distinguishing the two principal countries of consignment, viz. :—the United Kingdom and Germany, in the past two years. As in the case of France, quantities shown are gross weights.

TABLE III.—Exports of Raw Vegetables (other than Potatoes, Onions and Tomatoes) from the Netherlands.

Description.	1930.			1931.		
	United Kingdom.	Germany.	Total Exports.	United Kingdom.	Germany.	Total Exports.
	tons.	tons.	tons.	tons.	tons.	tons.
White and savoy cabbage	240	21,930	65,820	(a)	16,380	39,240
Red cabbage .. ..	2,500	31,100	44,390	2,560	16,200	27,700
Cauliflowers .. ..	5,220	35,180	45,630	4,190	23,590	35,590
Brussels sprouts .. ..	1,340	6,100	9,210	(a)	3,610	6,380
Salads .. .. .	10,170	21,060	33,760	9,540	18,300	31,000
Carrots .. .. .	18,450	5,520	43,000	17,390	5,140	36,530
Turnips .. .. .	150	2,380	2,860	(a)	(a)	1,240
Cucumbers .. .. .	2,610	47,680	51,020	2,750	41,920	45,930
Gherkins .. .. .	1,390	6,690	8,160	(a)	3,590	4,600
Green peas .. .. .	—	510	2,500	—	450	4,840
Beans .. .. .	—	8,390	8,900	—	3,790	3,940
Other descriptions .. ..	760	7,210	15,040	1,070	6,090	11,820
Total .. .. .	42,830	193,750	330,290	(a)	(a)	248,810

(a) Figures not yet available.

Exports of miscellaneous raw vegetables from the Netherlands last year showed a heavy decrease. Germany continues to take by far the largest share of the total exports, but the proportion tends to decline. Only about 55 per cent. of the total went to Germany in 1931, as compared with about 59 per cent. in the previous year. The United Kingdom apparently took over 15 per cent. last year and 13 per cent. in the previous year. Belgium comes next in order of importance and the bulk of the exports of green peas go to that country.

The figures in the above table indicate that carrots and salads form a very considerable proportion of the volume of imports of unclassified fresh vegetables into this country from the Netherlands, and together accounted for about two-thirds of the total volume of exports to this country in 1930. Cauliflowers, cucumbers and cabbages comprise the bulk of the remainder.

As previously stated France and the Netherlands account for about 85 per cent. of the imports of miscellaneous vegetables into the United Kingdom. Included in imports from other countries are beans, green peas, broccoli, and radishes from the Channel Islands; cauliflowers, green peas and asparagus from Italy; carrots and chicory from Belgium; salads, artichokes and green peas from Spain; and beans and vegetable marrows from Madeira. Imports of cauliflowers from Italy last year, according to special returns received by the Board, amounted to over 4,500 tons, and were therefore larger than imports of that produce from the Netherlands. No further figures are available in regard to the actual quantities or to the proportion of the different vegetables imported from these sources, but in any case they are of no great importance beside the imports from France and the Netherlands.

In Table IV are shown exports of raw vegetables (other than potatoes, onions and tomatoes) from France and the Netherlands to the United Kingdom during each month of 1931.

TABLE IV.—*Exports of Raw Vegetables from France and the Netherlands to the United Kingdom in each month of 1931.*

Month.	Salads.		Cauliflowers.		Carrots.	Cucumbers.	Asparagus.	Green Peas (a).
	France.	Netherlands.	France.	Netherlands.	Netherlands.	Netherlands.	France.	France.
	tons.	tons.	tons.	tons.	tons.	tons.	tons.	tons.
January ..	525	—	4,486	—	1,826	—	4	—
February ..	515	—	7,216	—	1,542	—	10	1
March ..	991	66	6,395	—	1,761	204	29	1
April ..	957	2,632	7,071	20	932	363	302	23
May ..	191	5,023	2,150	218	1,236	210	782	464
June ..	73	1,312	50	1,812	1,953	694	515	1,229
July ..	28	16	—	1,353	1,100	850	33	356
August ..	15	7	—	341	1,184	380	1	13
September ..	7	63	5	112	1,322	137	—	1
October ..	6	37	137	95	1,524	2	—	5
November ..	17	260	2,698	208	1,615	—	1	5
December ..	255	64	3,082	31	1,375	—	3	2
Total ..	3,580	9,540	33,290	4,190	17,390	2,750	1,680	2,100



### IMPORTS OF CUT FLOWERS.

Imports of fresh flowers into this country are shown in the trade returns of the United Kingdom under one heading, and by value only. The value of the imports in recent years has shown a progressive increase from £410,000 in 1925 to £765,000 in 1930 and £1,065,000 in 1931. France, the Channel Islands and the Netherlands together provide the bulk of the imported supplies, imports from other countries being negligible. Imports from France during the five years 1927-31 averaged about £268,000 recorded annual value, and showed no great variation in value from year to year, although the figure for 1931 was the highest yet recorded. The value of the imports from the Channel Islands rose from £122,000 in 1925 to £175,000 in 1931. The Netherlands has been mainly responsible for the substantial rise in the value of total imports in the years in question, the imports from that country showing a progressive increase each year from £70,000 in 1925 to £540,000 in 1931, and now accounting for rather more than half the total imports.

Table I shows the values of imports of cut flowers into this country during the last six years.

TABLE I.—*Imports of Cut Flowers into the United Kingdom.*

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
	£000	£000	£000	£000	£000	£000
Netherlands .. ..	90	151	284	328	358	540
France .. ..	221	285	264	214	247	333
Channel Islands .. ..	143	150	148	177	149	175
Other Countries .. ..	6	10	6	10	11	17
Total .. ..	460	598	702	729	765	1,065

Table II shows the value of imports of cut flowers into this country during each month in 1931 according to countries from which consigned. February was the most important month for France and the Netherlands, and April for the Channel Islands. During November and December France accounts for fully one-half the imports, but from January to April the Netherlands is the main source.

TABLE II.—Imports of Cut Flowers into the United Kingdom in 1931.

Month.	Nether-lands.	France.	Channel Islands.	Other Coun-tries.	Total.
	£	£	£	£	£
January .. .. .	105,323	54,948	4,984	403	165,658
February .. .. .	133,740	67,834	9,863	554	211,991
March .. .. .	112,880	54,654	37,680	556	205,770
April .. .. .	79,138	35,891	41,347	1,761	158,137
May .. .. .	41,624	25,711	28,345	563	96,243
June .. .. .	17,939	12,825	16,561	533	47,858
July .. .. .	7,835	2,889	3,955	446	15,125
August.. .. .	7,756	561	2,332	1,052	11,701
September .. .. .	4,501	415	1,427	632	6,975
October .. .. .	2,491	2,447	2,059	1,002	7,999
November .. .. .	4,017	30,859	10,631	3,668	49,175
December .. .. .	22,443	44,002	15,943	5,873	88,261
Total .. .. .	539,687	333,036	175,127	17,043	1,064,893

The trade returns of France and the Netherlands do not distinguish the different kinds of fresh flowers exported, but they give certain information regarding total quantities exported. The following particulars show the distribution of exports from France in each of the past six years. The United Kingdom took over 80 per cent. of the French exports in 1931.

Exports to Germany show a declining tendency, but Belgium is taking increasing quantities and has displaced Germany in 1931 as the second most important market for French flowers.

TABLE III.—Exports of Cut Flowers from France.

Exported to	1926.	1927.	1928.	1929.	1930.	1931.
	tons.	tons.	tons.	tons.	tons.	tons.
United Kingdom .. .. .	3,825	3,369	3,224	2,213	3,178	4,269
Germany .. .. .	345	583	348	261	376	242
Belgium .. .. .	85	141	181	156	217	273
Switzerland .. .. .	(a)	(a)	353	241	236	236
Other Countries .. .. .	81	180	164	105	119	140
Total .. .. .	4,336	4,273	4,270	2,976	4,126	5,160

(a) Figures not available, included in "Other Countries".

Exports from the Netherlands show the same features as those from France. The United Kingdom is easily the chief market and shipments to Germany have tended to decline in the past few years, but exports to France and Switzerland have increased proportionately more than those to the United Kingdom.

TABLE IV.—*Exports of Cut Flowers from the Netherlands.*

Exported to	1926.	1927.	1928.	1929.	1930.	1931.
	tons.	tons.	tons.	tons.	tons.	tons.
United Kingdom .. ..	549	1,030	1,897	2,130	2,074	4,198
Germany .. ..	592	831	1,236	860	1,106	1,037
France .. ..	10	24	102	239	373	674
Switzerland .. ..	—	18	51	51	69	105
Other Countries .. ..	107	91	104	113	145	243
Total .. ..	1,258	1,994	3,390	3,393	3,767	6,257

The volume of exports given in French and Dutch export returns is given in gross weights. Allowing a margin of 10 per cent., the average declared value of imports of cut flowers from Holland was 160s. to 175s. per cwt. (about 1s. 6d. per lb.) from 1927 to 1929, rose to 192s. (1s. 9d. per lb.) in 1930, when the rapid rise in imports was temporarily checked, and fell to 143s. (1s. 3d. per lb.) in 1931, when supplies doubled as compared with the previous year. The declared value of imports from France is lower, the average varying from 86s. to 107s. per cwt. (9d. to 11½d. per lb.) over the past five years.

The weight of exports of cut flowers from France and Holland to the United Kingdom, in each month of the past three years, according to French and Dutch trade returns, is shown below in Table V. Figures are gross weights; nett weights would be about 10 per cent. less.

TABLE V.—*Monthly Exports of Cut Flowers from France and the Netherlands to the United Kingdom.*

Month.	France.			Netherlands.		
	1929.	1930.	1931.	1929.	1930.	1931.
	tons.	tons.	tons.	tons.	tons.	tons.
January .. .. .	212	449	557	416	248	708
February .. .. .	559	834	693	500	456	944
March .. .. .	385	567	1,060	575	441	845
April .. .. .	344	372	609	314	259	722
May .. .. .	164	389	280	123	168	331
June .. .. .	242	193	186	14	89	157
July .. .. .	34	59	34	21	89	112
August .. .. .	16	6	10	34	117	132
September.. .. .	2	3	1	12	17	63
October .. .. .	3	6	10	25	19	25
November .. .. .	50	44	188	29	19	34
December .. .. .	202	256	641	67	152	125
Total .. .. .	2,213	3,178	4,269	2,130	2,074	4,198

IMPORTS OF FLOWER BULBS.

Over 90 per cent. of the total imports of flower bulbs into the United Kingdom come from the Netherlands. Of the remainder, the principal countries furnishing supplies are the Channel Islands, France, and Japan. Table I shows imports into this country during the last six years.

TABLE I.—*Imports of Flower Bulbs into the United Kingdom.*  
(Millions of bulbs.)

Country whence consigned.	1926.	1927.	1928.	1929.	1930.	1931.
Netherlands .. .. .	291	367	393	341	433	551
Channel Islands .. .. .	2	3	5	10	7	4
France .. .. .	5	7	6	9	8	6
Japan .. .. .	8	7	7	6	6	7
Other Countries .. .. .	4	6	5	10	10	13
Total .. .. .	310	390	416	376	464	581

The declared value of imports of flower bulbs in 1931 was £1,471,000, which is 38 per cent. larger than the imports of cut flowers in the same year. The aggregate value of imports of bulbs has risen from £1,103,000 in 1925, or by 33 per cent.

With the exception of 1929 there has been a progressive increase in total imports and in imports of Dutch bulbs during recent years, culminating in a record total of 581 millions in 1931, of which the Netherlands supplied 551 millions, or 95 per cent. Imports from other countries show no signs of expansion, and are insignificant in comparison with the Dutch figures.

Table II shows imports from the principal countries during each month of 1931.

TABLE II.—*Imports of Flower Bulbs in 1931.*  
(Thousands of bulbs.)

Month.	Nether-lands.	Channel Islands.	France.	Japan.	Other Countries.	Total.
January .. ..	16,811	—	88	632	1,893	19,424
February .. ..	13,200	—	7	47	412	13,666
March .. ..	14,579	6	—	14	649	15,248
April .. ..	10,257	9	—	8	483	10,757
May .. ..	3,230	—	—	—	104	3,334
June .. ..	168	—	—	—	243	411
July .. ..	1,735	223	724	33	818	3,533
August .. ..	133,589	1,653	4,648	836	3,296	144,022
September ..	243,804	1,023	756	862	1,288	247,731
October .. ..	64,823	459	32	1,389	554	67,257
November ..	25,343	208	9	1,639	775	27,974
December ..	23,064	9	9	1,905	2,272	27,259
Total .. ..	550,603	3,590	6,273	7,365	12,787	580,616

(a) Less than 500.

The Netherlands trade returns show exports of flower bulbs by weight. The United Kingdom takes a larger share of the total quantity exported than any other country, but substantial quantities are consigned to the United States, Germany, Canada, France and Scandinavian countries. Table III shows the distribution of total exports during the last six years. Figures shown are gross weights.

TABLE III.—*Exports of Flower Bulbs from the Netherlands.*

Exported to	1926.	1927.	1928.	1929.	1930.	1931.
	tons.	tons.	tons.	tons.	tons.	tons.
United Kingdom .. ..	11,860	14,345	15,255	12,155	17,750	21,250
United States .. ..	7,905	8,475	8,635	6,385	8,580	6,405
Germany .. .. .	4,415	6,230	7,795	6,590	7,245	5,731
Sweden .. .. .	2,170	2,420	2,510	2,090	2,710	2,627
Denmark .. .. .	1,925	1,925	2,230	1,360	2,230	2,352
Canada .. .. .	1,565	1,885	1,750	1,400	1,680	1,668
France .. .. .	455	630	795	775	1,200	1,588
Norway .. .. .	700	815	730	655	815	702
Other countries .. ..	1,595	1,945	2,230	2,280	2,590	2,886
Total .. .. .	32,590	38,670	41,930	33,690	44,800	45,209

Exports from Holland last year reached a new high record, but while the quantity exported to the United Kingdom and France showed a further substantial increase over previous years, exports to the United States, Germany, Sweden and Canada declined.

#### THE NORTH AMERICAN APPLE SEASON, 1930-31.

The North American apple export season ended about the middle of May, 1931, the final shipments reaching their European destinations towards the end of June. Shipments overseas from Canada and the United States, according to figures compiled by the International Apple Association, reached a record total, equivalent to 23,400,000 boxes. This compares with 14,200,000 boxes in 1929-30 and a previous record figure of 22,500,000 boxes, which was reached in 1926-27 and again in 1928-29.

The heavy shipments during the season were mainly accounted for by the increase in exports of box apples which in themselves constituted a record, having amounted to over 12,200,000 boxes, or more than double the quantity shipped in the preceding season, and 500,000 boxes more than the previous record in 1928-29. Shipments of barrel apples totalled 3,700,000 barrels, as compared with 2,800,000 barrels in the 1929-30 season, but were well below

the total of 5,000,000 barrels exported in 1926-27 season. Particulars of overseas shipments of apples from North America are shown in Table I.

TABLE I.—*Oversea Shipments of Apples from ports in Canada and the United States.*

Season.	Barrels.	Boxes.	Total (as boxes).	Commercial Apple Crop (as boxes).
	Thousand.	Thousand.	Thousand.	Thousand.
1924—25 .. .. .	2,612	4,647	12,482	92,904
1925—26 .. .. .	2,894	5,055	13,736	108,648
1926—27 .. .. .	5,005	7,516	22,530	127,185
1927—28 .. .. .	1,962	4,929	10,814	86,484
1928—29 .. .. .	3,600	11,727	22,527	116,091
1929—30 .. .. .	2,827	5,742	14,223	98,349
1930—31 .. .. .	3,718	12,246	23,400	111,238

The totals shown in the above table comprise shipments to all destinations overseas, including in each of the three past seasons over a million boxes to South America and the Far East. Total shipments to Europe in the 1930-31 season amounted to about 3,580,000 barrels and 11,500,000 boxes, as compared with 2,660,000 barrels and 5,000,000 boxes in 1929-30. Large increases are shown in shipments of box apples from both Canada and the United States as a result of the heavy commercial apple crops on the western seaboard. An increase is also recorded in shipments of barrel apples from the United States, but the reduced crop in Nova Scotia in 1930 caused a decline in total shipments of barrels from Canada, although the decline was less pronounced than the crop estimate suggested. Table II shows shipments to Europe from Canada and the United States respectively in the past three seasons. The figures are compiled from weekly advices, and are only approximate.

TABLE II.—*Shipments of Apples from Canada and the United States to Europe.*

	1928-29.	1929-30.	1930-31
<i>Canada—</i>	Thousand.	Thousand.	Thousand.
Barrels .. .. .	679	1,427	1,085
Boxes .. .. .	851	562	1,187
Total (as boxes) ..	2,888	4,843	4,441
<i>United States—</i>			
Barrels .. .. .	2,797	1,235	2,491
Boxes .. .. .	9,940	4,426	10,300
Total (as boxes) ..	18,331	8,131	17,744
Total, Canada and United States (as boxes) .. .. .	21,219	12,974	22,215

Tentative estimates were made in the "Weekly Fruit Intelligence Notes" early in the season as to the probable supplies of apples for export to Europe during 1930-31, the total being estimated at the beginning of November at only 19 million boxes. Subsequent crop reports indicated so much improvement in the apple crops that this estimate was revised in January, 1931, and the figure of total shipments was forecast at 22,800,000 boxes, which agrees fairly closely with the actual total as set out above. The Board's January estimate was for a total of 10,500,000 boxes and 2,650,000 barrels from the U.S.A., equivalent in the aggregate to 18,450,000 boxes, or about 4 per cent. larger than actual shipments. As regards Canada, exports of barrels were forecast at 980,000, and boxes at 1,400,000, a total of 4,350,000 boxes, or 2 per cent. less than actual shipments. But the under-estimate for barrels was apparently due to an official under-estimate of the Nova Scotian crop, as oversea shipments, at 989,000 barrels, exceeded the Government estimate of the whole commercial crop by over 50,000 barrels.

It will be seen from Table II that shipments of Canadian apples to Europe showed a slight decline in the 1930-31 season by comparison with 1929-30. This was mainly due to a substantial decline in shipments from Nova Scotia, which, at 989,000 barrels, were 343,000



barrels less than in the preceding season. Exports to Europe from British Columbia, on the other hand, rose to a higher level than ever before, having reached a total of 1,174,000 boxes, as compared with 560,000 boxes in 1929-30. The estimated commercial crop in 1930 in British Columbia reached the record total of 4,682,000 boxes. Shipments from Ontario amounted to some 95,000 barrels, about the same as in the previous season. Table III shows details of shipments of Canadian apples to Europe during recent seasons.

TABLE III.—*Shipments of Canadian Apples to Europe.*

Season.	British Columbia.	Nova Scotia.		Ontario.		Total.
	Thousand boxes.	Thousand barrels.	Thousand boxes.	Thousand barrels.	Thousand boxes.	Thousand boxes.
1927-28 ..	343	512	7	51	8	2,047
1928-29 ..	848	637	—	42	2	2,887
1929-30 ..	560	1,332	1	95	2	4,844
1930-31 ..	1,174	989	4	95	9	4,441

Although the commercial apple crop in the United States was at first expected to be below 29 million barrels, by December conditions had so much improved that the crop was reckoned as within measurable distance of that of 1928-29. In addition European crops were probably even lighter than in 1928, and industrial depression in the United States led to an export movement accounting for fully as large a proportion of the somewhat lighter crop as had been exported two years earlier. Altogether 17·6 per cent. of the commercial crop was shipped to Europe, as compared with 17·2 per cent. in 1928-29, and a proportion in normal years of no more than 10 per cent.

As regards Canada, European needs and the depression in the Canadian staple industries resulted in a much larger export in relation to the crop than is usually the case. Evidently almost the whole of the Nova Scotian crop was shipped to Europe (actual shipments are given as 6 per cent. greater than the October estimate of the commercial crop); Ontario shipped nearly 20 per cent. of the commercial crop, and British Columbia over one-quarter, as compared with about 20 per cent. in normal years. In the aggregate, after allowing for an upward revision of the Nova Scotian crop, some 45 per cent. of the commercial crop appears to have been shipped to Europe, a

proportion which in the past has only been approached in years when the Nova Scotian crop has been a good deal heavier than that of British Columbia—a condition which did not obtain in the 1930–31 season.

Figures of commercial production and exports for the various areas are given in Table IV.

TABLE IV.—*Proportions of Commercial Apple Crops shipped to Europe.*

	1928-29.			1929-30.			1930-31.		
	Com- mercial Crop.	Ship- ments to Europe.	Per cent.	Com- mercial Crop.	Ship- ments to Europe.	Per cent.	Com- mercial Crop.	Ship- ments to Europe.	Per cent.
	Thou- sand boxes.	Thou- sand boxes.		Thou- sand boxes.	Thou- sand boxes.		Thou- sand boxes.	Thou- sand boxes.	
<i>Canada—</i>									
Nova Scotia ..	3,267	1,911	58.5	5,214	3,997	76.7	2,804	2,971	106.0
Ontario .. ..	1,684	128	7.6	2,636	287	10.9	1,507	284	19.5
British Columbia	4,373	848	19.5	3,304	560	17.0	4,662	1,174	25.4
Total ..	9,708(a)	2,887	29.7	11,820(a)	4,844	41.0	9,493(a)	4,441	46.8
<i>U.S.A.—</i>									
Barrel area ..	55,371	8,391	15.0	46,953	3,705	7.9	48,741	7,473	15.3
Box area ..	51,012	9,940	19.5	40,059	4,426	11.0	52,428	10,300	19.6
Total ..	106,383	18,331	17.2	87,012	8,131	9.3	101,169	17,773	17.6

(a) Including Quebec and New Brunswick.

In the "Weekly Fruit Intelligence Notes" in January, 1931, it was estimated that the Continent would probably take about 55 per cent. of the shipments to Europe. Actually the proportion was 53 per cent., but this is a considerably larger proportion than ever before, comparing with only 40 per cent. in 1928-29, and only 22 per cent. in 1929-30.

The result of this was that, in spite of the increased quantities sent from North America to Europe during the season, the aggregate shipped to the United Kingdom has been no more than 10,400,000 boxes, only 250,000 boxes more than in 1929-30, and about 2,000,000 boxes less than in the 1928-29 season. Table V shows the proportion of shipments to Europe destined for the United Kingdom and the Continent respectively during recent seasons.

TABLE V.—*Shipments of Apples from Canada and the United States to the United Kingdom and the Continent of Europe.*

Season.	To United Kingdom.		To Continent.		Total.
	Thousand boxes.	Per cent.	Thousand boxes.	Per cent.	Thousand boxes.
1926-27 ..	17,962	83	3,548	17	21,510
1927-28 ..	8,297	83	1,747	17	10,004
1928-29 ..	12,802	60	8,417	40	21,219
1929-30 ..	10,150	78	2,824	22	12,974
1930-31 ..	10,402	47	11,813	53	22,215

A considerable increase was shown in exports of Canadian apples to the Continent during the season, about 27 per cent. of the shipments for Europe, comprising some 380,000 barrels and 56,000 boxes, having been consigned to Continental ports, as against about 6 per cent. (94,000 barrels and 24,000 boxes) in 1929-30. Normally the United Kingdom takes well over 90 per cent. of Canada's exports to Europe, and even in 1928-29 the proportion was fully 90 per cent.

#### THE SOUTH AFRICAN DECIDUOUS FRUIT SEASON, 1930-31.

Shipments of South African deciduous fruit during the 1930-31 season amounted to 1,830,000 packages, a substantial decline from the previous season's record total of 2,441,000 packages, but an advance of over 300,000 packages on the 1928-29 season.

The decline as compared with the 1929-30 season was mainly due to the substantial decrease in shipments of pears, which totalled only 302,000 packages as against 992,000 packages in the previous season, and fell short of the pre-season estimate by 200,000 packages, but in actual volume shipments of pears declined by hardly so great an amount, as there was an increasing shipment of pears in bushel and  $\frac{1}{4}$ -bushel boxes, instead of trays. Recorded imports of pears into the United Kingdom from South Africa declined from 107,571 cwts. in 1930 to 39,535 cwts. in 1931, a fall of 63 per cent., whereas the number of packages shipped fell by nearly 70 per cent. Shipments of peaches also declined from the previous season's record figure, but with that exception the season was the largest recorded for South African peaches. Record shipments of grapes and plums were made, grapes showing an increase of 130,000 packages or about 25 per cent. over the preceding season's record, following the steady upward tendency in recent seasons. These four fruits—pears,

peaches, plums and grapes—comprise the bulk of South Africa's deciduous fruit shipments, accounting in the 1930-31 season for 94 per cent. of total shipments. Of the remainder, nectarines and fresh prunes are usually the most important, but these fruits showed a decline for the second year in succession, whereas shipments of apples increased to nearly 34,000 boxes as compared with an average of only 5,000 boxes in the previous five seasons. Among the minor fruits, melons showed a substantial increase on previous seasons and increases were also recorded in the case of apricots, litchies and some other fruits, but total shipments of these minor fruits amounted to only about 15,000 packages.

In the following table are shown shipments of each variety of deciduous fruits from South Africa during the past six seasons.

*Shipments of Deciduous Fruits from South Africa.*

Description of Fruit.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.
	Packages.	Packages.	Packages.	Packages.	Packages.	Packages.
Peaches .. ..	156,349	326,463	178,223	316,619	421,831	329,375
Pears .. ..	860,890	347,916	997,339	340,293	992,235	302,545
Plums .. ..	129,187	241,470	219,973	246,500	418,014	440,743
Nectarines .. ..	17,009	35,708	32,584	57,765	49,090	41,193
Grapes .. ..	332,028	499,880	458,334	520,264	521,882	652,111
Melons .. ..	1,004	409	479	2,127	1,126	5,826
Apricots .. ..	8,295	3,755	7,915	3,953	6,318	7,765
Apples .. ..	4,884	6,713	4,830	10,521	8,541	33,852
Mangoes .. ..	2,495	381	1,093	819	879	715
Persimmons .. ..	452	193	214	447	782	325
Quinces .. ..	50	192	398	164	237	329
Avocado Pears .. ..	30	229	635	57	16	49
Pomegranates .. ..	10	99	40	70	40	100
Egg fruit .. ..	—	459	—	—	—	—
Litchies .. ..	—	374	1,283	109	50	413
Cherries .. ..	—	—	—	—	370	—
Tomatoes .. ..	11	—	—	—	—	—
Grenadillas .. ..	721	886	1,201	901	331	380
Fresh Prunes .. ..	1,662	22,164	7,823	20,583	19,472	13,809
Gooseberries .. ..	—	1,067	—	—	—	—
Strawberries .. ..	—	171	—	—	—	—
Figs .. ..	—	—	—	—	10	—
Not classified .. ..	62	25	—	6	—	—
Total .. ..	1,515,139	1,488,554	1,912,364	1,521,198	2,441,224	1,829,530

The decreased arrivals of pears from South Africa met with competition from largely increased supplies of United States pears, arrivals of which in the period when South African pears were on the market totalled 280,000 boxes as compared with only 64,000 boxes in the corresponding period last year. But the total quantity of South African and United States pears which reached this country during the season fell considerably short of the total from the same two sources in the 1929-30 season, which exceeded 1,000,000 boxes. On the other hand there was a considerable increase in supplies of grapes. The heavier arrivals from South Africa met increased competition from Argentine grapes, which reached a record total of some 150,000 boxes as compared with about 100,000 boxes in the previous season.

#### THE AUSTRALIAN AND NEW ZEALAND DECIDUOUS FRUIT SEASON, 1931.

The 1931 Australian and New Zealand apple season ended in the last week of July. The season finished comparatively early; arrivals from Australia in the previous year continued until the beginning of September and in 1929 till early August. The last shipment from New Zealand reached the United Kingdom in the middle of July, the season thus finishing at about the same time as in 1930.

In articles appearing in the "Weekly Fruit Intelligence Notes" in January and February, 1931, shipments of apples to Europe were provisionally estimated at about 2,500,000 boxes from Australia and 940,000 boxes from New Zealand and shipments of pears were expected to amount to 275,000 boxes from Australia and 50,000 boxes from New Zealand. A subsequent improvement in the crops led to revised estimates; an official forecast for New Zealand received in May increased the estimated shipments to a total of 1,140,000 boxes of apples and pears, while further information from Australia indicated the probability that shipments would be heavier than was at first anticipated.

Actually, aggregate shipments of apples from the two countries combined reached 4,280,000 boxes, which is considerably below the previous season's total of 5,423,000 boxes. Australian shipments amounted to 3,145,000 boxes and New Zealand to a record total of 1,135,000 boxes, as compared with 4,318,000 boxes and 1,105,000 boxes respectively in 1930. A similar increase in actual shipments over the pre-season estimate is recorded in the case of pears from Australia which reached a new high level of 345,000 boxes, of which

over 200,000 came from the State of Victoria. The previous record occurred in the 1930 season, when pear shipments amounted to 275,000 boxes. Some 55,000 boxes of pears were shipped from New Zealand, or about the same quantity as in the preceding season.

As compared with 1930 a smaller proportion of the Australian apple shipments to Europe went to the Continental ports, but on the other hand a marked increase was shown in shipments of New Zealand apples to the Continent. In the aggregate, therefore, the proportion of European shipments which came to this country declined slightly, amounting to 74 per cent. as against 76 per cent. of last season's much higher total.

In Table I are shown shipments of apples and pears to Europe from each State in Australia and from New Zealand. The figures given include all packages converted to an equivalent number of boxes.

TABLE I.—*Aggregate Shipments of Australian and New Zealand Apples and Pears to Europe.*

Whence Consigned.	Apples.			Pears.		
	1929.	1930.	1931.	1929.	1930.	1931.
	Thou- sand boxes.	Thou- sand boxes.	Thou- sand boxes.	Thou- sand boxes.	Thou- sand boxes.	Thou- sand boxes.
<i>To United Kingdom—</i>						
Victoria.. .. .	2	638	250	38	139	200
New South Wales ..	1	49	36	10	6	4
South Australia ..	—	284	17	3	11	3
Western Australia ..	170	48	231	32	7	20
Tasmania .. .. .	624	2,176	1,893	98	91	94
Total Australia to U.K.	797	3,195	2,427	181	254	321
Total New Zealand to U.K.	640	938	755	47	43	45
<i>To Continent—</i>						
Victoria.. .. .	—	235	95	—	—	12
New South Wales ..	—	—	—	—	—	—
South Australia ..	2	123	—	—	6	—
Western Australia ..	434	277	213	6	8	—
Tasmania .. .. .	244	488	410	3	7	12
Total Australia to Con- tinent.	680	1,123	718	9	21	24
Total New Zealand to Continent.	110	167	380	7	13	10
<i>To U.K. and Continent—</i>						
From Australia ..	1,477	4,318	3,145	190	275	345
From New Zealand ..	750	1,105	1,135	54	56	55

Shipments of grapes and plums from Australia to the United Kingdom increased considerably by comparison with the previous year, the total quantity of grapes having amounted to the equivalent of 13,800 boxes as against 9,100 boxes, and plums 6,900 boxes as against only 660 boxes.

In the past few years there has been a tendency to ship a larger proportion of Australian fruit to ports other than London, which has always taken the greatest share. In the 1931 season this tendency was reversed and London took 68 per cent. of the total Australian apple shipments to the United Kingdom as compared with 58 per cent. last year. Shipments of New Zealand apples to London declined further to 50 per cent. of the whole, while Southampton this season took 31 per cent. as compared with only 14 per cent. in 1930.

Table II shows the quantities of Australian and New Zealand apples arriving at the different ports in Great Britain in the past three seasons.

TABLE II.—*Ports of arrival of Australian and New Zealand Apples 1929-31.*

Port.	1929.		1930.		1931.	
	Thousand boxes.	Per cent. of total.	Thousand boxes.	Per cent. of total.	Thousand boxes.	Per cent. of total.
<b>From Australia.</b>						
London .. .. .	473	60	1,864	58	1,641	68
Southampton .. .. .	6	1	115	4	2	—
Liverpool .. .. .	141	18	607	19	500	21
Glasgow .. .. .	19	2	126	4	74	3
Manchester .. .. .	27	3	95	3	26	1
Hull .. .. .	131	16	368	12	184	7
Total .. .. .	797	100	3,195	100	2,427	100
<b>From New Zealand.</b>						
London .. .. .	414	65	516	55	376	50
Southampton .. .. .	133	21	130	14	233	31
Liverpool .. .. .	20	3	39	4	33	4
Glasgow .. .. .	41	6	97	10	65	9
Manchester .. .. .	9	1	84	9	32	4
Hull .. .. .	—	—	37	4	—	—
Avonmouth .. .. .	23	4	35	4	16	2
Total .. .. .	640	100	938	100	755	100

In spite of the smaller supplies during the season, prices showed no material advance on those of 1930, although the pronounced fall that occurred towards the end of that season was not repeated in 1931.

#### THE SUMMER ORANGE SEASON, 1931.

The 1931 summer orange season, which may be considered as ending with the arrival of the first substantial shipments from Jaffa and Spain towards the end of November, proved a record one from the point of view of supplies, which were heavier than in any similar period in previous years. The steady increase in the consumption of oranges during the summer months gives cause for satisfaction, but the pressure of supplies coupled with the severe competition offered by other fruits and the depression of commodity prices generally, were no doubt mainly responsible for the lower level of prices which prevailed practically throughout the season.

In an article in "Weekly Fruit Intelligence Notes" on 13th May, 1931, which surveyed the prospects for the season, some decrease was anticipated in shipments of oranges from South Africa as compared with the record quantity of over 1,800,000 boxes in 1930, while supplies from the United States were estimated as likely to exceed one million boxes during the period from March to October. These forecasts have been fully realised; the total for the season from South Africa (including Southern Rhodesian fruit shipped via Union ports) amounted to just under 1,600,000 boxes of oranges and naartjes, and since 1st March about 1,100,000 boxes of oranges arrived from the United States. As regards imports from Brazil, the other important source of supply during the summer months, an unusually rapid expansion occurred. The previous season's shipments totalled rather over 500,000 boxes, and it was expected that the moderate increase shown in recent years would continue but actually over 1,700,000 boxes, together with some 57,000 boxes of tangerines have been sent to this country, and the season, which started as early as March, extended well into December.

The supplies of oranges thus available from South Africa, Brazil and the United States combined, since 1st March, totalled nearly  $4\frac{1}{2}$  million boxes. In addition there arrived during the period over 100,000 boxes from various other countries in the Southern Hemisphere, mainly Southern Rhodesia (via Beira), Australia and Argentina. Southern Rhodesian fruit shipped through ports in the Union of



South Africa is included in the Union total. On the other hand shipments of Spanish oranges during the spring and early summer were of comparatively moderate dimensions, and offered less competition to the first shipments from South Africa than in 1930.

The following table based on special returns obtained from the Customs and Excise Department shows imports into the United Kingdom during the eight months April to November in 1931 and in the two previous years.

*Imports of Oranges into the United Kingdom.*

Country whence consigned.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Total (eight months).
	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.	Thou- sand cwts.
<b>1929.</b>									
Spain .. ..	669	483	324	47	1	—	1	432	1,957
Palestine ..	91	12	4	—	—	—	—	16	123
South Africa (a)	—	2	39	96	218	155	104	35	649
United States..	32	70	163	122	145	187	167	33	919
Brazil .. ..	—	14	46	45	41	61	20	17	244
Argentina ..	—	1	5	9	19	14	1	—	49
Other countries	14	12	26	26	24	13	15	4	136
<b>Total ..</b>	<b>806</b>	<b>594</b>	<b>607</b>	<b>347</b>	<b>448</b>	<b>430</b>	<b>308</b>	<b>537</b>	<b>4,077</b>
<b>1930.</b>									
Spain .. ..	1,023	966	593	168	2	1	1	196	2,950
Palestine ..	222	1	—	—	—	—	—	13	236
South Africa (a)	—	1	46	267	220	208	289	69	1,100
United States..	1	9	16	1	—	—	—	—	27
Brazil .. ..	—	12	42	43	41	79	96	32	345
Argentina ..	—	—	—	1	—	—	—	—	1
Other countries	16	21	6	8	11	17	—	2	61
<b>Total ..</b>	<b>1,262</b>	<b>1,010</b>	<b>703</b>	<b>488</b>	<b>274</b>	<b>305</b>	<b>386</b>	<b>312</b>	<b>4,740</b>
<b>1931.</b>									
Spain .. ..	807	605	215	—	—	—	4	273	1,904
Palestine ..	111	—	—	—	—	—	1	52	164
South Africa (a)	—	2	74	271	148	148	275	52	970
United States..	40	94	154	169	168	88	67	1	781
Brazil .. ..	11	93	169	188	135	98	178	163	1,035
Argentina ..	—	3	—	5	4	10	1	1	24
Other countries	15	4	11	27	20	37	18	15	147
<b>Total ..</b>	<b>984</b>	<b>801</b>	<b>623</b>	<b>660</b>	<b>475</b>	<b>381</b>	<b>544</b>	<b>557</b>	<b>5,025</b>

(a) Includes Southern Rhodesia.

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It will be seen from the above table that in each month from July onwards imports of oranges in 1931 were substantially larger than a year earlier. The effect of abundant supplies and the generally depressed conditions of industry is reflected in the wholesale prices for South African oranges which were throughout on an appreciably lower level than in the previous year. The fall in prices as compared with the 1930 season was more pronounced for the smaller than for the larger sizes, but it is probable that the average over the season as a whole was about 2s. 6d. per box below that of the preceding season. Except perhaps from the middle of August to the end of September, prices appear to have been on an even lower level than in 1929.

In a review of the 1930 summer orange season last year<sup>(a)</sup>, it was pointed out that two of the factors which contributed to the general recovery of prices in that year as compared with 1929, viz., the comparative failure of the Californian Valencia crop, and the slowing down in the rate of expansion of shipments from Brazil, were unlikely to operate in favour of the South African grower in 1931. As already mentioned shipments of oranges from the United States, though not up to the 1929 level, showed a considerable recovery in 1931, while shipments from Brazil assumed record proportions and actually exceeded the quantities arriving from either South Africa or the United States. Brazil, in fact, in 1931 for the first time assumed the leading position in the summer orange supply. Trade depression in this country increased during the summer, and for a great part of the season prices of commodities generally continued their downward trend. In view of these circumstances the lower level of prices is not surprising, although it was, of course, very disappointing to the South African grower.

#### THE JAFFA ORANGE SEASON, 1930-31.

At the beginning of the 1930-31 season the Jaffa orange crop was reported to be approximately the same as in the previous season, and it was anticipated that while shipments to the United Kingdom would show little variation there might be a slight increase in shipments to Germany and other Continental countries. Largely as the result of the severe storm which occurred in the third week of January, when a considerable quantity of fruit was spoilt, the crop fell short of expectations and there was a decline in total exports to 2,467,000

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<sup>(a)</sup> Fruit Supplies in 1930. (E.M.B. 38. April, 1931.)

boxes from the 1929-30 season's record total of 2,696,000 boxes. The decrease occurred almost entirely in shipments to the United Kingdom the quantity going to the Continent, especially to Germany, showing a substantial increase.

Exports to the United Kingdom totalled 1,725,000 boxes, or 69 per cent. of the total, as compared with 1,997,000, or 74 per cent. of previous season's total. Liverpool continued to take heavier quantities than any other port; in the past season 34 per cent. of total shipments to the United Kingdom were shipped to Liverpool, as compared with 29 per cent. in the previous season. Glasgow and London each took a slightly larger proportion of total exports than in the previous season, but there was a substantial decline in shipments to Manchester and Hull. These ports each took only 13 per cent. of total exports as compared with 17 per cent. in the previous season.

While exports to the United Kingdom decreased both absolutely and relatively the actual quantity shipped to the Continent, particularly to Germany, increased and the proportion of the total rose from 21 per cent. in the 1929-30 season to 29 per cent. in the season just closed. Shipments to Germany totalled 510,000 boxes, and accounted for 21 per cent. of the total exports, as compared with 421,000 boxes, or 16 per cent. of total exports, in the previous season. The two direct services from Jaffa and Haifa carried 337,000 boxes of the total quantity exported to Germany.

Shipments to Scandinavian countries have shown a marked development, and increased to over 84,000 boxes. Exports to Denmark are shipped direct to Copenhagen, but exports to Sweden, Norway and Finland are made via Hamburg. Exports to Austria and other central European countries increased and for the first time there was an export to Yugoslavia, but the Netherlands and France took smaller quantities.

As a result of the tariff imposed on imports of oranges into Egypt the Egyptian market took only 25,000 boxes last season, as compared with 123,000 boxes in the previous season.

Shipments from Haifa to the United Kingdom and the Continent amounted to 102,000 boxes and 421,000 boxes respectively, as compared with 36,000 boxes and 307,000 boxes in the previous season.

The following table gives detailed figures of exports in the past five seasons.

*Exports of Oranges from Palestine.*

Destination.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.
United Kingdom.	Boxes.	Boxes.	Boxes.	Boxes.	Boxes.
Liverpool .. ..	637,411	614,525	423,886	585,565	585,381
Glasgow .. ..	417,865	393,162	261,146	384,332	354,622
Manchester .. ..	306,106	291,913	204,368	344,171	233,832
Hull .. ..	303,418	236,084	168,451	341,825	221,227
London .. ..	154,811	141,896	141,716	254,486	241,795
Southampton .. ..	} 84,638	27,651	19,472	28,300	25,749
Cardiff .. ..		23,988	28,663	52,732	47,101
Bristol .. ..		—	5,293	—	—
Newcastle .. ..		—	5,800	—	6,991
Belfast .. ..		—	—	6,027	8,570
Total to United Kingdom.	1,904,249	1,729,219	1,258,795	1,997,438	1,725,268
Germany .. ..	66,349	141,541	190,857	421,022	510,412
Roumania .. ..	33,571	51,852	37,276	39,385	42,829
Netherlands .. ..	—	32,623	33,807	35,554	12,243
France .. ..	—	8,897	17,770	11,557	7,189
Bulgaria .. ..	996	2,679	8,504	5,294	6,937
Scandinavia .. ..	} 9,909	} 24,460	} 29,134	42,769	84,175
Austria .. ..				3,500	10,736
Poland .. ..				1,785	6,008
Czechoslovakia .. ..				1,995	5,000
Switzerland .. ..				2,907	5,452
Belgium .. ..	2,341	2,913			
Hungary .. ..	1,005	1,920			
Yugoslavia .. ..	—	4,067			
Total to Continent	110,825	262,052	317,348	569,114	699,881
Various other destinations.	9,656	4,924	4,401	129,309	41,840
Total .. ..	2,024,730	1,996,195	1,580,544	2,695,861	2,466,989

Shipments to other destinations in 1929-30 included 122,740 boxes to Egypt, 3,500 boxes to India, 2,100 boxes to Ceylon and 600 boxes to China, and the 1930-31 figures included 25,540 boxes to Egypt, 6,200 boxes to India, 3,000 boxes to Soudan, 2,700 boxes to Canada, 800 boxes to Ceylon and 450 boxes to China.

*Grape Fruit.*

Some 57,000 boxes of grapefruit were exported from Palestine in the 1930-31 season, as compared with 17,000 boxes in the previous season, an increase of 40,000 boxes, in spite of the considerable storm damage to the crop.

IMPORTS OF FRUIT INTO GERMANY.

In pre-war years total imports of raw fruit into the United Kingdom and Germany were about on the same level, but although imports into Germany in recent years are higher than in the pre-war period, the increase in the United Kingdom's imports has been far heavier, so that there is now a much wider disparity between the fruit import trade of the two countries.

In Table I are shown, in round figures, average imports of the six principal raw fruits into the United Kingdom and Germany in the three years immediately preceding the war and in the last three years. These figures show that Germany imported only 10 per cent. less fruit than the United Kingdom in the pre-war years, whereas the post-war figures show a difference of nearly 40 per cent. Both countries have experienced changes of boundaries since the war, but these account for only a small part of the difference.

TABLE I.—Average Imports of Raw Fruit into the United Kingdom and Germany.  
(Thousands of tons.)

Description.	United Kingdom.		Germany.	
	1911-13.	1929-31.	1911-13.	1929-31.
Apples .. .. .	174	325	309	172
Pears .. .. .	32	56	44	47
Grapes .. .. .	32	42	36	71
Oranges .. .. .	277	498	137	285
Lemons .. .. .	37	71	37	69
Bananas .. .. .	107	233	36	108
Total .. .. .	659	1,225	599	752

Imports of apples show the most striking change in the two periods. Whereas imports into the United Kingdom increased by over 80 per cent., Germany's imports have declined by over 40 per cent. Both

countries produce a fair proportion of their own apple requirements and the variation in imports may to some extent be attributable to changes in home production. But it is noticeable that in none of the past six years have Germany's imports of apples been more than 80 per cent. of the pre-war average.

Increases are recorded by both countries in all the other fruits included in the table. Imports of pears into the United Kingdom increased by nearly 80 per cent., as against an increase of less than 8 per cent. shown by Germany, but in imports of oranges the United Kingdom shows an increase of barely 80 per cent., and Germany over 100 per cent. Germany's imports of bananas are three times as heavy and imports into the United Kingdom more than twice as heavy as in pre-war years, but consumption of bananas in Germany, in spite of the rapid advance in recent years, still shows the greatest disparity of any fruit as between the two countries. Imports of lemons have increased to about the same extent in both countries, but Germany's imports of grapes show a considerably larger increase than those of the United Kingdom and are nearly twice as heavy as in pre-war years. Grapes afford the only instance in the above list in which imports into Germany have exceeded those into the United Kingdom both in pre-war and in post-war years.

Table II shows imports of the same fruits into Germany in the past six years. In spite of variations from year to year in individual fruits there was a steady development generally up to 1930 inclusive, but this was somewhat checked last year, principally on account of a decline of over 50 per cent. in imports of apples, as compared with the previous year. At the same time imports of oranges and bananas also declined.

TABLE II.—*Imports of Raw Fruit into Germany.*  
(Thousands of tons.)

Description.	1926.	1927.	1928.	1929.	1930.	1931.
Apples .. ..	178	169	209	160	240	116
Pears .. ..	59	60	55	60	35	45
Grapes .. ..	39	47	62	75	70	68
Oranges .. ..	187	206	255	234	345	274
Lemons .. ..	53	57	55	61	71	74
Bananas .. ..	67	65	86	101	116	108
Total .. ..	583	604	722	691	877	685

British Empire countries continue to figure to only a limited extent among countries contributing to Germany's raw fruit supplies, except in regard to bananas, of which nearly 70 per cent. were recorded as being imported last year from the British West Indies. Australia's share of the apple imports in 1931 amounted to only 5,000 tons, as compared with 9,000 tons in 1930, but New Zealand's contribution increased from 3,000 tons in 1930 to over 4,000 tons last year. Imports of apples from the United States were again substantially heavier than from any other country, and were the largest ever recorded, but there was an all round decline in imports from other European countries, probably as a result of the good home crop. Spain continues to supply the largest proportion of the orange imports. Imports from Palestine increased to 14,000 tons, as compared with 13,000 tons in the previous year, but South Africa's contribution declined to 1,800 tons as compared with 3,500 tons in the previous year. Pears were imported last year mainly from Czechoslovakia and Italy. Italy and France continue to be the main sources of supply of grapes, and the former country still supplies the bulk of lemons imported.

Germany's substantial imports of fruit are at present mainly of importance to Empire producers in that they offer an alternative outlet for supplies from competitive producing countries, which might otherwise go to swell the supplies competing with Empire fruits on the British market.

#### IMPORTS OF FRUIT INTO FRANCE.

France has been for many years an importer of large and increasing quantities of citrus fruits, mainly oranges and mandarines, and bananas, but imports of other fruits up to a few years ago were relatively unimportant. In recent years, however, there has been a rapid expansion in imports of apples and pears and also to a minor extent in imports of other fruits. In the space of the last six years total imports of the principal fruits imported, as shown in the table below, have nearly trebled. The rate of progress has been considerably more rapid than in the case of either the United Kingdom or Germany, and as a result of this development France has now become, as a fruit importing country, only little less important than Germany. Imports of bananas, which have shown the greatest expansion, increased from 50,000 tons in 1926 to 211,000 tons in 1931. Imports of this fruit last year were nearly as heavy as imports into the United Kingdom and

nearly double those recorded by Germany in the same year. Imports of citrus fruits during the same period have increased by about 75 per cent., and oranges, mandarines and bananas still account for over 70 per cent. of France's total imports of raw fruit. The increase in shipments of American apples to French markets in the last two or three years mainly accounts for the increased imports of this fruit. In 1926 total imports of apples and pears amounted to only 6,000 tons, whereas last year 71,000 tons of apples and 22,000 tons of pears were imported. Imports of table grapes have doubled and imports of peaches quadrupled during the past three years.

Table I shows in round figures imports of the principal fruits imported into France during the past six years.

TABLE I.—*Imports of Raw Fruit into France.*  
(Thousands of tons.)

Description.	1926.	1927.	1928.	1929.	1930.	1931.
Oranges and mandarines	} 133	131	157	{ 129	204	209
Lemons .. .. .						
Bananas .. .. .	50	79	109	126	181	211
Apples .. .. .	} 6	12	22	{ 33	41	71
Pears .. .. .						
Grapes .. .. .	9	5	10	9	17	18
Peaches .. .. .	3	4	7	5	17	27
Plums .. .. .	1	1	4	3	5	7
Cherries and strawberries	1	2	2	1	4	5
Total .. .. .	203	234	311	329	499	593

Spain accounted for nearly 90 per cent. of the imports of oranges and mandarines into France last year while Algeria furnished about 10 per cent., supplies from other sources being negligible; imports from Spain in recent years have increased to a much larger extent than those from Algeria. Lemons are imported mainly from Italy and Spain and those countries last year accounted for about 74 per cent. and 24 per cent. respectively of the total. The bulk of the bananas consist of Canary Islands produce, supplemented by supplies from Central America, French West Africa and produce re-exported from other European countries. Guatemala figured somewhat prominently among countries of consignment last year, imports from that country amounting to over 18,000 tons, as compared with only negligible quantities previously.



For the first six months of 1932 France has fixed a quota for imports of bananas from foreign countries at 92,000 metric tons (90,500 tons), limiting imports from the Canary Islands to 68,080 metric tons (67,000 tons). A surtax on foreign imports also came into force this year.

In Table II are shown imports of apples into France in the past three years, with principal countries of consignment. Apples and pears have been separately distinguished in French trade returns only since 1929.

TABLE II.—*Imports of Apples into France.*

Country whence consigned.	1929.	1930.	1931.
	tons.	tons.	tons.
United States .. .. .	6,044	11,265	34,049
Belgium .. .. .	15,466	12,332	12,929
Switzerland .. .. .	3,885	1,412	8,157
Netherlands .. .. .	2,184	1,126	5,307
Italy .. .. .	1,928	5,583	3,446
Canada .. .. .	956	2,121	1,969
United Kingdom .. .. .	1,017	3,194	1,825
Other countries .. .. .	1,135	3,732	3,539
Total .. .. .	32,615	40,765	71,221

The increasing trade in imports of raw fruit into France, Germany, Scandinavia and other European countries not only offers to British Empire growers alternative markets for their produce, but also relieves the British market of quantities of fruit which would otherwise compete with Empire supplies.

#### IMPORTS OF FRUIT INTO SWEDEN.

The Scandinavian countries rank after the United Kingdom, Germany and France among the largest importers of raw fruit. They are far behind those countries in this respect, but the growth of their fruit import trade in recent years has been very rapid, and they are steadily developing as an outlet for the surplus fruit production of more southerly countries.

Developments in fruit imports have been most marked in Sweden. Home production of fruit barely suffices to supply one-half of the country's needs, and demand, which is being continually stimulated by propaganda, turns more and more to imported supplies. At the same time an impetus has been given to the importing trade by improvements in warehouse and cold storage accommodation at the ports and improved transport facilities.

The following table shows imports of the six principal raw fruits into Sweden in the six years, 1926 to 1931.

*Imports of Fruit into Sweden.*

Description.	1926.	1927.	1928.	1929.	1930.	1931.
	tons.	tons.	tons.	tons.	tons.	tons.
Apples .. ..	12,900	16,200	18,690	21,400	14,640	17,770
Pears .. ..	4,800	5,800	6,950	7,940	5,020	12,230
Grapes .. ..	1,120	1,140	1,390	1,670	1,820	2,130
Oranges .. ..	11,170	12,300	13,870	15,400	26,020	27,750
Lemons .. ..	1,520	1,580	1,520	1,620	2,150	2,330
Bananas .. ..	7,450	9,500	10,500	12,950	13,890	12,860
Total.. ..	38,960	46,520	52,920	60,960	63,540	74,890

In the space of the last six years total imports of the principal raw fruits have nearly doubled. All the different kinds have shown expansion, oranges particularly showing a steady increase throughout the period.

The United States still supplies the largest proportion of the apples, but imports from Australia show a steady increase. The total of 14,640 tons imported in 1930 included 7,860 tons from U.S.A. and 2,500 from Australia, while considerable quantities came from the United Kingdom, Germany and Denmark, consisting of fruit previously imported from other sources. Pears are imported mainly from Czechoslovakia, lemons from Italy and grapes from Spain, while the latter country has now replaced Italy as the chief source of supply of oranges. The bulk of the imports of bananas consists of re-exported fruit shipped from the United Kingdom. A fair proportion of imports of other kinds of fruit, grapes, oranges and lemons, imported from Germany also consist of re-exported produce. Figures relating to sources of supply in 1931 are not yet available.

There was an increase in imports of apples last year as compared with 1930 due to a large extent to the fact that the home crop fell considerably short of the very good yield of the previous year. Imports of bananas failed to reach the high level recorded in 1930, but imports of pears, grapes, oranges and lemons all rose to new high levels, the increase in imports of pears, as compared with previous years, being particularly marked.

#### IMPORTS OF FRUIT INTO NORWAY.

Fruit consumption in Norway is increasing steadily and the country imports substantial quantities of raw fruit to supplement home production. Home-grown apples, principally "Gravensteins," appear on the market during August and September and the supply is finished by October. The United States furnishes the bulk of the imported supplies, while fair quantities, consisting mainly of re-exported produce, are imported from Germany and the United Kingdom. The most substantial increase in consumption is shown in the case of citrus fruits and bananas. The consistent rise in imports of oranges and lemons was checked last year, but imports of bananas rose to a new high level. Spain supplies by far the heaviest proportion of the orange imports and the bananas imported are chiefly Jamaican. The trade in bananas is reported to be a monopoly of an Oslo Company which is carrying out an extensive advertising campaign for the increased sale of this fruit. Berry fruits are not imported, home production being sufficiently large to leave a margin for export, and fair quantities of currants and other berry fruits are shipped to the United Kingdom in the late summer months.

The following table shows imports of the principal fruits into Norway during the past six years.

*Imports of Fruit into Norway.*

Description.	1926.	1927.	1928.	1929.	1930.	1931.
	tons.	tons.	tons.	tons.	tons.	tons.
Apples and pears.. ..	4,059	5,345	3,965	4,691	3,629	4,503
Plums .. ..	2,818	2,782	2,726	2,879	2,292	2,488
Oranges and lemons ..	12,852	13,479	14,823	15,097	19,116	17,507
Bananas .. ..	5,864	6,585	6,945	7,872	8,292	8,575
Grapes .. ..	1,247	1,451	1,391	1,659	1,677	1,551
Total .. ..	26,840	29,642	29,850	32,198	35,006	34,624

## IMPORTS OF FRUIT INTO DENMARK.

Home production of fruit in Denmark falls considerably short of consumption and imports of apples have become so important in recent years that the size of the home crop has no longer any appreciable effect on the Copenhagen market. Denmark is a larger importer of apples than Sweden.

The following table shows imports of the six principal fruits into Denmark in the six years 1926 to 1931.

*Imports of Fruit into Denmark.*

Description.	1926.	1927.	1928.	1929.	1930.	1931.
	tons.	tons.	tons.	tons.	tons.	tons.
Apples .. ..	14,235	21,884	14,534	18,581	14,775	19,939
Pears .. ..	4,029	4,170	2,949	3,418	2,268	5,327
Grapes .. ..	997	987	1,131	1,301	1,118	1,075
Oranges .. ..	8,806	8,384	8,914	8,838	10,737	10,380
Lemons .. ..	1,680	1,804	1,429	1,440	1,804	2,256
Bananas .. ..	4,050	5,658	6,479	6,480	8,958	10,072
Total .. ..	33,797	42,887	35,436	40,058	39,660	49,049

In the space of the last six years total imports of the fruits shown in the above table have increased by nearly 50 per cent. Nearly all the fruits show a progressive expansion, but the import trade in bananas shows the greatest development, imports last year, which rose to a new high level, being about 2½ times as large as those of 1926. There was the usual increase in imports of apples—which appears to occur in alternate years—in 1931, but the total quantity imported fell short of the record of 22,000 tons imported in 1927. The United States continues to supply the largest proportion of the total imports, but there is keen competition from European countries, principally the Netherlands, Switzerland, Italy and Russia, in favourable crop years. Imports from the United States accounted for 40 per cent. of the total in 1929 and 60 per cent. in 1930, when supplies from Europe were only moderate owing to poor crops nearly everywhere. Imports of Australian apples in 1930 showed a slight recovery to 676 tons, as compared with 426 tons in the previous year and 865 tons in 1928, while imports from Canada are steadily increasing ;

imports in 1930 amounted to 387 tons, as against only 34 tons in 1926. There is a considerable re-export trade in apples from the free port of Copenhagen, which in recent years has averaged over 1,000 tons annually.

Spain supplies nearly 70 per cent. of the total imports of oranges and Italy about 20 per cent., and imports from the former country are increasing, while supplies from Italy tend to decline. Palestine accounted for about 300 tons of the total imports in 1930. The bulk of the lemons are imported from Italy, while Spain supplies the largest proportion of the grape imports. Pears are imported from various European countries with imports from Czechoslovakia predominating in favourable crop years. Total imports of pears rose to a new high level last year. The bulk of the imports of bananas are credited to Germany, the United Kingdom and the Netherlands, and consist of re-exported fruit, previously imported from other sources. Considerable quantities of apples, pears and oranges, and smaller quantities of lemons and grapes, recorded as imported from Germany, also consist mainly of re-exported fruit. Figures relating to sources of supply in 1931 are not yet available.

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# THE DEMAND FOR HONEY

REPORT OF AN INVESTIGATION BY THE STATISTICS  
AND INTELLIGENCE BRANCH OF THE EMPIRE  
MARKETING BOARD INTO THE RETAIL  
MARKETING OF HONEY



MAY, 1932

LONDON  
PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE  
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses  
Astral House, Kingsway, London, W.C.2 ; 120, George Street, Edinburgh.  
York Street, Manchester ; 1, St. Andrew's Crescent, Cardiff  
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1932

Price 1s. od. Net.

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X9(λ611:71):731.3.N3

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## THE DEMAND FOR HONEY

REPORT OF AN INVESTIGATION BY THE STATISTICS  
AND INTELLIGENCE BRANCH OF THE EMPIRE MARKET-  
ING BOARD INTO THE RETAIL MARKETING OF HONEY

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### I.—INTRODUCTION.

THE present report on the "Demand for Honey" is the sixth of a series of similar studies of the retail demand for certain Empire products. Previous reports have dealt with Cheese, Butter and Canned Fruits.

2. The object of this enquiry was to examine the position of Empire honey in the retail shops in London and Glasgow, to estimate the extent and nature of the competition from honey of foreign origin, and to obtain information on certain aspects of retail practice and regional preferences.

3. The survey was undertaken during the year 1930 and the early part of 1931; in any detailed comparison of stocks and prices, therefore, some allowance must be made for the fact that the areas were not surveyed simultaneously. Examination of the data from this angle, however, reveals little material difference, and in view of the nature of the commodity, it is probable that the time factor does not, on the whole, seriously affect the position.

4. In all, records were secured from 793 shops stocking honey in London, and from 345 in Glasgow, a total of 1,138. The information was obtained, according to a standard questionnaire, by personal interview with the proprietor or manager of the shop.

5. Information was also obtained from 25 honey importers, brokers, blender-packers and wholesale suppliers; from over 50 manufacturers, including manufacturing chemists, confectioners and bakers; and from 18 catering firms controlling about 750 restaurants.

6. The London part of the enquiry was carried out in two stages. During the first stage it was essential to learn in what trades honey was stocked, and what types of shop constituted the main channels

of its distribution. Three representative boroughs were therefore selected, and every shop was visited where there was a reasonable prospect of honey being found. Using the results obtained in this preliminary stage as a basis, the survey was then extended over the whole Metropolitan area, a proportionate number of shops of each trade and type being visited in the remaining boroughs. The Glasgow enquiry covered the same trades, and extended over twelve wards or about one-third of the City area.

7. For purposes of analysis, the shops have been classified according to type of organisation and class of trade. Thus, of the 1,138 shops for which records were obtained, 55 per cent. were independent or single shop businesses, and 45 per cent. were branches of multiple organisations, including both national and local multiple firms and Co-operative societies. About 36 per cent. of all shops were serving a population exclusively or mainly poor, and their class of trade has been classified as low, while 64 per cent. were catering for a higher class of trade, as evidenced by their situation and the apparent financial position of the greater proportion of their customers as well as by their trading methods. These groups include shops of all sizes, and the enquiry may be taken as representative of every type of retail business dealing in honey in London and Glasgow.

8. The Board desire to record their indebtedness for the assistance so generously afforded by members of the trades concerned, and to express their thanks to all who supplied information on the various aspects of the enquiry. It is recognised that investigations of this nature involve considerable trouble on the part of traders, and the Board are keenly appreciative of the active co-operation which was extended to their officers throughout the course of this work.

## II.—SUPPLIES.

### *Home Production.*

9. The total production of honey in England and Wales was estimated by the Ministry of Agriculture to be about 20,000 cwts. in 1925,\* but according to an estimate made in 1929, the output of a normal year is about 34,000 cwts. The increase was largely attributed to the recovery of the industry from the ravages of the Isle of

---

\* Agricultural Output of England and Wales in 1925. Cmd. 2815/1927.

1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050

Mally & Son

300  
Th.cwts

200  
Th.cwts

100  
Th.cwts

### IMPORTS OF HONEY INTO THE UNITED KINGDOM.

EMPIRE 

OTHER COUNTRIES 

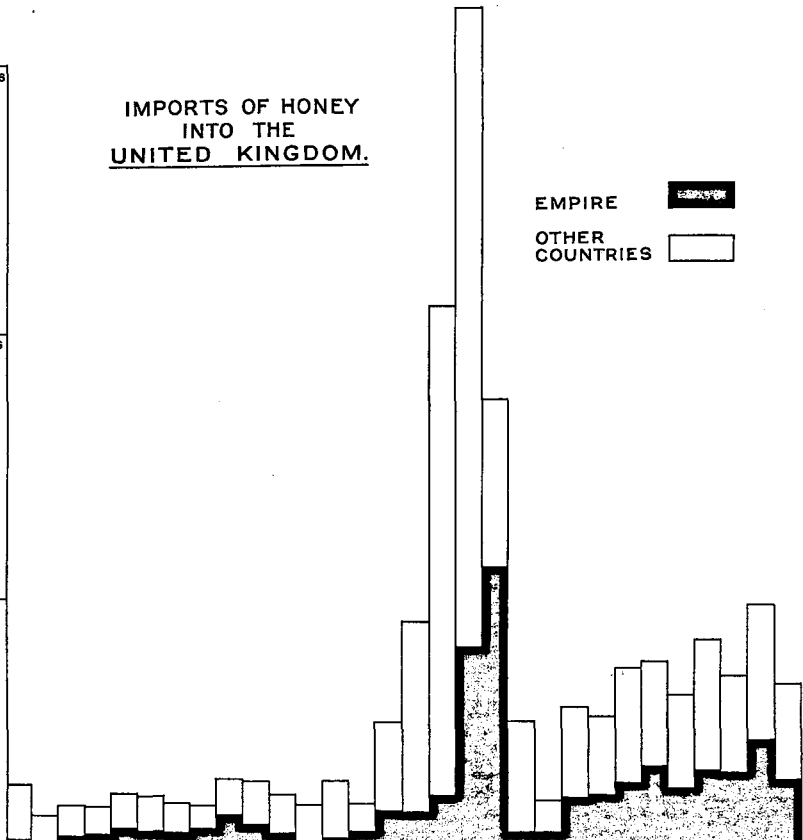


FIGURE I.

To face page 6.

Wight Disease, which, in the few years previous to 1925, had destroyed large numbers of colonies.\* No information in respect of Scottish production is available for any year subsequent to 1925 but in that year output amounted to 1,900 cwts.†

*Imports.*

10. Imported supplies of honey, though still comparatively small, have considerably increased since the beginning of the century. Between 1900 and the first year of the war imports varied between about 20,000 and 33,000 cwts. per annum. In 1915 there was a substantial rise to nearly 54,000 cwts. and by 1918 the record figure of 320,000 cwts. had been reached. A sharp decline followed in the succeeding years and in 1921 imports fell to about 25,000 cwts. or slightly more than the 1914 level. In 1922 there was again a substantial advance to 58,000 cwts. and this year may be said to mark the return to normal after the period of inflated war-time demand. Since 1922 the imports of honey have shown a definitely upward trend.

11. These movements are illustrated in Figures I and II. Figure I shows the long period trend in total imports; the enormously increased supplies during the war came chiefly from the United States, the West Indies and Australia. In Figure II is shown the trend of supplies from the principal countries since 1922.

12. In the five years 1926-30 the average annual import of honey into the United Kingdom was nearly 77,000 cwts. of which oversea Empire countries supplied an average of 47 per cent. Imports during the period are shown in a table in Appendix I.

13. The United States was the most important source and accounted on the average for a quarter of the supplies. The British West Indies with 18 per cent. were second in importance during the period, closely followed by New Zealand with about 17 per cent.; the average for New Zealand was reduced by the abnormally low import in 1930, due chiefly to an extremely bad season. Imports from Canada averaged over 9 per cent. and it may be noted that, apart from the year 1928 when there was a reduction, the quantity

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\* Report on the Marketing of Honey and Beeswax in England and Wales—Ministry of Agriculture and Fisheries. Economic Series, No. 28.

† The Agricultural Output of Scotland, 1925.

of Canadian honey coming to this country showed a consistent rise, the import of 11,800 cwts. in 1930 (representing 18 per cent. of the total imported supplies), being nearly two and one-half times as great as in 1926.

*Consumption.*

14. In the absence of annual estimates of British honey production average production from 1925 to 1929 may reasonably be placed at about 30,000 cwts. per annum, which is approximately the mean of the 1925 Census of Production figure and the 1929 estimate. In the same period retained imports averaged some 70,000 cwts., making a total available supply of about 100,000 cwts. per annum. On this basis average annual consumption per head of the population is about  $\frac{1}{4}$  lb.

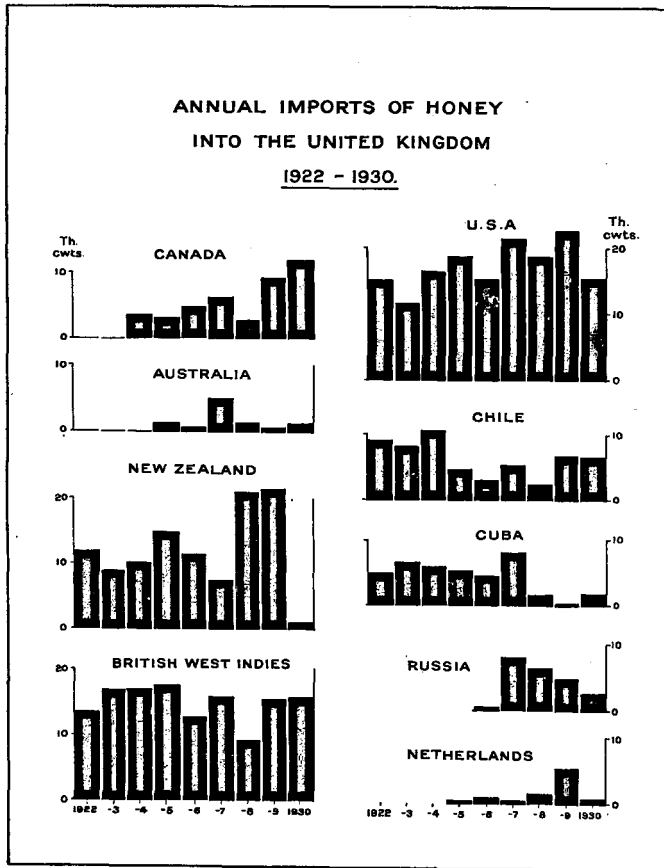
*Blending and Packing.*

15. Canadian honey is for the most part retailed under the brands "Beekist" and "Quebec", the former being the brand of the Ontario Honey Producers' Co-operative while the latter covers the honeys of the Cooperative Fédérée de Quebec. The greater part of Australian honey is marketed in this country under the label "Golden Wattle", the brand applied to the produce of the Australian honey co-operative associations shipped to their agents, the Overseas Farmers' Co-operative Federations, Ltd. The bulk of the New Zealand honey is retailed under the brand "Imperial Bee", the brand of the New Zealand Honey Producers' Association. Honey from these Dominions is also packed and marketed in considerable quantities under the labels of individual firms. Similarly, Jamaican honey and honey from the United States of America are usually retailed under the special brands of wholesale or retail firms. Many proprietary brands contain honey from more than one country of origin, the choice of constituents in each instance being determined by flavour, colour, market price, and various other factors.

16. The term "blend" in connection with honey has several shades of meaning. In the country of origin, honey from many farms and apiaries is blended in preparation for export: on arrival in the United Kingdom honey from different parts of a single country may be blended to produce a standardised representative type: and again, honeys from several countries are frequently mixed or blended together.

To face page 8.

FIGURE II.





17. Imported honey offered for retail sale is required to bear an indication of origin: the order provides for the use of the name of the country or countries of origin, the words " Empire " or " Foreign," or in the case of a mixture containing some foreign honey, the term " Blended Imported." (See Appendix II.)

18. In illustration of the extent of the practice of blending honey from different countries it may be mentioned that imported honey was found during the survey under 187 different designations or proprietary labels, of which 92 gave the name of a particular country of origin, and 95 were couched in terms applicable to blends or mixtures. Of these 95 brands, the honey in 60 instances was stated to be derived from Empire sources only, while 35 contained foreign honey and either bore the indication " Blended imported " or the names of more than one country of origin.

19. Honey is usually imported in large containers, and, apart from blending, its preparation for the retail trade mainly consists in repacking in containers of attractive appearance and convenient size. Containers for retail distribution are of three main kinds, glass jars, crocks and cartons, and of a variety of sizes; the most widely used type is the glass jar. Of eleven blender-packers interviewed in London and Glasgow, nine were packing in glass jars only; the others were packing some of their honey in glass jars and some in crocks. The advantages claimed for the glass jars are that consumers can see what they are buying, and that glass displays honey attractively, showing up the rich amber transparency of liquid honey, and the smooth texture and light colour of the set varieties. A generation ago honey was packed more often in crocks than in glass containers, and there is still a fairly wide-spread liking for these among consumers. An advantage of the crock or earthenware container is that it makes possible the sale of types of honey which are of such dark colour that they would not sell readily in glass.

20. Of more recent introduction is the carton container, which is often found useful for the sale of honey in small quantities, especially by chemists in poor districts as an alternative to selling loose honey. A fourth type, the tin, is usually packed in the country of origin, and not by blender-packers after import.

21. The usual sizes of glass jars are 2 lbs., 1 lb.,  $\frac{1}{2}$  lb.,  $\frac{1}{4}$  lb., and midget, the last term being used to describe any size smaller than  $\frac{1}{4}$  lb., and ranging from the 1 oz. size frequently used in restaurants

to jars holding about 3 ozs. In the majority of instances, the sizes are nominal and indicate only approximately the weight of the contents. The sizes most widely used in the retail trade are the 1 lb. and  $\frac{1}{2}$  lb. jar, described as "1's" and "halves." The most frequently used size in crocks is the 1 lb., but  $\frac{1}{2}$  lb. crocks are also common. Cartons are seldom used in other than  $\frac{1}{2}$  lb. and midget sizes, and tins are mainly restricted to quantities of over 2 lbs.

### III.—MANUFACTURING DEMAND.

22. The demand for honey arises from three main sources :—

- (a) from domestic consumers ;
- (b) from various manufacturing trades, such as chemists, confectioners, and bakers ;
- (c) from the catering trade.

No estimate is available of the relative quantities absorbed through these channels, but domestic consumption is by far the most important.

23. While the main body of this report deals with the retail trade through which the domestic consumer is supplied, it will be convenient here to summarise briefly the general position in regard to the manufacturing and catering demand.

#### *Chemists.*

24. The two pharmaceutical preparations containing honey which are in widest use are oxymel of squill, an important constituent of many cough mixtures, and honey borax. The honey in both these preparations is required to conform to the specifications of the British Pharmacopoeia, and is known as "purified honey". Honey is also widely used in the manufacture of proprietary cough cures, balsams and lung tonics, being employed as a demulcent and flavouring agent in combination with expectorants and sedatives. In addition to the employment of honey in medicinal preparations, one chemist stated that a small quantity was used by him in the manufacture of tooth-paste.

25. Of 16 leading manufacturing chemists, ten were using honey in quantities ranging from half a ton up to 100 tons per year. The total amount used by these firms during 1930 was 255 tons, and the requirements of the trade appeared to remain fairly steady from year to year. Of the total of 255 tons, 47 per cent. was Chilean honey,

and 35 per cent. Jamaican ; 9 per cent. was from the United States of America, and the remaining 9 per cent. was made up chiefly of New Zealand, Canadian, and Russian honeys. A property of Chilean honey which appears to recommend it to manufacturing chemists is that it retains its liquid consistency, and does not therefore mar the appearance of liquid compounds by becoming crystallised or lumpy after manufacture.

#### *Confectioners.*

26. The products in which honey most commonly occurs are chocolates and nougat, but it is also employed in the manufacture of toffee, marzipan goods, Turkish delight, caramels, crystallized gums, creams and pastilles. In chocolates honey is chiefly used to form centres ; in sugar confectionery it is mainly used as a flavouring, though it is also said to impart a certain richness to the texture of the various sweets.

27. Of 23 manufacturing confectioners from whom information was obtained, 17 were using honey, the quantities ranging from half a hundredweight up to 250 tons per year. There is some evidence that the utilization of honey in this industry is decreasing, although the decline appears to be slow. One large firm making sweets stated that they were using only half as much honey as they did five years ago, while several others had reduced their quantities by about a quarter. On the other hand, one firm specialising in certain types of toffee and nougat reported that they had previously used very little honey but were now taking about six tons a year, while several chocolate firms stated that their consumption over a period of years had been fairly regular.

28. The aggregate amount taken by the 17 firms during 1930 was about 300 tons, of which some 85 per cent. came from the United States and Chile, principally the former, 13 per cent. was of British West Indian origin, and the remaining 2 per cent. was English, Scottish, Canadian, New Zealand or Cuban.

#### *Bakers and Biscuit Makers.*

29. To a limited extent, honey is used in the making of cakes, biscuits, rusks and ginger-bread, mainly as a flavouring ; dark honey is used for colouring certain kinds of biscuit, while honey is said to have a preservative effect in cakes and ginger-bread, maintaining in the product a palatable moisture.

30. Of 19 large firms visited, nine were using honey, the quantities varying between  $1\frac{1}{2}$  cwts. and 9 tons per year. By comparison with the quantities used five years ago there did not appear to be any material change. Two large firms reported an increase in each case of about 20 per cent., but this was probably attributable to the general expansion of their business; one smaller firm had found honey to be unpopular as a flavouring and was reluctantly dropping its use and substituting sugar. The total amount used in a year by the nine firms was about 35 tons, of which 43 per cent. was from the United States and Cuba, 37 per cent. from Jamaica, and the remainder in about equal parts from Australia and Chile. As in the case of confectionery, the demand for products containing honey remains fairly steady throughout the year.

*Manufacturing Trades—Summary.*

31. The manufacturing firms of the three kinds which were visited were using honey at the rate of nearly 600 tons a year, and the total quantity of honey used in manufacturing is no doubt considerably more. Of the total for which particulars were obtainable West Indian, United States and Chilean honey accounted for no less than 95 per cent. In fact the quantity of Chilean honey used by the 36 firms which were using honey was about 70 per cent. of the total imports of Chilean honey in 1930. The proportion for other countries was much smaller, but over 20 per cent. of the United States and nearly 20 per cent. of the Jamaican honey imported appears to be used for manufacturing purposes.

*The Catering Trade.*

32. During the last few years honey has been increasingly included in the menu cards of restaurants. It is served sometimes in midget containers, and sometimes loose in portions. Many restaurants maintain a counter trade, and find that their sale of honey over the counter is stimulated by the serving of honey at meals.

Of the 18 catering firms interviewed, eleven supplied honey in their restaurants and buffets. In the case of nine firms controlling about 400 restaurants, the average amount of honey served at table during 1930 amounted to 46 lbs. per restaurant, or a little less than 1 lb. per week. Of about 700 restaurants supplying honey, 58 per cent. were serving Empire honey, of which more than half was New Zealand.

#### IV.—GENERAL ASPECTS OF THE RETAIL TRADE.

33. As already stated, the survey was carried out in three stages: intensively in three selected London boroughs, by sample in the remaining 25 boroughs in London and intensively in twelve wards in Glasgow, comprising about one-third of the whole Glasgow area.

##### *The Survey in London.*

34. The special object of the first London survey was to ascertain in what types of shop honey was stocked, and broadly the relative proportion of the honey trade done in each type of shop. The boroughs selected for this part of the enquiry as being fairly representative of different sections of London were Kensington, Paddington and Shoreditch and every shop in these areas in which there was a reasonable probability of honey being stocked was visited. With the exception of a poor and congested district at the northern extremity, Kensington is almost wholly residential and contains a considerable population of the middle and wealthy classes. Paddington combines all three classes but in somewhat different proportions, while, by contrast, Shoreditch is definitely industrial, its resident population being almost wholly of the wage-earning class.

35. During this part of the survey 1,045 shops were visited, of which 348, or about a third, were stocking honey. Table I below shows the relative importance of the retail trade in honey in the several types of shops in the three boroughs.

36. It will be seen that in every trade except that of chemists the percentage of shops stocking honey was very much lower in Shoreditch than in either Kensington or Paddington, which confirms the general belief that the trade in honey for table use is almost entirely confined to the upper and middle classes. On the other hand the proportion of chemists stocking honey was larger in Shoreditch than in either of the other boroughs, indicating that among the industrial population the use of honey is largely medicinal.

37. Similar differences were observed in the average sales of the shops stocking honey. With the exception of the confectioners' shops in Shoreditch the average sales per shop were much higher in the residential boroughs. The high average sales in the two confectioners' shops in Shoreditch, were due to the fact that both shops are restaurants situated on the borders of the City and have an exceptional counter trade with City workers.

38. The combination of these two factors results in some very marked contrasts in aggregate sales. More than half the total annual sales of honey in the three boroughs was concentrated in the six departmental stores, but it must be borne in mind that these stores serve a much wider area than their immediate neighbourhood. Excluding the sales of the departmental stores, the total sales of honey amounted in Kensington to 370 cwts. a year and in Paddington to 186 cwts., against a total of only 14 cwts. in Shoreditch.

TABLE 1.

*Retail Honey Trade in Kensington, Paddington and Shoreditch.*

Type of Shop.	Total Number of Shops Visited.			Number Stocking Honey.			Percentage Stocking Honey.			Average Annual Sales per Shop Stocking.		
	K.	P.	S.	K.	P.	S.	K.	P.	S.	K.	P.	S.
Grocers ..	160	103	110	79	57	7	49	55	6	2.8	1.8	0.3
Dairies ..	90	55	36	67	47	7	74	85	19	1.6	1.3	0.2
Chemists ..	64	38	21	20	12	10	31	32	48	0.7	1.1	0.6
Confectioners ..	81	63	43	16	14	2	20	22	5	1.4	0.9	2.5
Fruiterers ..	91	52	32	4	—	—	4	—	—	1.0	—	—
Departmental Stores.	6			6			100			110.0		

39. As the result of this survey it was clear that the following trades constitute in varying proportions the main channels through which honey is retailed to the domestic consumer—grocers, dairies, chemists, confectioners and fruiterers. It may here be mentioned that in the preliminary enquiry, and throughout the remainder of the survey, for the purpose of analysis, the grocery departments of departmental stores and large central shops have been treated separately owing to their exceptionally large turnover. Among confectioners are included confectionery-bakers, in addition to those restaurants having a confectionery counter. "Retail trade" in restaurants is taken as synonymous with "counter trade" and

thus excludes any account of the serving of honey with meals. Similarly, no account has been taken of the use of honey in chemists' shops in making up medicinal compounds.

40. The extension of the survey in London from the three boroughs in which every shop was visited to the remaining 25 boroughs in the Metropolitan area was undertaken in order to amplify and supplement the earlier results, and to make the enquiry as representative as possible of London as a whole. The method employed was to visit a proportionate number of shops of each type and class in each of the honey-stocking trades situated in or near the main shopping centres of every borough, and the proportions taken as a basis to determine the number of shops in the different trades to be visited were those which had been found in the intensive survey of the three boroughs in which all shops were visited.

41. In this stage of the survey 904 shops were visited, of which 445, or nearly half, were found to be stocking honey. The results obtained are summarised in Table 2.

TABLE 2.  
*Retail Honey Trade in certain Shopping Centres in London.*

Type of Shop.	Total No. of Shops Visited.	Number Stocking Honey.	Percentage Stocking Honey.	Average Annual Sales per Shop.
			Per cent.	Cwts.
Grocers .. .. .	310	196	63	2.3
Dairies .. .. .	151	120	79	2.2
Chemists .. .. .	118	69	58	1.3
Confectioners .. .. .	168	40	24	1.4
Fruiterers .. .. .	151	14	9	1.1
Departmental Stores ..	6	6	100	179.9

*The Survey in Glasgow.*

42. Glasgow was included in the enquiry in order that a picture might be obtained of another large consuming centre comparable with that obtained in London. The method employed was similar to that used in the first London survey. Every shop of the honey-stocking trades was visited in the area selected, which covered about a third of the whole city. Twelve wards, with a combined population

of 371,000, were chosen as being representative of the various sections of the city. Broadly the area includes three types of district.

(1) The central shopping district, including the Exchange Ward and parts of Blythswood.

(2) A mainly residential area containing a population of all classes and including the Wards of Whiteinch, Pollokshaws, Camphill, Park, Woodside, North Kelvin and Govanhill.

(3) A definitely industrial area with a population almost wholly working-class and including the Wards of Calton, Govan, Mile End and Shettleston.

43. In the Glasgow area, 1,612 shops in the five honey-stocking trades were visited and of these 345, or rather more than one-fifth of the total, were stocking honey. Table 3 shows the results obtained.

TABLE 3.  
*Retail Honey Trade in Glasgow.*

Type of Shop.	Total No. of Shops Visited.	Number Stocking Honey.	Percentage Stocking Honey.	Average Annual Sales per Shop.
			Per cent.	Cwts.
Grocers .. .. .	552	171	31	1·6
Dairies .. .. .	410	20	5	0·4
Chemists .. .. .	118	96	81	0·8
Confectioners .. .. .	219	13	6	0·7
Fruiterers .. .. .	305	37	12	2·1
Large Central Stores .. .. .	8	8	100	45·1

44. The proportion of shops stocking honey, and the average sales per shop, were, on the whole, lower in Glasgow than in London, although a high proportion of Glasgow chemists was found to be stocking honey; fruiterers were also an exception to the general rule, but this is partly explained by the fact that, in Glasgow, confectionery is often included as a supplementary business in fruiterers' shops. In Glasgow, as in London, however, demand for honey comes mainly from the more prosperous sections of the community. The shops stocking honey, with the exception of chemists, were found to be much more numerous in central and residential districts than in industrial areas, and the largest trade was concentrated in a few central shops corresponding to the departmental stores in London, which cater for a good class of custom drawn from a wide area.



45. Between the prevailing practice in London and Glasgow, certain marked differences were noted. Omitting departmental stores and large central shops the highest proportion of shops stocking honey in London was found among dairies ; in Glasgow, where the majority of dairies cater for a different type of trade, the proportion was lowest of all. But it should be noted that both in London and Glasgow, again excluding departmental stores, the grocers were responsible for the largest individual share of the trade ; in London the dairies were next in importance, in Glasgow the chemists and fruiterers.

46. In all districts of Glasgow a much larger proportion of chemists stocked honey for sale over the counter than in London. The difference was particularly noticeable in residential neighbourhoods ; in Kensington, for example, only 31 per cent. of the chemists stocked honey, with average sales of .7 cwt. per annum, the corresponding figures for similar districts in Glasgow being 82 per cent. and .8 cwt.

47. The results of the various stages of the enquiry have been brought together in Table 4, and are further illustrated in Figure III.

TABLE 4.  
*Retail Honey Trade in London and Glasgow.*

Type of Shop.	Total Number of Shops Visited.			Number of Shops Stocking Honey.		
	London.		Glasgow.	London.		Glasgow.
	K.P. and S.	Remainder.		K.P. and S.	Remainder.	
Grocers .. .. .	373	310	552	143	196	171
Dairies .. .. .	181	151	410	121	120	20
Chemists .. .. .	123	118	118	42	69	96
Confectioners .. .. .	187	168	219	32	40	13
Fruiterers .. .. .	175	151	305	4	14	37
Departmental Stores and Large Central Shops ..	6	6	8	6	6	8

TABLE 4.—*continued.*

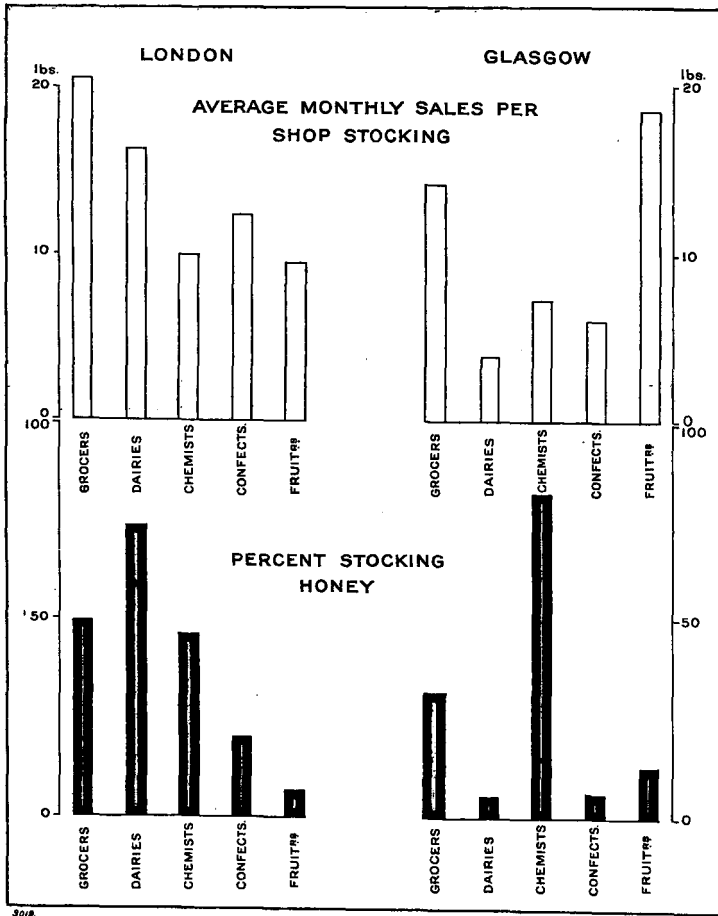
Type of Shop.	Percentage of Shops Stocking Honey.			Average Annual Sales per Shop Stocking Honey.		
	London.		Glasgow.	London.		Glasgow.
	K.P. and S.	Remainder.		K.P. and S.	Remainder.	
	Per cent.	Per cent.	Per cent.	Cwts.	Cwts.	Cwts.
Grocers .. .. .	38	63	31	2·3	2·3	1·6
Dairies .. .. .	67	79	5	1·4	2·2	0·4
Chemists .. .. .	34	58	81	0·7	1·3	0·8
Confectioners .. .. .	17	24	6	1·2	1·4	0·7
Fruiterers .. .. .	2	9	12	1·0	1·1	2·1
Departmental Stores and Large Central Shops ..	100	100	100	109·7	179·9	45·1

48. The proportion of the shops visited found to be stocking honey, and the average sales per shop, were considerably lower in the intensive survey carried out in the three London boroughs than in the sample survey in the remaining London areas. This difference is due to the concentration in the latter survey upon shops situated in the main shopping centres, or within easy reach of them. The shops in these centres tend to carry a wider range of commodities, and generally enjoy a larger turnover than the average of all shops.

49. The figures given above, representing the proportion of shops stocking honey and their average sales, are, therefore, not strictly comparable as regards the two London surveys, and on these points (but these two points only) the survey carried out in Kensington, Paddington and Shoreditch may perhaps be taken as more truly representative than the later survey of London trade as a whole.

50. The disparity is of no material consequence except in regard to the two questions now under discussion—proportion of shops

**FIGURE III**  
**DISTRIBUTION OF HONEY TRADE**  
**DEPARTMENT STORES EXCLUDED.**



stocking honey and average sales per shop. The sample in the survey of the remaining London areas was based upon the proportions of shops in the three boroughs first surveyed and the relation between the various types of shops found to be stocking honey and their average sales was much the same at the two London surveys. The questions dealt with in the later sections of this report are not materially affected by the difference in method, except in one or two instances to which attention is drawn in the course of the report.

#### *Sales in the Honey Stocking Trades.*

51. The five trades covered by the survey are grocers, dairies, chemists, confectioners and fruiterers, but for the purpose of analysis a sixth division has been added to include the departmental stores in London, and a few of the largest central shops in Glasgow. The necessity for this arrangement becomes clear when the great variety of honeys stocked by these large stores, and the extremely disproportionate volume of their sales compared with those of the general run of shops, are taken into consideration. It was found, for instance, that two departmental stores in London were selling more honey per month than the 683 grocers visited in London, while the twelve departmental and central stores in London were selling more than the remaining 1,937 shops of all the trades combined. The disparity was slightly less in Glasgow, but even then the honey trade was greater in three central stores than in the 552 grocers' shops visited in the twelve wards. In the analysis of sales undertaken in the following paragraphs departmental stores have accordingly been omitted, but certain aspects of this special branch of the retail trade have been considered in Section VIII.

52. One further distinction should be mentioned. The shops have been grouped according to the basis of their organisation and class of trade, the terms used to differentiate being independent and multiple on the one hand, and 'high' and 'low' on the other.

53. By independent is meant a firm with a single shop; multiple shops are branches of some larger organisation which may be either national or local in its scope, and include Co-operative Stores. The terms 'high' and 'low' have been used to distinguish between shops which serve all classes of the public and those whose custom is

definitely restricted to poor neighbourhoods. If a threefold classification were used, most of those classed here as high would have been classed as middle, but the number of shops doing an exclusively high class trade is so small that it has been found better to make two classes only.

54. *Average Monthly Sales.*—In both the centres under survey, but particularly in Glasgow, branches of multiple organisations were more often stocking honey than independent retailers. In London 56 per cent. of the multiple shops visited carried stocks as compared with 33 per cent. of the independents, the corresponding figures for Glasgow being 34 and 16 per cent. With the exception of the small number of fruiterers in London, all of which were of the independent type, the same tendency was noted in each of the honey stocking trades, but the disparity was less marked among the grocers in London and the chemists in Glasgow than among the other trades.

55. In both cities average monthly sales were substantially greater for multiples than independents. The highest average in London occurred in the grocers' shops, but the average sales in the multiple dairies were more than twice as heavy as in the independent grocers, and only slightly less than in the multiple grocers. Sales in all types of Glasgow shops were generally on a lower level than in London, but this is probably due in part to the higher average sales in the sample survey in London, to which reference was made above. The disparity between independents and multiples was not nearly so marked in Glasgow as in London. Fruiterers were, however, an exception and the average sales in the 13 multiple shops of this type stocking honey were higher than those of any other kind or type of shop. The explanation for this high average lies in the fact that four of the Glasgow fruiterers visited were selling honey at the rate of 100 lbs. a month, and three more from 40 to 60 lbs. each, these seven shops, less than a fifth of the total fruiterers stocking honey in Glasgow, accounting for three-quarters of the total sales by fruiterers.

Details are given in Table 5 in which results have been classified on the basis of the type of organisation of the shop.

TABLE 5.

*Shops Stocking Honey and Monthly Sales grouped on the basis of Organisation.*

Type of Shop.	Total Number of Shops Visited.		Number Stocking Honey.		Percentage Stocking Honey.		Total Monthly Sales of Honey.		Average Monthly Sales per Shop.	
	Ind.	Mult.	Ind.	Mult.	Ind.	Mult.	Ind.	Mult.	Ind.	Mult.
<i>London.</i>					Per cent.	Per cent.	lbs.	lbs.	lbs.	lbs.
Grocers .. ..	438	245	194	145	44	59	2,642	4,563	14	31
Dairies .. ..	233	99	145	96	62	97	1,218	2,845	8	30
Chemists .. ..	159	82	51	60	32	73	266	872	5	15
Confectioners ..	188	167	19	53	10	32	224	683	12	13
Fruiterers .. ..	288	36	18	—	6	—	177	—	10	—
<i>Glasgow.</i>										
Grocers .. ..	283	269	74	97	26	36	804	1,712	11	18
Dairies .. ..	357	53	14	6	4	11	51	29	4	5
Chemists .. ..	86	32	67	29	78	91	290	427	4	15
Confectioners ..	136	83	4	9	3	11	17	63	4	7
Fruiterers .. ..	282	23	24	13	9	57	254	465	11	36

56. As would be expected from the nature of the commodity, high-class shops greatly preponderated among the shops stocking honey, particularly in Glasgow. This tendency was observed in both centres, and in all trades except chemists; in London the proportion of chemists in poor class neighbourhoods which were stocking honey was slightly higher, while in Glasgow the proportions were 87 per cent. of high class shops to 75 per cent. of low as compared with 55 and 11 per cent. for Glasgow as a whole.

57. Average monthly sales in the shops classed as high were on the whole about three times as great as in the type found in the poorer districts. Exception must, however, be made in the case of the confectioners in London, but the average for this class is affected by the rather unusual counter trade conducted by two shops situated on the borders of the City.

Table 6 shows the shops in the various trades classified according to their class of trade.

TABLE 6.  
*Shops Stocking Honey and Monthly Sales grouped on the  
basis of Class of Trade.*

Type of Shop.	Total Number of Shops Visited.		Number Stocking Honey.		Percentage Stocking Honey.		Total Monthly Sales of Honey.		Average Monthly Sales per Shop.	
	High.	Low.	High.	Low.	High.	Low.	High.	Low.	High.	Low.
<i>London.</i>					Per cent.	Per cent.	lbs.	lbs.	lbs.	lbs.
Grocers .. ..	245	438	192	147	78	34	6,014	1,191	31	8
Dairies .. ..	158	174	146	95	92	55	3,438	625	24	7
Chemists .. ..	182	59	83	28	46	47	988	150	12	5
Confectioners ..	203	152	68	4	33	3	844	63	12	16
Fruiterers .. ..	167	159	15	3	9	2	163	14	11	5
<i>Glasgow.</i>										
Grocers .. ..	155	397	105	66	68	17	1,957	559	19	8
Dairies .. ..	38	372	7	13	18	3	48	32	7	2
Chemists .. ..	67	51	58	38	87	75	597	120	10	3
Confectioners ..	64	155	10	3	16	2	71	9	7	3
Fruiterers .. ..	53	282	27	10	51	4	674	45	25	5

58. *Distribution of Sales.*—The minor position of honey in the scale of commodities is indicated by the very large proportion of shops which were selling under 10 lbs. of honey a month. The details given in Table 7, which shows monthly sales of honey graduated in a series ranging from less than 10 lbs. to over 100 lbs. per month, illustrate the outstanding feature of a study of the data on sales collected during the survey—the high relative importance of a small section of the trade.

59. Graduated monthly sales in the five honey-stocking trades have also been shown graphically in Figure IV, which throws this point into relief. The diagram is of further interest in that it shows the relative importance of the sales in the different trades, but in this connection it should again be repeated that the sales per shop in London and Glasgow are not truly comparable owing to the somewhat special character of the shops visited at the second London survey. Moreover, the diagrams for the London and Glasgow shops have been drawn on different scales, and, for this reason also, direct comparisons between the two cities cannot be made.

TABLE 7.  
*Graduated Sales in the Honey-stocking Trades.*

Monthly Sales of Honey.	Number of Shops.						Total Monthly Sales.					
	Grocers.	Dairies.	Chemists.	Confectioners.	Fruiters.	Total.	Grocers.	Dairies.	Chemists.	Confectioners.	Fruiters.	Total.
<i>London.</i>												
Less than 10 lbs.	138	128	68	37	9	380	496	521	237	197	31	1,482
10 - 20 lbs. ..	60	44	20	17	5	146	827	550	238	187	62	1,864
20 - 30 " ..	51	22	12	11	4	100	1,144	488	257	227	84	2,200
30 - 40 " ..	29	10	7	4	—	50	936	321	216	126	—	1,599
40 - 50 " ..	19	18	3	1	—	41	817	754	120	45	—	1,736
50 - 60 " ..	18	8	—	1	—	27	919	409	—	50	—	1,378
60 - 70 " ..	8	2	—	—	—	10	480	120	—	—	—	600
70 - 80 " ..	2	—	1	1	—	4	142	—	70	75	—	287
80 - 90 " ..	6	4	—	—	—	10	484	320	—	—	—	804
90 -100 " ..	1	2	—	—	—	3	96	180	—	—	—	276
100 lbs. and over	7	3	—	—	—	10	864	400	—	—	—	1,264
Total ..	339	241	111	72	18	781	7,205	4,063	1,138	907	177	13,490
<i>Glasgow.</i>												
Less than 10 lbs.	88	17	78	10	22	215	293	32	257	34	76	692
10 - 20 lbs. ..	45	2	12	2	7	68	523	28	140	22	83	796
20 - 30 " ..	15	1	2	1	1	20	340	20	40	24	20	444
30 - 40 " ..	10	—	1	—	—	11	328	—	30	—	—	358
40 - 50 " ..	2	—	—	—	2	4	88	—	—	—	80	168
50 - 60 " ..	4	—	—	—	—	4	200	—	—	—	—	200
60 - 70 " ..	1	—	—	—	1	2	60	—	—	—	60	120
70 - 80 " ..	1	—	1	—	—	2	72	—	70	—	—	142
80 - 90 " ..	—	—	1	—	—	1	—	—	80	—	—	80
90 -100 " ..	1	—	—	—	—	1	80	—	—	—	—	80
100 lbs. and over	4	—	1	—	4	9	522	—	100	—	400	1,022
Total ..	171	20	98	13	37	337	2,516	80	717	80	719	4,112



60. About half the shops stocking honey in London were selling under 10 lbs. a month, and these shops accounted for only one-tenth of the trade; the proportions in Glasgow were rather higher at just under two-thirds and one-fifth respectively. Barely one-third of the London shops and about one-quarter of the shops in Glasgow were selling an average of between 10 and 30 lbs. a month, and only 15 per cent. in London and 6 per cent. in Glasgow, a monthly average of from 30 to 60 lbs. The effect of this uneven distribution of sales was that about nine-tenths of the total trade in London, other than that of the large stores, was done by half the shops and over four-fifths of the Glasgow trade, excluding the large central shops, by about one-third of the shops.

61. The grocery trade was the most important in both centres, but the proportion of grocers' shops with low average sales was nevertheless comparatively high. In London about 40 per cent. were recorded as selling under 10 lbs. per month, and these shops accounted for only 7 per cent of grocers' sales; for the Glasgow shops the proportion was rather more than half with about one-tenth of the trade. The bulk of the grocers' trade was in the hands of about three-fifths of the shops in London and under half the shops in Glasgow, and these shops accounted for no less than 90 per cent. of the trade in each city.

62. Among the other trades the concentration of business in a few shops was especially noticeable. Nearly nine-tenths of the honey trade in the London dairies, for instance, was carried on by less than half the shops; about two-fifths of the London chemists were responsible for four-fifths of the sales; and more than half the business done by confectioners in London and Glasgow combined was in the hands of barely a quarter of the shops.

63. The explanation of the high relative importance of a comparatively small number of shops in each trade lies mainly, though not entirely, in the low level of sales ruling in a substantial proportion of the shops of medium and small size, which formed the bulk of the shops stocking honey. In all trades considerable variations were found as between individual shops; large shops with small sales were not unusual and comparatively high average monthly sales in medium and small shops were quite frequently noted, but generally there was a definite relation between the size of the shop and the volume of sales.

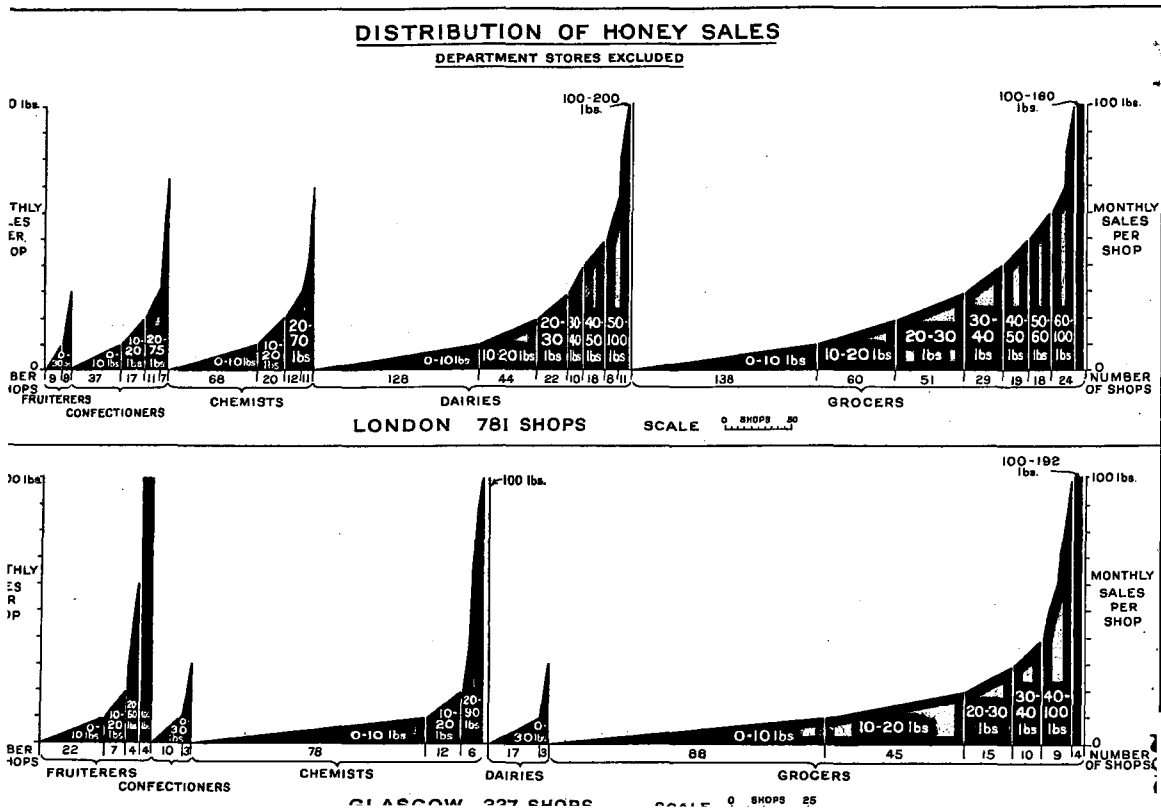


FIGURE IV

64. On the whole, the greatest proportion of sales in the grocers', chemists' and fruiterers shops was contributed by the large shops, whereas in the dairy and confectionery trades medium and small shops accounted for the larger proportion of the total. Half the sales among the London grocers, for example, were being made in the shops classified as large, which amounted to less than one-third of the total ; in Glasgow, also, sales in the large shops were responsible for over half the total for the trade in the city.

65. Among the dairies, on the other hand, shops which could be classified as large were comparatively rare ; in London they formed only 2 per cent. of the total and accounted for no more than 6 per cent. of the sales in all the London dairies, the remaining 94 per cent. of the trade being about equally divided between medium and small shops, the latter class considerably preponderating. None of the dairies visited in Glasgow could be classified as large ; about four-fifths of the shops were small and the proportion of the small total trade contributed by these shops was about 60 per cent. A further point to be taken into consideration in comparing dairies with other trades is that there is a greater measure of uniformity of size among shops of this type, and also that the main business of the dairy lends itself to smaller units.

#### V.—THE ATTITUDE OF THE CONSUMER TOWARDS HONEY.

66. Practically all retailers regarded honey as a very minor sideline in their business and not as one of the staple commodities on which their trade depended. Various reasons were put forward in explanation of the popular lack of interest in honey as a food. Thus, for example, it was frequently pointed out that American and Continental cooks used honey in a variety of dishes, but in this country no method other than that of consumption with bread seemed to be generally known. Again, as a potential competitor with jam, honey was considered to be too expensive for mass consumption, and it suffered from its failure to offer any marked variety of flavour. The most potent of all discouraging influences upon the wide use of honey as a food, however, was said to be its association in the mind with medicine. From early childhood in a great number of homes honey was remembered as the invariable vehicle of cough medicines and

the suggestion was frequently put forward that propaganda was probably the most effective means of counteracting this early impression.

67. Retailers, generally, were agreed that the sale of honey could be stimulated by effective displays in the window or the shop. Customers seldom include honey in their shopping lists, but an attractive counter display often results in an addition to the list.

68. The association of honey with sore throats and colds was markedly reflected in the seasonal variation in sales. All classes of retailer agreed that the bulk of their honey trade took place in the late autumn and in winter. Many who made special displays of honey only did so during the cold weather, and some gave up stocking honey in the summer months. The sale of clear honey as distinct from set was also stated to be greater in the winter, clear honey being more suitable for compounding domestic remedies, while set was preferred for table use. It was mentioned by some restaurant proprietors that the demand for honey and milk was increasing.

69. Methods of packing honey elicited some interesting comments. Crocks were not popular with the Scottish housewife, who, it was stated, preferred to see both the colour and the quantity of what she bought. But, in London, crocks were fairly popular, partly from custom, and partly because of their adaptability to other uses. At special seasons like Christmas, honey was sold in highly decorative jars and pots, which sometimes cost far more than their contents. Glass jars were criticised on the score of shape, and in some cases for the method by which the cap was made adjustable. Long narrow jars were said to be suitable for liquid honey, but when it was firmly set a shorter and wider jar was more convenient. People were said to prefer caps which unscrew or come off with a half turn to those that need leverage with a knife-point or the pressure of a thumb upon the centre. To meet these criticisms the Ministry of Agriculture and Fisheries has recently introduced, for honey produced in England and Wales, a type of glass jar fitted with a quick-grip quarter-turn cap, and practically shoulderless in shape. The packing of home-produced comb honey was frequently criticised, and the neat Canadian and United States sections were held up as patterns on the ground that the cellophane wrapping successfully excludes dust and flies, while permitting a clear view of the contents.

This question has also engaged the attention of the Ministry, and a standard package for comb sections, consisting of a carton with large cellophane windows in the front and back panels, has now been designed.

#### VI.—TYPES, CONTAINERS, SIZES AND PRICES.

70. Honey offered for retail sale is of two main types—comb honey and extracted honey. Extracted honey may be either set or clear.

71. Comb honey is sold in wooden sections, each containing a nominal pound weight. These sections are packed in various ways. English sections are often covered at the back and front by a sheet of glass, which is kept in place by a strip of adhesive paper round the edge (but see para. 69 above). American sections are usually wrapped in transparent cellophane paper: Canadian sections are packed in cartons with a cellophane centre.

72. Honey is extracted from the comb by draining, by centrifugal extractors, or by expression, and is packed while clear or liquid. Most honeys, however, tend to become set when cold, some types more readily than others. New Zealand and Canadian honey are nearly always set when found in the shops, while West Indian and Californian are more often clear. Home produced honey is found fairly frequently in both states.

73. Extracted honey is packed for the retail trade in glass jars, in earthenware crocks which may be either plain or fancy, and in cartons similar to those used for cream. Tins are chiefly used for quantities of 2 lbs. and over.

74. The sizes in common use are 2's, 1's, halves, quarters and midgets, but larger sizes are also packed. Sizes are usually nominal and represent approximate weights in lbs.

#### *Comb Honey.*

75. Honey in the comb was found in 11 per cent. of the shops stocking honey and more often in Glasgow than in London. Of the Glasgow shops, 52, or 15 per cent., were stocking this type of honey, while the London figures were 77, or 10 per cent. No London shop was stocking honey in the comb exclusively, nor did any London

retailer state that his maximum sales were of this type. On the other hand, nine shops in Glasgow were stocking comb honey only, and in eight other Glasgow shops, in which both types were stocked, sales of comb honey were said to be greater than those of other kinds.

76. Practically all the department stores in London, and the large central shops in Glasgow stocked honey in the comb, and it was in these shops that the greatest volume of the trade in comb honey was done.

TABLE 8.  
*Number of Shops in each Trade stocking Comb Honey.*

Type of Shop.	Number of Shops Stocking Honey.		Number of Shops Stocking Comb Sections.	
	London.	Glasgow.	London.	Glasgow.
Grocers .. .. .	339	171	30	26
Dairies .. .. .	241	20	25	1
Chemists .. .. .	111	96	—	1
Confectioners .. .. .	72	13	7	3
Fruiterers .. .. .	18	37	4	14
Department Stores and large Central Shops ..	12	8	11	7

77. Honey in the comb is a relatively high-priced product, and the trade is to a large extent confined to high class shops.

78. The bulk of the comb honey found during the survey was either Home produced or imported from the United States. Towards the close of the enquiry, however, Canadian honey in the comb was also found. In London most of the comb honey was English: in Glasgow American or Scottish predominated. A number of shops both in London and in Glasgow were found to be stocking comb honey of two or more kinds, but this practice was the exception rather than the rule.

TABLE 9.  
*Number of Shops stocking Comb Honey from the several Countries.*

Country of Origin.	London.	Glasgow.
Home .. .. .	57	24
United States .. .. .	18	35
Irish Free State .. .. .	4	8
Canada .. .. .	2	2
British West Indies .. .	1	—
Empire (country not stated)	1	—
Foreign (country not stated)	1	—

*Extracted Honey.*

79. Very much the largest proportion of honey on the retail market has been extracted and packed in some kind of container. Of the 1,138 shops which were stocking honey, all but nine were stocking the extracted type, and of these only 120 were stocking comb and extracted honey simultaneously.

*Consistency.*

80. Until within the last few years, clear or liquid honey was generally preferred, but the survey gave evidence of a wide though gradual change-over to a preference for set or granulated honey. In London the shops stocking clear honey and set were fairly evenly divided; in Glasgow the preponderance was definitely on the side of set honey.

TABLE 10.  
*Percentage of Shops in each Trade stocking Clear and Set Honey.*

Type of Shop.	London.			Glasgow.				
	Total Number of Shops Stocking Extracted Honey.	Percentage Stocking.			Total Number of Shops Stocking Extracted Honey.	Percentage Stocking.		
		Clear only.	Set only.	Clear and Set.		Clear only.	Set only.	Clear and Set.
Grocers .. .. .	339	34	27	39	166	42	46	12
Dairies .. .. .	241	29	13	58	20	35	65	—
Chemists .. .. .	111	42	42	16	96	18	79	3
Confectioners .. .	72	20	67	13	13	69	15	16
Fruiterers .. .. .	18	50	33	17	33	18	67	15
Departmental Stores and large Central Shops .. .. .	12	—	—	100	8	—	—	100
All Shops .. .. .	793	32	28	40	336	32	56	12

81. It will be seen that in London, where the preference was fairly evenly divided as between set and clear, two-fifths of the shops stocked both; in Glasgow, where the preference for set was emphatic, very few shops stocked both, but it should be noted in this connection that Glasgow shops were on the whole smaller.

82. In London set honey was especially favoured by confectioners; but, omitting departmental stores, the highest percentage of shops stocking both kinds was found among the London dairies. In Glasgow the dairies, fruiterers and chemists all showed a marked preference for set, while confectioners preferred clear.

83. In high and middle class shops, the maximum demand was more often said to be for set honey than for clear, but the clear variety appeared to be preferred in the lower class shops. The tendency to stock both kinds, and to offer customers a choice was strongest in the highest class of trade.

84. Clear honey is generally described as amber in colour and varies only slightly in shade. In set honey the variation of colour is wider and more defined, ranging from white to a dark brown. The London preference was four to one in favour of a light coloured type, while the Glasgow figures were five to two in favour of the slightly darker coloured amber. Nowhere was very dark honey preferred, except when it was of some special kind such as heather honey.

#### *Containers.*

85. The most popular type of container for extracted honey is the glass jar which, with an effective label, presents a clean appearance and shows the clearness and colour of the honey. In London 92 per cent. of the shops stocking honey stocked glass jars, and in Glasgow 94 per cent. Many of the London shops stocked more than one type of container, the next in importance to the glass jar being the plain crock, usually of red earthenware. One advantage of the crock as compared with the usual glass jar was said to be the wider opening which enabled the contents to be served with greater ease. Its main disadvantage is that it does not permit of the contents being seen before purchase. In Glasgow very few shops stocked more than one type of container, and glass jars were almost universal. Nearly one third of the chemists' shops both in London and in Glasgow were selling honey in cartons. The practice of selling honey



loose was occasional in all the London trades, but in Glasgow was entirely confined to chemists, and was a feature almost exclusively of shops serving poor neighbourhoods.

TABLE 11.  
*Percentage of Shops in each Trade stocking the various  
Types of Container.*

Type of Shop.	Total Number of Shops Stocking Extracted Honey.		Percentage Stocking.											
			Glass Jars.		Plain Crocks.		Fancy Crocks.		Cartons.		Tins.		Loose.	
	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.
Grocers .. ..	339	166	89	98	48	4	11	2	1	—	2	2	2	—
Dairies .. ..	241	20	94	100	36	—	15	—	—	—	—	—	1	—
Chemists .. ..	111	96	89	84	1	—	—	—	30	29	1	—	4	12
Confectioners ..	72	13	97	92	1	15	2	—	—	—	2	—	1	—
Fruiterers .. ..	18	33	83	100	11	—	—	—	—	—	—	—	6	—
Departmental Stores and large Central Shops .. ..	12	8	100	100	75	12	58	—	33	12	50	25	—	—
All Shops .. ..	793	336	92	94	33	3	11	1	5	9	2	1	2	4

86. The most noticeable feature of this comparison is the almost complete absence of crocks in Glasgow, where they were only found a dozen times altogether. Even in the few shops where crock were stocked, the preference was always for glass jars, but in London about a fifth of the shops in which both types of container were or sale were doing a larger trade in crocks.

*Sizes.*

87. Of all the shops in London and Glasgow stocking honey 98 per cent. were stocking either 1's or halves or both, and it was evident that the great bulk of the retail honey trade was done in

these two sizes. Of the two, halves were slightly more popular in London, and 1's in Glasgow. Sizes smaller than halves were distinctly unpopular in Glasgow: only 10 per cent. of the shops stocked quarters as against 40 per cent. in London, and only 1 per cent. stocked midgets compared with 21 per cent. in London.

TABLE 12.

*Percentage of Shops in each Trade stocking various Sizes.*

Type of Shop.	Total Number of Shops Stocking Extracted Honey.		Percentage Stocking.											
			Midget.		¼ lb.		½ lb.		1 lb.		2 lb.		Over 2 lbs.	
	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.
Grocers .. ..	339	166	10	—	24	1	78	55	76	79	5	1	4	2
Dairies .. ..	241	20	37	5	80	10	80	60	65	55	5	—	—	—
Chemists .. ..	111	96	26	4	33	27	77	79	74	71	1	—	—	—
Confectioners ..	72	13	19	—	6	8	74	85	86	77	—	—	1	—
Fruiterers .. ..	18	33	6	—	22	—	61	81	67	84	—	—	—	—
Departmental Stores and large Central Shops .. ..	12	8	8	—	—	62	100	50	100	100	25	—	75	37
All Shops .. ..	793	336	21	1	40	10	78	66	74	76	4	1	3	2

\* 1 shop = 0.4 per cent.

88. The practice of stocking several sizes was more common in London than in Glasgow. Shops doing a high class trade tended to stock the larger sizes, and the low class shops, the smaller; there was usually a greater choice among the middle class shops. The ¼ lb. and midget sizes were usually glass jars, except among chemists who favoured cartons for these sizes. Tins in the 1 lb. size were found both in London and Glasgow, but generally they were only used for sizes of 2 lbs. and upwards.

*Prices.*

89. Retail prices of all types of honey have been summarised in Tables 13 and 14 below. It will be observed that in most cases the range of prices is wide, and one of the chief reasons for this variation is that each series of prices relates to honeys of all types and qualities. But apart from these considerations, which will be dealt with later, some part of the variation is accounted for by the fact that the sizes are nominal; the nett weight of honey in the so-called 1 lb. jars, for example, was found to vary from about 12 to 16 ozs. It must also be noted that the survey was made during a period when the prices of all commodities were falling, but in general the retail price of honey seemed less susceptible to change than that of most commodities, though one widely distributed brand dropped in price by 2½d. per 1 lb. jar during the course of the enquiry.

TABLE 13.  
*Retail Prices of Honey in London and Glasgow.*

Description.	No. of Price Records.		Range.		Most Usual Prices.	
	London.	Glasgow.	London.	Glasgow.	London.	Glasgow.
Comb Sections (1 lb.).	86	71	1/6 to 5/6	1/- to 4/-	2/3 to 2/6	1/4 to 1/6 and 2/6
<i>Glass Jars.</i>						
2 lbs. . . . .	20	—	1/6 to 3/3	—	2/6	—
1 lb. . . . .	842	288	10½d. to 4/3	1/- to 3/6	1/3 to 1/4	1/4 to 1/6
½ lb. . . . .	773	231	6d. to 1/8	6d. to 1/2	8½d. to 10½d.	10d., 10½d. and 1/-
¼ lb. . . . .	371	34	4d. to 10d.	5d. to 7½d.	6½d.	6d.
Midget . . . . .	152	—	2d. to 5½d.	—	3d. and 3½d.	—
<i>Crocks.</i>						
Fancy (1 lb.) . . . . .	75	—	10½d. to 4/-	—	11½d. and 1/-	—
Plain.						
2 lbs. . . . .	30	—	1/5 to 1/10	—	1/6	—
1 lb. . . . .	222	8	8½d. to 1/8	1/- to 1/4	10½d.	1/-
½ lb. . . . .	95	—	5½d. to 10d.	—	6½d. and 7d.	—

90. Comb sections were the most expensive form of honey in both the centres covered by the survey, and the general level in London was much higher than in Glasgow where prices for the 1 lb. comb

section were much nearer to the 1 lb. glass jar. In both cases the range was wide. The most usual prices in London were 2s. 3d. to 2s. 6d., but special kinds of honey, such as heather or clover honey, were selling at high prices and French comb honey reached as much as 5s. 6d. per lb. In Glasgow a number of shops were selling comb honey at 2s. 6d., but 1s. 4d. to 1s. 6d. was more usual. The marked difference here noted is explained by the fact that the prevailing price for Home honey in Glasgow was 2s. 6d. as compared with 1s. 4d. to 1s. 6d. for the United States variety.

91. Crocks were generally very considerably cheaper than glass jars. In London, for example, the prevailing prices for the 1 lb. glass jar were 1s. 3d. to 1s. 4d., whereas the usual price for the crock of the same quantity was 10½d. As already stated crocks were not popular in Glasgow; in the few shops stocking this kind of container 1s. was the price most frequently noted for the 1 lb. size as compared with 1s. 4d. to 1s. 6d. for the 1 lb. glass jar. It was explained earlier in the report that crocks are largely used for packing dark honey which does not show up well in glass jars, and this honey is generally in less demand, and cheaper, than the lighter coloured honey.

92. Cartons, which were sold almost exclusively by chemists, were relatively dear. Tins were not very often met with; the bulk was in the larger sizes and is not, therefore, comparable with other types of container.

93. It will be noted in comparing the prices for the different sizes that the smaller sizes of each type of container are relatively expensive. The usual London price for 1 lb. glass jars was 1s. 3d. to 1s. 4d. whereas honey in the ½ lb. size was generally selling at the rate of 1s. 5d. to 1s. 9d. per lb. and ¼'s at the equivalent of 2s. 2d. per lb. The same conditions apply to crocks, where the difference in the price between the ½ lb. and 2 lb. sizes amounted to as much as 4d. or 5d. per lb. No similar comparison is possible in the case of "midgets," which vary so greatly in the weight of their contents, but there is no doubt that, so far as the price of the contents is concerned, this is the most expensive way of buying honey.

94. In the following table prices for containers of varying sizes not already dealt with in Table 13 are summarised.

**TABLE 14.**  
*Retail Prices of Honey in other Containers and Sizes—London and Glasgow.*

	Size.	Tins.		Glass Jar.		Crocks.		Cartons.	
		No. of Shops.	Prices.	No. of Shops.	Prices.	No. of Shops.	Prices.	No. of Shops.	Prices.
London.	60 lbs.	3	40/- to 70/-		*				
	30 lbs.	1	23/6						
	14 lbs.	1	15/-						
	7 lbs.	10	6/- to 9/3			2	5/8 & 7/6		
	5 lbs.	8	4/4 to 5/4	1	6/6	1	3/6		
	4 lbs.	3	4/- to 4/6			1	2/9		
	3 lbs.					3	2/6 to 4/6		
	2½ lbs.	5	2/4 & 2/4½	13	2/6 to 3/1½	2	3/- & 3/6		
	2 lbs.	2	2/3 & 2/6		*	3	2/8½ to 4/-†		
	1 lb.	8	1/1½ to 1/6 & 4/6		*		*	13	1/2 to 2/9
	½ lb.				*	9	6½d. to 9d.	4	9d. to 1/2
	¼ lb.	1	6d.		*	1	3½d.	3	5d. to 7½d.
Midget				*			5	3d. & 4½d.	
Glasgow.	5 lbs.	3	4/6 & 5/-						
	2½ lbs.	1	2/6	3	2/10½ & 3/-				
	2 lbs.	1	2/-		*				
	1 lb.	5	1/- to 2/-		*		*	2	1/6
	½ lb.				*		*	5	10½d. & 1/-
	Midget							21	5½d. to 6½d.

\* Included in Table 13.

† Fancy Crocks.

### VII.—COUNTRY OF ORIGIN.

95. In previous sections of this report honey has been considered solely as a commodity and irrespective of its source; in this section the subject will be dealt with from the point of view of country of origin.

#### *Stocks.*

96. In the course of the survey honey was found under 244 different designations or descriptions. About 50 of these indicated the particular district from which the honey came; in the case of Home-produced honey this was usually the county, or a district, but the designation which occurred more frequently was "English"

or "Scottish." A further 90 were fancy titles given to certain brands, including those adopted by particular countries, such as "Beekist," "Imperial Bee" and "Golden Wattle," and the remaining 100 were the names of firms by whom or for whom special brands were packed.

97. Three of the brands were found in over 100 shops, but more than half of them occurred only once each during the whole survey.

98. Table 15 shows the distribution of the different types of honey in the shops of each trade in London and Glasgow. For purposes of analysis Palestine honey, which was found in one shop only, has been included as "Other Empire" which includes also blends of honey from two or more Empire countries. French, Greek, Russian, Chilean and other South American honeys, which occurred very seldom, have been grouped together as "Other Foreign."

99. The term "Blended Imported," which is one of the descriptions authorised under the Merchandise Marks Act (*see* Appendix II) has been used to cover all brands containing foreign honey which were not stated to be the product of a single country. In view of the small numbers involved in some cases, the figures in this and the two following tables have not been expressed as percentages.

TABLE 15.

*Number of Shops in each Trade stocking Honey of Different Countries.*

Type of Shop.	Total Number Stocking Honey.		Home.		Canadian.		Australian.		New Zealand.		British West Indian.	
	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.
Grocers ..	339	171	46	26	13	15	46	2	76	56	32	1
Dairies ..	241	20	24	3	2	7	11	—	6	4	4	—
Chemists ..	111	96	4	3	—	—	—	2	9	24	12	5
Confectioners ..	72	13	15	3	—	7	6	—	21	—	—	—
Fruiters ..	18	37	5	7	—	—	5	—	1	15	1	—
Departmental Stores and large Central Shops ..	12	8	12	4	8	6	8	1	12	6	6	—
All Trades	793	345	106	46	23	35	76	5	125	105	55	6

TABLE 15—continued.

Type of Shop.	Total Number Stocking Honey.		Irish Free State.		Other Empire.		United States.		Other Foreign.		Blended Imported.	
	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.
Grocers ..	339	171	2	4	127	42	36	17	24	1	185	64
Dairies ..	241	20	—	—	187	—	9	1	2	—	68	7
Chemists ..	111	96	—	—	35	24	24	46	6	5	47	8
Confectioners ..	72	13	—	—	6	2	8	—	4	—	21	6
Fruiterers ..	18	37	1	1	2	5	5	15	1	—	2	12
Departmental Stores and Large Central Shops ..	12	8	1	3	9	—	5	8	10	—	10	1
All Trades	798	345	4	8	366	73	87	87	47	6	333	98

100. The most notable feature of Table 15 is the very wide distribution of blended honey compared with that of honey from any single country. In London, where this tendency was more marked than in Glasgow, the varieties grouped under the description "Other Empire," which were mostly blends of more than one Empire type, were found in 46 per cent. of the shops, while "Blended Imported" honey was found in 40 per cent. Of honeys originating in a single country New Zealand stood the highest, and was found in about 16 per cent. of the London shops stocking honey, while Home honey occurred in about 13 per cent. Comparing the several trades in London, the preference for blended honey was most marked among the dairies, the majority of which stocked one of a few well-known blends, generally of Empire honeys, but in the grocery trade also, more than twice as many shops stocked "Blended Imported" honey as stocked the product of any single country.

101. In Glasgow, New Zealand honey was found in slightly over 30 per cent and "Blended Imported" in about 28 per cent. of the shops, United States honey in 25 per cent. and "Other Empire" in 21 per cent. More than half the shops stocking United States honey in Glasgow were chemists.

*Containers.*

102. Table 16 shews the frequency of the different kinds of package for each type of honey. The number of shops stocking honey shewn in the first column of the table includes those shops stocking honey loose, but these have necessarily been excluded from the figures in the remainder of the table.

TABLE 16.  
*Number of Shops Stocking Honey from various countries  
in different types of Container.*

Country of Origin.	Number of Shops Stocking.		Glass Jars.		Plain Crocks.		Fancy Crocks.		Cartons.		Tins.		Comb Sections.	
	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.
Home .. ..	106	46	80	31	2	—	4	—	5	—	1	1	57	24
Canadian .. ..	23	35	17	32	4	1	—	—	—	—	9	2	2	2
Australian .. ..	76	5	74	4	2	1	—	—	—	—	4	—	—	—
New Zealand .. ..	125	105	118	103	2	1	1	—	1	1	4	—	—	—
British West Indian	55	6	35	3	18	—	2	1	3	1	—	—	1	—
Irish Free State ..	4	8	—	—	—	—	—	—	—	—	—	—	4	8
Other Empire .. ..	366	73	319	69	147	5	51	—	7	4	1	—	1	—
United States .. ..	87	87	55	36	6	—	2	—	4	16	1	—	18	35
Other Foreign .. ..	47	6	41	4	1	—	1	—	1	—	2	—	1	—
Blended Imported	333	98	300	90	81	3	25	2	19	5	2	—	—	—
Number of Shops Stocking different Containers ..			726	316	263	10	84	3	39	27	15	3	77	51

103. Except in the case of Irish Free State honey, which was found only in comb sections, the predominant type of packing on sale for all varieties of honey was the glass jar. Australian, New Zealand and foreign honeys, other than those from the United States, were rarely found in other containers, but a wider variation of types was observed in some of the other honeys.

104. The types of honey most frequently found in crocks in London were the varieties classed as "Other Empire" and "Blended Imported." In 55 per cent. of the shops stocking plain crocks the honey was of the former variety, the corresponding figure for "Blended Imported" being about 30 per cent. These two types of honey also predominated in the case of fancy crocks. British West Indian honey was stocked in crocks in half as many shops as



in glass jars—a higher proportion than in the case of any other honey. Corks of any kind, as already noted, were very infrequently observed in Glasgow.

105. In about half the shops stocking cartons in London the honey was of the "Blended Imported" type, but in Glasgow United States honey was more usual. Home honey and United States honey were the prevailing types of comb honey. In Glasgow, United States comb honey was found as frequently as Empire comb honey and not much less frequently than similar honey in glass jars. In the few shops stocking loose honey British West Indian, United States and Russian were the most usual kinds; in four London shops the honey was from the British West Indies, in 12 shops, 8 of which were in Glasgow, it was from the United States, and in 6, all in London, Russian honey was sold in this form.

*Sizes.*

106. Table 17 analyses the distribution of the different kinds of honey, according to sizes of containers. The qualification in regard to loose honey noted above, also applies to the figures in this table.

TABLE 17.  
*Number of Shops Stocking Honey from various countries  
in different sizes of container.*

Country of Origin.	Number of Shops Stocking.		Midgets.		½'s.		¾'s.		1's.		2's.		Over 2.	
	Lond.	Glas.	Lond.	Glas.	Lond.	Glas.	Lon.	Glas.	Lon.	Glas.	Lon.	Glas.	Lon.	Glas.
Home .. ..	106	46	5	—	5	1	33	11	71	27	1	—	—	—
Canadian .. ..	23	35	2	—	3	3	9	19	14	20	2	—	11	3
Australian .. ..	76	5	8	—	11	1	57	1	54	3	—	—	4	—
New Zealand .. ..	125	105	15	—	7	1	85	68	111	90	3	—	14	3
British West Indian	55	6	1	—	5	—	28	3	34	4	2	—	2	—
Irish Free State ..	4	8	—	—	—	—	—	—	—	—	—	—	—	—
Other Empire .. ..	366	73	90	—	201	3	257	47	263	46	20	—	3	—
United States .. ..	87	87	6	—	11	21	19	23	50	36	—	—	1	—
Other Foreign .. ..	47	6	1	—	16	—	21	2	41	3	1	2	—	—
Blended Imported	333	98	39	4	85	2	256	57	259	69	9	1	4	—
Number of Shops Stocking different sizes .. ..	166	4	320	32	619	220	584	256	34	2	23	6	—	—

107. For all honeys  $\frac{1}{2}$ 's and 1's were the most popular sizes ; the number of shops stocking other sizes in Glasgow was small, but in London an appreciable number were stocking midgets and  $\frac{1}{4}$ 's. In over 60 per cent. of the shops stocking  $\frac{1}{2}$ 's the honey was of "Other Empire" origin, and in more than a quarter "Blended Imported." "Other Empire" and "Blended Imported" honeys were also the types most frequently found in the midget size.

*Prices.*

108. In Table 18 the prices noted for 1 lb. and  $\frac{1}{2}$  lb. glass jars have been grouped according to country of origin. The range in each group is in most instances considerable, and it is difficult to make any comparisons as to the general run of prices, either as between the different types of honey, or as between London and Glasgow, but it may be noted that, in both centres, the prices of honeys from different sources in  $\frac{1}{2}$  lb. jars appeared to show a rather closer correspondence than was the case with 1 lb. jars.

TABLE 18.  
*Retail Prices of Honey from different countries in London and Glasgow.*  
*1 lb. and  $\frac{1}{2}$  lb. Glass Jars.*

Varieties of Honey.	Number of Price Records.		Range.		Most usual Prices.	
	London.	Glasgow.	London.	Glasgow.	London.	Glasgow.
<b>1 lb. Glass Jars.</b>						
Home ..	80	32	1/2 to 3/8	1/2 to 3/8	1/10 & 2/-	2/- to 2/6
Canadian ..	12	18	1/3 to 2/-	1/- to 1/6	1/4	1/2
Australian ..	55	—	11d. to 1/6	—	1/3 & 1/4	—
New Zealand	124	90	1/3 to 1/8	1/2 to 1/10	1/4	1/4 & 1/8
British West						
Indian ..	21	—	11½d. to 2/3	—	*	—
Other Empire	218	42	10½d. to 2/3	1/2 to 2/-	1/1 to 1/4 & 1/6	1/3 & 1/8
United States	46	28	1/- to 3/9	1/- to 3/6	1/2	1/6
Blended Imported ..	223	69	11½d. to 1/10	1/- to 1/10	1/4	1/2 & 1/4
<b><math>\frac{1}{2}</math> lb. Glass Jars.</b>						
Home ..	32	11	9d. to 1/8	10d. to 1/-	10½d. to 1/-	1/-
Canadian ..	9	16	8½d. to 1/-	7½d. to 1/-	9½d.	10½d.
Australian ..	61	—	6½d. to 10½d.	—	8½d., 9½d. & 10½d.	—
New Zealand	92	71	8½d. to 1/-	8½d. to 1/-	10½d.	10½d.
British West						
Indies ..	25	—	6½d. to 1/2	—	8½d. to 10½d.	—
Other Empire	294	42	6½d. to 1/-	8½d. to 1/-	8½d. to 9½d. & 10½d.	8½d. & 10½d.
United States	16	22	8d. to 1/6	6d. to 1/-	10½d.	10½d. & 1/-
Blended Imported ..	233	58	7½d. to 1/-	6½d. to 1/2	8½d. to 10½d.	8d. & 10½d.

\* No predominant price.

109. In general there was no evidence connecting price differences with specific differences in quality, but a few instances were found of special qualities which commanded an exceptionally high price; the chief of these was Home produced heather honey. If the prices are grouped by brands there is considerably less variation. The multiple firms which sold their own brands marketed them at a uniform price throughout. Other brands, which enjoyed a wide distribution through all types of shop, showed a fairly wide range of prices, but in those cases where the price differed most from the general run, the honey was not being sold under any well known brand name.

#### TYPES OF HONEY.

110. The earlier paragraphs in this chapter have indicated the chief points of comparison and difference among the various kinds of honey. In the remaining paragraphs the main features as regards distribution, containers and sizes, will be considered separately for each variety of honey. Reference should be made to Tables 19 and 20, which shew, for each variety of honey, the number of shops stocking the different types and sizes of container, and the percentage of each variety stocked in the various types.

##### *Home.*

111. *Stocks, Containers and Sizes.*—Honey produced in the United Kingdom is sold under a great variety of descriptions. Nineteen of those noted were names of counties, and eleven more indicated other localities. Heather honey and clover honey were named as distinct varieties, but the appeal of the majority of brands was based either on geographical association or on the reputation of the firms who packed them. It is of interest to note that a National Mark scheme has recently been introduced by the Ministry of Agriculture and Fisheries for honey produced in England and Wales.

112. The proportion of shops stocking Home honey in London and Glasgow was approximately the same, namely 13 per cent. Very few chemists stocked it in either area, but about 20 per cent. of the London confectioners who stocked honey stocked this type. It was found in all the London departmental stores, usually in several varieties, but while the London stores stocked both English and Scottish honey, only Scottish honey was found in the central shops of Glasgow.

113. Home honey was fairly evenly distributed between independent shops and multiples, the percentage of multiple shops carrying stocks being very slightly higher in both areas. To a considerable extent, especially in London, it constituted a definitely high class trade owing to its price, but in both London and Glasgow it was found in 12 per cent. of the middle class shops stocking honey, and in Glasgow in 10 per cent. of the shops catering for a poorer trade.

114. Home honey when extracted was nearly always stocked in glass jars, but more than half the shops stocking it in London and Glasgow sold it also in the comb. It was rarely found in any size of jar other than the 1 lb., and the  $\frac{1}{2}$  lb., and the 1 lb. sizes occurred about twice as frequently as the "half."

115. *Prices.*—The prices noted for Home honey differed widely, but in general it was an expensive honey. The most usual prices for 1 lb. glass jars were 1s. 10d. and 2s. in London and 2s. to 2s. 6d. in Glasgow as compared with average prices for all honey of 1s. 2d. to 1s. 4d. in London and 1s. 4d. to 1s. 6d. in Glasgow. Comb sections, which were generally dearer than glass jars, were most often retailed at 2s. 6d., and three departmental stores in London were selling a brand of English honey in 1 lb. cartons at 2s. 1d. and 2s. 9d. Heather honey and clover honey generally commanded a higher price than other types. As between London and Glasgow there was little difference in the general level of prices for extracted honey, but for comb sections the Glasgow price was slightly lower.

#### *Canadian.*

116. *Stocks, Containers and Sizes.*—Ten brands of Canadian honey were found in London and eight in Glasgow, while over the whole survey fourteen different brands were found. The official brands of the two honey-exporting provinces accounted for 60 per cent. of the Canadian honey stocked, "Beekist," the Ontario brand, being found most frequently in London, and "Quebec" in Glasgow; this difference is probably due to the fact that Ontario honey is landed and packed in London, while Quebec honey goes to Liverpool, which is nearer to Glasgow. The remaining brands were proprietary, and bore the labels of wholesale or large retail firms for whom they were packed.

117. Both relatively and actually Canadian honey appeared to be more popular in Glasgow than in London. It was found only in 23,

or 3 per cent., of the shops in London, and in 35, or 10 per cent., of those in Glasgow. But in London very large quantities were being sold in some of the departmental stores, both under the "Beekist" label and under the label of the store, and shortly before the survey closed one of the largest multiple organisations, with headquarters in London, started selling Quebec honey under a special label in its branches. Canadian honey was most frequently found in grocers' shops, and in a higher proportion of multiples than independents.

118. The most popular form of container was the glass jar, and the two sizes most usually stocked were the 1 lb. and  $\frac{1}{2}$  lb.; but Canadian honey was much more often sold in tins than any other type of honey. In the London departmental stores it was found in tins of various sizes from 1 lb. to 60 lbs., and two of the Glasgow central stores were selling it in 5 lb. and 1 lb. tins. In a few of the grocers' shops, also, in both cities it was found in 4 lb. and 5 lb. tins.

119. *Prices.*—Although Canadian honey was retailed principally by the higher class shops it was on the whole a comparatively low priced honey, especially in Glasgow. The usual prices in London and in Glasgow, for the 1 lb. glass jar were 1s. 4d. and 1s. 2d. respectively, and for the  $\frac{1}{2}$  lb. size 9 $\frac{1}{2}$ d. and 10 $\frac{1}{2}$ d. Prices for the 5 lb. tin varied from 4s. 4d. to 5s. 4d. in London and 4s. 6d. and 5s. in Glasgow; the 2 $\frac{1}{2}$  lb. size was usually sold in London at 2s. 4d. or 2s. 4 $\frac{1}{2}$ d., while 1 lb. tins retailed at 1s. 1 $\frac{1}{2}$ d. and 1s. 2d. in London, Glasgow prices being 1s. and 1s. 2d. These were the most usual sizes, but three London stores were selling 60 lb. tins at prices ranging from 40s. to 70s., one shop 30 lb. tins at 23s. 6d., two shops 7 lb. tins at 7s. 6d. and 8s. 11d. and two shops 4 lb. tins at 4s. and 4s. 4 $\frac{1}{2}$ d.

#### *Australian.*

120. *Stocks, Containers and Sizes.*—The official brand of the Australian producers is "Golden Wattle," and in all except three instances this was the designation under which Australian honey was found. A London departmental store, which was importing Tasmanian honey in considerable quantities, and making a special feature of it, was the chief exception.

121. Australian honey was stocked in 76, or about 10 per cent., of the London shops stocking honey, but only in five shops in Glasgow. Most of the London departmental stores stocked it, and about 13 per cent. of the London grocers. The bulk of these were independent

grocers, and half of them were doing a small poor class trade. Australian honey was stocked more often in shops in poor class neighbourhoods than the honey of any other single country though not so frequently as the Empire blends and "Blended Imported."

122. The most usual type of container was the glass jar, but tins were found in four shops and crocks in two. The  $\frac{1}{2}$  lb. size seemed rather more popular than the 1 lb., and these two sizes accounted for the bulk of the stocks. Sizes over 1 lb. were only noted in four shops, three of which were departmental stores; quarters and midgets were found occasionally.

123. *Prices.*—Australian honey was among the less expensive honeys. London prices for the 1 lb. glass jar ranged from 11*d.* to 1*s.* 6*d.*, 1*s.* 3*d.* and 1*s.* 4*d.* being the most usual prices, while the  $\frac{1}{2}$  lb. jar was generally retailed at from 8 $\frac{1}{2}$ *d.* to 10 $\frac{1}{2}$ *d.*

#### *New Zealand.*

124. *Stocks, Containers and Sizes.*—By far the greater quantity of New Zealand honey found during the survey was being sold under the official label of the New Zealand producers, "Imperial Bee." This was the brand stocked by 77 per cent. of the shops stocking New Zealand honey in London, and by 93 per cent. in Glasgow. Fifteen other designations were observed in London; one, a wholesaler's brand, occurred twelve times, but the rest were observed only once or twice, and three were also noted once or twice in Glasgow.

125. From the point of view of distribution the position of New Zealand honey was about twice as strong in Glasgow as in London. Of all shops stocking honey 30 per cent. in Glasgow stocked New Zealand, and less than 16 per cent. in London. Multiple shops in London stocked this honey more frequently than the independent retailers, the proportions being 19 per cent. and 10 per cent., but in Glasgow it was much more popular among the latter group, 40 per cent. of which stocked it as compared with 16 per cent. of the multiples. Again, it was more evenly spread over all classes of trade in Glasgow than in London, where only 4 per cent. of the poor class shops stocked it against 22 per cent. in Glasgow.

126. New Zealand honey was almost always stocked in glass jars. Less than 4 per cent. of the containers noted were of any other type, and the two popular sizes, 1 lb. and  $\frac{1}{2}$  lb., accounted for the bulk.

Four shops, including three departmental stores, were stocking 7 lb. tins, and it was found a few times in both crocks and cartons, mostly in the 1 lb. size. Sizes smaller than  $\frac{1}{2}$  lb. were not often noted.

127. *Prices.*—At the beginning of the enquiry the standard price for "Imperial Bee" 1 lb. jars was 1s. 4 $\frac{1}{2}$ d. in London and 1s. 4d. in Glasgow. Later the wholesale price was raised, and some of the retailers visited after this change were found to have increased their price to 1s. 5 $\frac{1}{2}$ d. or 1s. 6d. In Glasgow this honey was stocked by a number of chemists, and in these shops 1s. 6d. was the most usual price throughout the enquiry. The  $\frac{1}{2}$  lb. glass jar was selling at 10 $\frac{1}{2}$ d. in a considerable number of the shops both in London and Glasgow.

128. Of the few shops stocking other types of containers four in London had 7 lb. tins at 6s. 6d. to 8s. 3d. and three 1 lb fancy crocks at 1s. to 1s. 10d., while 15 were selling glass "midgets" at 2d. or 3d.

*British West Indian.*

129. *Stocks, Containers and Sizes.*—A considerable quantity of British West Indian honey is used in blends, both of the wholly Empire type and of the type which includes foreign honey, and in many of these cases its identity is lost. But in the course of the survey it was found on sale as a separate type in 61 shops, or 5 per cent. of those stocking any kind of honey. In about a third of these it was described as Jamaican; in the remainder it appeared under 17 special labels, of which three were those of retail firms and the rest wholesalers. The variety of labels was entirely a London feature; in Glasgow it was always sold simply as Jamaican.

130. Unblended British West Indian honey appeared to be more widely stocked in London than in Glasgow. Half the London departmental stores stocked it, and about a tenth of the London grocers and chemists. In Glasgow it was found in six shops only, five of which were chemists and one a grocer. Nearly two thirds of the shops stocking it were of the independent type. Most of the grocers selling it were doing a middle class trade, but half the chemists were serving poor class neighbourhoods.

131. Like all other kinds of honey the glass jar was the predominating type of container for British West Indian honey, but, with the exception of blends, it was the only honey fairly often found

in crocks. About two thirds of the shops stocked it in glass jars and one third in crocks ; it was only once found in the comb, and four times in cartons, and in five chemists' shops it was sold loose. On the whole the 1 lb. size was the most popular, but in the glass jar the  $\frac{1}{2}$  lb. size was slightly more in favour than the 1 lb., while in the crock the 1 lb. size was more usual than other sizes.

132. *Prices.*—The prices noted for this honey showed considerable variation and for this reason it is practically impossible to make comparisons with other honeys. The range in London for the 1 lb. glass jar was  $11\frac{1}{2}d.$  to  $2s. 3d.$ , and there was no predominant price within this range ; but in the case of the  $\frac{1}{2}$  lb. size, prices for which varied from  $6\frac{1}{2}d.$  to  $1s. 2d.$ ,  $8\frac{1}{2}d.$  to  $10\frac{1}{2}d.$  were the most usual prices.

133. The most frequent price for the 1 lb. crock was  $10\frac{1}{2}d.$ , and one shop was selling 7 lb. crocks at  $5s. 8d.$

#### *Irish Free State.*

134. Irish Free State honey was only found twelve times during the survey, four times in London and eight times in Glasgow. In every instance it was stocked only in the comb. One London departmental store and three central shops in Glasgow were stocking it, while of the remaining eight shops six were grocers and two fruiterers.

135. In London the price varied from  $1s. 6d.$  to  $3s.$  In Glasgow the four shops were charging  $1s. 6d.$ , and the others from  $1s. 8d.$  to  $3s.$  for the 1 lb. section.

#### *Other Empire.*

136. *Stocks, Containers and Sizes.*—The group of honeys classed as "Other Empire" includes Palestine honey, which was found only once, in a London departmental store, and 60 different brands of honey labelled "Empire" with no definite indication of the actual country of origin. Several of these were known to be blends of honey from more than one Empire country, while others, especially those packed by wholesale chemists for their retail customers, were probably of British West Indian origin ; but in the absence of any clear evidence these have been classed together under the term "Empire."



**TABLE 19.**  
*Shops Stocking Honey from various countries in  
different types of container.*

Country of Origin of Honey.	Total Shops Stocking.	Glass Jars.	Plain Crocks.	Fancy Crocks.	Cartons.	Tins.	Comb Sections.
<i>London.</i>							
Home .. .. .	No. 106	80	2	4	5	1	57
	Per cent. —	75	2	4	5	1	54
Canadian .. .. .	No. 23	17	4	—	—	9	2
	Per cent. —	74	17	—	—	39	9
Australian .. .. .	No. 76	74	2	—	—	4	—
	Per cent. —	97	3	—	—	5	—
New Zealand .. .. .	No. 125	118	2	1	1	4	—
	Per cent. —	94	2	1	1	3	—
British West Indian .. .. .	No. 55	35	18	2	3	—	1
	Per cent. —	64	33	4	5	—	2
Other Empire .. .. .	No. 366	319	147	51	7	1	1
	Per cent. —	87	40	14	2	*	*
United States .. .. .	No. 87	55	6	2	4	1	18
	Per cent. —	63	7	2	5	1	21
Blended Imported .. .. .	No. 333	300	81	25	19	2	—
	Per cent. —	90	24	8	6	1	—
<i>Glasgow.</i>							
Home .. .. .	No. 46	31	—	—	—	1	24
	Per cent. —	67	—	—	—	2	52
Canadian .. .. .	No. 35	32	1	—	—	2	2
	Per cent. —	91	3	—	—	6	6
Australian .. .. .	No. 5	4	—	—	—	—	—
	Per cent. —	80	—	—	—	—	—
New Zealand .. .. .	No. 105	103	1	—	1	—	—
	Per cent. —	98	1	—	1	—	—
British West Indian .. .. .	No. 6	3	—	1	1	—	—
	Per cent. —	50	—	17	17	—	—
Other Empire .. .. .	No. 73	69	5	—	4	—	—
	Per cent. —	95	7	—	5	—	—
United States .. .. .	No. 87	36	—	—	16	—	35
	Per cent. —	41	—	—	18	—	40
Blended Imported .. .. .	No. 98	90	3	2	5	—	—
	Per cent. —	92	3	2	5	—	—

\* 0.3 per cent.

TABLE 20.  
Shops Stocking Honey from various countries in  
different sizes of container.

Country of Origin of Honey.	Total Shops Stocking.	Midgets.	$\frac{1}{2}$ 's.	$\frac{1}{4}$ 's.	1's.	2's.	Over 2
<i>London.</i>							
Home .. .. .	No. 106	5	5	33	71	1	—
	Per cent. —	5	5	31	67	1	—
Canadian .. .. .	No. 23	2	3	9	14	2	11
	Per cent. —	9	13	39	61	9	48
Australian .. .. .	No. 76	8	11	57	54	—	4
	Per cent. —	11	14	75	71	—	5
New Zealand .. .. .	No. 125	15	7	85	111	3	14
	Per cent. —	12	6	68	89	2	11
British West Indian .. .. .	No. 55	1	5	28	34	2	2
	Per cent. —	2	9	51	62	4	4
Other Empire .. .. .	No. 366	90	201	257	263	20	3
	Per cent. —	24	55	70	72	5	1
United States .. .. .	No. 87	6	11	19	50	—	1
	Per cent. —	7	13	22	57	—	1
Blended Imported .. .. .	No. 333	39	85	256	259	9	4
	Per cent. —	12	26	77	78	3	1
<i>Glasgow.</i>							
Home .. .. .	No. 46	—	1	11	27	—	—
	Per cent. —	—	2	24	59	—	—
Canadian .. .. .	No. 35	—	3	19	20	—	3
	Per cent. —	—	9	54	57	—	9
Australian .. .. .	No. 5	—	1	1	3	—	—
	Per cent. —	—	20	20	60	—	—
New Zealand .. .. .	No. 105	—	1	68	90	—	3
	Per cent. —	—	1	65	85	—	3
British West Indian .. .. .	No. 6	—	—	3	4	—	—
	Per cent. —	—	—	50	67	—	—
Other Empire .. .. .	No. 73	—	3	47	46	—	—
	Per cent. —	—	4	64	63	—	—
United States .. .. .	No. 87	—	21	23	36	—	—
	Per cent. —	—	24	26	41	—	—
Blended Imported .. .. .	No. 98	4	2	57	69	1	—
	Per cent. —	4	2	58	70	1	—

137. Honey of this type was found in nearly half the London shops stocking honey, and in about a fifth of those in Glasgow. Three quarters of the London dairies stocked it, including all the multiple dairies and about two thirds of the independent type. The multiple dairies stocked a brand of their own, and the independent dairies one of the two most widely distributed wholesalers' or blender-packers' brands. Rather more than a third of the London grocers and nearly a third of the London chemists stocked honey of this description. One of the two above mentioned blender-packers' brands was especially popular among the grocers, and was stocked by about two-fifths of them. Among the chemists no single brand enjoyed any special favour, or was found in more than three or four shops; eleven brands bore the name of the wholesale drug house from which the chemist obtained other goods.

138. In Glasgow a blend of Empire honeys was stocked by all the co-operative stores; about a dozen grocers, and a quarter of the chemists also, were stocking an Empire blend. The brands most frequently found in London were not stocked in Glasgow, and, with the exception of that seen in the co-operative stores, no single brand was found there more than a few times.

139. Most of the departmental stores and more than half of the other shops doing a high class trade in London stocked Empire brands of this type, but in Glasgow, with the exception of one high class chemist, the trade was entirely confined to shops serving middle or poor class neighbourhoods.

140. Certain brands of this class of honey, including one which enjoyed a wide distribution, were habitually packed in crocks, which were especially popular in London, where the plain crock was found in 147 shops and the fancy crock in 51; in Glasgow, crocks were only found five times. Glass jars were, nevertheless, the most popular type of container in both centres; about 87 per cent. of the London and 95 per cent. of the Glasgow shops stocking this form of honey were selling it in glass jars. The  $\frac{1}{2}$  lb. size was slightly more common than the 1 lb. in glass jars, but both plain and fancy crocks were stocked more often in the 1 lb. size. A feature of the London trade, particularly among the dairies, was the frequency of small sized jars,  $\frac{1}{4}$  lbs., and midgets, but in Glasgow, glass jars of less than  $\frac{1}{2}$  lb. size were rare.

141. *Prices.*—A multiple dairy in London, which accounted for a large proportion of the trade in this type of honey, made a practice of stocking a set and a clear honey in 1 lb.,  $\frac{1}{2}$  lb. and  $\frac{1}{4}$  lb. glass jars, the set being 1*d.* dearer in the larger and  $\frac{1}{2}$ *d.* in the two smaller sizes. At the beginning of the enquiry the prices usually charged were 1*s.* 3 $\frac{1}{2}$ *d.* or 1*s.* 4 $\frac{1}{2}$ *d.* for the 1 lb. size, 8 $\frac{1}{2}$ *d.* or 9*d.* for the  $\frac{1}{2}$  lb. and 6 $\frac{1}{2}$ *d.* or 7*d.* for the  $\frac{1}{4}$  lb. Later the 1 lb. size fell to 1*s.* 1*d.* or 1*s.* 2*d.* and the  $\frac{1}{2}$  lb. size to 6*d.* In the grocery trade, and the remainder of the dairies, the most usual price was 1*s.* 3*d.* per 1 lb. jar, both in London and Glasgow, while in chemists it was 1*s.* 6*d.* In London no price above 1*s.* 7*d.* was recorded except among chemists and departmental stores.

142. In the great majority of the London shops 10 $\frac{1}{2}$ *d.* was the price for the 1 lb. plain crock, the most usual price for the  $\frac{1}{2}$  lb. size being 6 $\frac{1}{2}$ *d.* These honeys were not often seen in containers other than glass jars or crocks, but one London shop was stocking 7 lb. tins at 8*s.* 3*d.* and two had 1 lb. tins at 1*s.* 6*d.*

#### *United States.*

143. *Stocks, Containers and Sizes.*—More than half the United States honey found was simply described as Californian, and, of the 24 other labels under which it was being sold, the majority were the brands of wholesale or retail firms. This honey was stocked by about 11 per cent. of the shops stocking honey in London and 25 per cent. of those in Glasgow. The two trades stocking it most frequently in both areas were grocers and chemists, but while the percentage of grocers was about equal in the two places, the percentage of chemists was more than twice as high in Glasgow as in London. A substantial proportion of the London chemists stocking United States honey were branches of multiple firms, but nearly all those in Glasgow were independent traders. All the large central shops in Glasgow stocked it, and about half the departmental stores in London.

144. The United States honey stocked by grocers was either in glass jars or in the comb; among the fruiterers, comb honey was in greater favour, while in the chemists' shops the glass jar and the carton were about equally popular. The favourite size in the glass jar was 1 lb. both in London and Glasgow; the cartons stocked by Glasgow chemists were nearly always of the  $\frac{1}{4}$  lb. size.

145. *Prices.*—The prices asked for United States honey generally showed wide variations, but comb sections were distinctly cheaper than the English product and they were generally much cheaper in Glasgow than in London. The most usual prices for Home honey in comb sections were 2s. 3d. to 2s. 6d. in London and 2s. to 2s. 6d. in Glasgow, the corresponding prices for the American varieties being 1s. 10d. in the former, and 1s. 4d. and 1s. 6d. in the latter city. The 1 lb. glass jar was selling at a lower price in London than in Glasgow; in the former centre 1s. 2d. was the usual price as compared with 1s. 6d. in the latter.

146. The chemists who sold this honey retailed it, with a few exceptions, at a uniform price, viz. 1s. 2d. for 1 lb. and 8d. for  $\frac{1}{2}$  lb. glass jars in London, and in Glasgow 1s. 6d. for 1 lb. glass jars and 6d. for  $\frac{1}{2}$  lb. cartons.

*Blended Imported.*

147. *Stocks, Containers and Sizes.*—Under this heading have been grouped all the brands in which foreign honey formed an ingredient, and which bore labels including the words "blended imported" or the names of more than one country of origin.

148. Altogether 35 different brands of this type were noted; 25 of them were in London only, six in Glasgow only, and four in both areas. One of these brands, which is well advertised, enjoyed a wider distribution than any other type or variety of honey, blended or unblended, and was found in 21 per cent. of all the honey-stocking shops in the combined areas. Of the other brands six occurred 15 or more times each, and 21 occurred only once each. One wholesaler's brand was stocked in 44 shops in Glasgow, and another in 37 shops in London, and two large multiple firms stocked their own brand in their branches.

149. Blended imported honey was stocked in over 40 per cent. of the London shops stocking honey, and in 28 per cent. of those in Glasgow. Grocers stocked it more frequently than any other retailers; more than half the London grocers and over a third of those in Glasgow were selling this type. Among the grocers it was slightly more favoured by the multiple firms than by the independent; but, on the other hand, it was much more frequently found among the independent than the multiple dairies, which were usually stocking their own blends of Empire honey. The chemists who stocked

"blended imported" were mostly branches of multiple firms. Its popularity was little affected by neighbourhood or class of trade; it seemed to be equally favoured by all classes.

150. As in the case of other types, blended imported honey was most frequently stocked in glass jars, but crocks were also well favoured in London; about a quarter of the shops in London stocking this kind of honey stocked it in plain crocks, which were three times as numerous as fancy crocks. In Glasgow it was almost always in glass jars. Cartons were found in 24 shops and it was twice found in tins.

151. The  $\frac{1}{2}$  lb. and 1 lb. containers were by far the most popular types for blended imported honey. The number of shops stocking each size was about equal in London, and represented nearly 80 per cent. of the shops; in Glasgow 70 per cent. were stocking '1's' and 58 per cent. "halves". Compared with these, other sizes were relatively unimportant; " $\frac{1}{4}$ 's" were noted in under 30 per cent. of the shops in London and "midgets" in 12 per cent. but the 2 lb. size was found only nine times in London and once in Glasgow.

152. *Prices.*—As might be expected from the great variety of honeys included under the heading of blended imported, prices showed substantial variations, ranging from 11 $\frac{1}{2}$ *d.* to 1*s.* 10*d.* for the 1 lb. glass jar in London and 1*s.* to 1*s.* 10*d.* in Glasgow. The predominant price for this size and container was 1*s.* 4*d.* in the London shops but a considerable number was selling at 1*s.* 3*d.* and 1*s.* 7*d.*, all the shops retailing this type of honey at the latter price being multiple chemists. Glasgow prices were somewhat lower and 1*s.* 2*d.* was more usual, though a fair number of shops was selling 1 lb. glass jars at 1*s.* and 1*s.* 4*d.*

153. During the first stage of the London enquiry the most usual prices for  $\frac{1}{2}$  lb. glass jars were 9 $\frac{1}{2}$ *d.* and 10 $\frac{1}{2}$ *d.* but in the second stage, when the majority of instances of this size was recorded, 8 $\frac{1}{2}$ *d.* was the most frequent price. In Glasgow 9*d.* and 10 $\frac{1}{2}$ *d.* were the prices most often noted.

154. In the majority of the London shops where these honeys were stocked the  $\frac{1}{2}$  lb. glass jar was sold at 6 $\frac{1}{2}$ *d.* The price in London for the fancy 1 lb. crock was generally 11 $\frac{1}{2}$ *d.* as against 10 $\frac{1}{2}$ *d.* for the plain crock in the same size. Not many London shops stocked  $\frac{1}{2}$  lb. plain crocks, but among those which did, 7*d.* was the usual price.

*French.*

155. Honey of French origin was found in 19 shops, 17 in London and two in Glasgow. On 15 occasions it was sold under the local description of Narbonne and once as French heather honey; the other descriptions were the labels of French wholesale firms. Usually its sale was confined to departmental stores and high class grocers. In one grocer's shop it was stocked in the comb, but elsewhere in glass jars, almost invariably in the 1 lb. size. French honey commanded a high price; 1 lb. glass jars varied from 2s. to 2s. 8½d. and the comb section was 5s. 6d.

*Other Foreign.*

156. The types of honey in this group which could be definitely identified are Chilian, other South American, Greek, and Russian. In addition, a number of shops were stocking straight honeys of unknown foreign origin, some of which should probably be included with the foreign countries already considered.

157. Chilian, described as such, only occurred twice, and was stocked by a London chemist and a Glasgow grocer. A honey labelled South American was found once, in a London departmental store. Greek honey was stocked in two departmental stores and was offered at 2s. 6d., 3s. 6d. and 4s. 3d. per lb. Eight shops, all in London, were stocking Russian honey. In six instances it was sold loose, and the price was always low.

*Synthetic Honey.*

158. A product described as synthetic or "prepared" honey was found in eight shops, and under three different brands, one of which occurred six times and the others once each. One of the latter was a foreign brand, and the other two were of English manufacture. This product was stocked by two grocers, one dairy, four chemists, and one fruiterer. All were in London except one of the chemists.

VIII.—DEPARTMENTAL STORES AND LARGE  
CENTRAL SHOPS.

159. Of the 20 establishments included in this group, 12 were in London and 8 in Glasgow. All were stocking honey and their sales ranged from half a ton per annum to 20 tons. The trade of these stores extends far beyond their immediate neighbourhoods, and in many cases a large mail order business is carried on, while

several of them maintain their own export departments, through which they regularly supply customers in all parts of the world with groceries and other goods.

160. The importance of this type of shop is brought out by the figures assembled in Table 21, which shows average annual sales in 20 departmental stores and large central shops, compared with the sales in grocers and other shops visited during the survey. In London aggregate sales in the 12 stores were more than twice as heavy as the total sales in 339 grocers' shops, and exceeded by a considerable margin the total in the 781 honey-stocking shops of all types visited in the metropolitan boroughs. The level of sales in the 8 Glasgow shops included in this class was much lower, and their preponderance was not therefore so marked.

TABLE 21.  
*Average Annual Sales in Departmental Stores and the  
Honey Stocking Trades.*

	London.		Glasgow.		Total.	
	Sales.	Number of Shops.	Sales.	Number of Shops.	Sales.	Number of Shops.
<i>Average Annual Sales.</i>	Cwts.		Cwts.		Cwts.	
Departmental Stores, etc.	1,727	12	361	8	2,088	20
Honey Stocking Trades.						
Grocers .. .. .	772	339	270	171	1,042	510
Other Trades .. ..	673	442	172	166	845	608
Total .. .. .	1,445	781	442	337	1,887	1,118
<i>Average Annual Sales per Shop.</i>						
Departmental Stores, etc.	143·9	12	45·1	8	104·4	20
Honey Stocking Trades.						
Grocers .. .. .	2·3	339	1·6	171	2·0	510
Other Trades .. ..	1·5	442	1·0	166	1·4	608
Total .. .. .	1·9	781	1·3	337	1·7	1,118



161. A large proportion of the customers of these stores is of the type who insist on being supplied with the particular variety of honey which they favour, and the satisfaction of a discriminating demand of this nature entails the maintenance of a wide selection of stocks. In 18 out of the 20 stores comb and extracted honey were stocked simultaneously; all of them stocked extracted honey in both the set and clear forms, and, especially in London, a large number of types and varieties.

162. It was found that in the London departmental stores 12 main types and more than 50 varieties of honey were on sale. Home produced honey was stocked in all of them, and was sold under 16 different designations, most of which represented the produce of different counties or localities. New Zealand honey was also stocked by all the London stores, 11 of them stocking the official brand, "Imperial Bee," and in addition six other proprietary brands.

163. Glasgow differed from London in offering fewer types (7 against 12) and fewer varieties of single types (11 against 54). In Glasgow Home honey, for instance, was either heather honey or labelled "Scottish," and New Zealand honey was always the official brand. Canadian honey was stocked in eight of the London and six of the Glasgow stores, but only the official brands "Bee-kist" and "Quebec" were found in the latter, while in London six varieties were on sale. Australian, Other Empire, and Blended Imported honeys were also fairly popular in London, although rarely found in Glasgow, but United States honey, which was stocked by only five of the London stores, was the only type of honey sold in every store in the northern centre.

164. These stores also offered a large variety of containers and sizes. Four large London stores stocked every type of honey container found during the survey, glass jars, plain and fancy crocks, cartons and tins, and, with the exception of the  $\frac{1}{4}$  lbs., almost every obtainable size from 2 oz. midgets up to 60 lbs. including tins of 2 $\frac{1}{2}$ , 4, 5, 7 and 14 lbs., and in one case of 30 lbs., and crocks of 2 $\frac{1}{2}$ , 3 and 7 lbs. Of the remaining London stores all stocked 1 lb. and  $\frac{1}{2}$  lb. jars, and most of them stocked a selection of larger sizes from 2 lbs. up to 7 lbs. in tins. In Glasgow all the central stores stocked 1 lb. jars, five of them stocked either  $\frac{1}{4}$ 's or  $\frac{1}{2}$ 's or both, and three stocked a selection of sizes above 2 lbs.

The following table shows the number of stores stocking each type and the number of varieties in which it was found.

**TABLE 22.**  
*Types of Honey Stocked by Departmental Stores and  
Large Central Shops.*

Varieties.	London (12 Stores).		Glasgow (8 Stores).	
	No. of Stores Stocking.	No. of Varieties Stocked.	No. of Stores Stocking.	No. of Varieties Stocked.
Home .. .. .	12	16	4	2
Canadian .. .. .	8	6	6	2
Australian .. .. .	8	3	1	1
New Zealand .. .. .	12	7	6	1
Irish Free State .. .. .	2	1	3	2
British West Indian .. .. .	6	2	—	—
Palestine .. .. .	1	2	—	—
Other Empire .. .. .	9	8	—	—
French .. .. .	8	1	—	—
United States .. .. .	5	3	8	2
Greek .. .. .	1	2	—	—
South American .. .. .	1	1	—	—
Blended Imported .. .. .	10	2	1	1

**IX.—SUMMARY.**

165. *Object and Scope of Survey.*—The object of the enquiry was to examine the position of Empire honey in the retail shops in London and Glasgow, and to estimate as far as possible the extent and nature of the competition from honey of foreign origin.

166. The survey was undertaken during the year 1930 and the early part of 1931. In all 3,561 shops were visited, 1,949 in London and 1,612 in Glasgow; 1,138 of these shops were stocking honey, and of these 793 were in London and 345 in Glasgow.

167. In addition, information was obtained from 25 honey importers, brokers, blender-packers and wholesale suppliers; from over 50 manufacturers, including manufacturing chemists, confectioners and bakers; and from 18 catering firms controlling about 750 restaurants.

168. *Supplies.*—In the five years 1926–30 imports of honey averaged 76,700 cwts. per annum. The principal sources of supply are indicated below, the figures representing average percentages in the period 1926–1930 :—

	<i>Per cent.</i>
British West Indies .. .. .	18
New Zealand .. .. .	17
Canada .. .. .	9
Other Empire.. .. .	3
	—
Total—Empire Countries .. ..	47
	—
United States .. .. .	25
Cuba and St. Domingo .. .. .	8
Chile.. .. .	6
Russia .. .. .	6
Other foreign .. .. .	8
	—
Total—Foreign Countries .. ..	53
	—

The average for New Zealand, the chief Empire source in 1928 and 1929, was reduced by the abnormally low import in 1930.

169. *Consumption.*—Home production of honey may be estimated at about 30,000 cwts. per annum and total available supplies to an average of 100,000 cwts. per annum, an average annual consumption per head of the population of about  $\frac{1}{4}$  lb.

170. *Sources of Demand.*—The demand for honey arises from three main sources—(a) domestic consumers; (b) manufacturing traders, such as chemists, confectioners and bakers; and (c) the catering trade.

171. Estimates of the relative quantities absorbed through these channels are not available, but it is generally agreed in the trade that domestic consumption is by far the most important.

172. *Stocks and Sales.*—In the two areas combined only 32 per cent. of the shops visited were found to be stocking honey and a number of reasons may be advanced to account for this apparent indifference.

173. By the majority of retailers honey was regarded as a minor item in their business. The lack of popular interest in honey as a

food was attributed to a variety of causes, the chief of which were its price, which was relatively high compared with jam, the lack of any marked variety of flavour, and its association in the minds of consumers with medicine. To the use of honey as a medicine was attributed the marked seasonal variation in sales, which were generally agreed to be heaviest in late autumn and winter.

174. Of the two areas, London was the more important market for honey. As compared with Glasgow the percentage of shops stocking honey was higher (41 per cent. against 21 per cent.) and, also, average sales per shop were generally greater. London shops offered a wider selection of honeys.

175. From the point of view of sales the London departmental stores and large central shops in Glasgow, 20 in all, were more important than the remaining 3,540 shops of all trades visited in both centres. Of the five honey stocking trades the highest proportion of shops stocking honey in London was found among the dairies; in Glasgow the chemists were highest. But in both London and Glasgow the grocers were responsible for the largest individual share of the trade. The dairies were next in importance in London and the chemists and fruiterers in Glasgow.

176. Branches of multiple organisations were more frequently stocking honey than independent retailers, and average sales in these shops were generally substantially greater; this applied particularly to the London dairies and the Glasgow chemists. A striking difference was also noted between shops catering for different income groups; the proportion of shops stocking honey and average sales per shop were much higher in the better class districts than in those areas where the population is mainly poor. These conditions may be attributed partly to price and partly, according to many retailers, to the tendency among the poorer classes to confine their purchases of honey to small quantities for medicinal purposes.

177. Another interesting feature is the high relative importance of a small section of the trade. In London the bulk of the sales among the honey stocking trades was concentrated in about three-fifths of the shops, and under half in Glasgow. Although there was considerable variation in the level of sales in shops of different sizes, the chief reason for this concentration of business was the comparatively higher average sales in the larger shops, which formed a relatively small proportion of the total.

*Types, Containers, Sizes and Prices.*

178. The bulk of the honey on the retail market was extracted honey. Of the 1,138 shops stocking honey all but nine were stocking this type.

179. Comb honey was found in 15 per cent. of the shops stocking honey in Glasgow, and in about 10 per cent. of the London shops. The bulk of the comb honey found was Home produced or imported from the United States, but some Canadian honey in the comb was noted towards the end of the survey. It was the only form in which Irish Free State honey was found.

180. As between set and clear extracted honey there appeared to be no definite preference in London, the shops stocking each being fairly evenly divided, but in Glasgow there was a definite preference for set honey.

181. In London honey of a light coloured type was preferred while in Glasgow the slightly darker coloured amber honey was more in favour.

182. The glass jar was the most popular type of container for extracted honey. In London 92 per cent. of the shops stocking honey stocked glass jars and in Glasgow 94 per cent. The shape of some of the glass jars in use was occasionally criticised, and consumers were said to prefer caps which unscrewed.

183. Crocks were noted in one-third of the shops in London ; only 3 per cent. of the Glasgow shops stocked this type of container.

184. The great bulk of the retail honey trade was done in 1 lb. and  $\frac{1}{2}$  lb. containers, and 98 per cent. of the shops in London and Glasgow combined were stocking one or other or both these sizes. A greater variety of sizes was offered in the London shops, and sizes smaller than "halves" were not favoured in Glasgow.

185. For honey as a whole the range of prices was wide, the main reason for this being that such a range must necessarily include honeys of all types and qualities ; allowance must also be made for the fact that sizes are nominal. The prices most frequently noted for the 1 lb. glass jar were 1s. 2d. to 1s. 4d. in London and 1s. 4d. to 1s. 6d. in Glasgow.

The salient features of this analysis have been summarised in Table 23.

TABLE 23.

*Summarised details of Retail Honey Trade.*

Particulars.	London.		Glasgow.
	K.P.S.	Rest.	
<i>Shops.</i>			
<i>Number of Shops Visited</i> .. .. .	1,045	904	1,612
<i>Percentage of Shops Stocking Honey</i> .. ..	33	49	21
<i>Sales.</i>			
<i>Total Annual Sales.</i>			
<i>Honey Stocking Trades</i> .. .. .	570 cwts., 876 cwts.		446 cwts.
<i>Departmental Stores, etc.</i> .. .. .	1,727 cwts.		361 ..
<i>Average Annual Sales per Shop.</i>			
<i>Honey Stocking Trades</i> .. .. .	1·7 cwts., 2·0 cwts.		1·3 ..
<i>Departmental Stores, etc.</i> .. .. .	143·9 cwts.		45·1 ..
<i>Types of Honey.</i>			
<i>Percentage Stocking.</i>			
(a) Comb .. .. .	10 per cent.		15 per cent.
(b) Clear only .. .. .	32 " "		32 " "
(c) Set only .. .. .	28 " "		56 " "
(d) Clear and Set .. .. .	40 " "		12 " "
<i>Containers.</i>			
<i>Percentage Stocking.</i>			
(a) Glass Jars .. .. .	92 per cent.		94 per cent.
(b) Plain Crocks .. .. .	33 " "		3 " "
(c) Fancy Crocks .. .. .	11 " "		1 " "
(d) Cartons .. .. .	5 " "		9 " "

TABLE 23.—*continued.*

Particulars.	London.	Glasgow.
<i>Sizes.</i>		
Percentage Stocking.		
(a) 1 lb. . . . .	74 per cent.	76 per cent.
(b) $\frac{1}{2}$ lb. . . . .	78 " "	66 " "
(c) $\frac{1}{4}$ lb. . . . .	40 " "	10 " "
(d) Midget . . . . .	21 " "	1 " "
<i>Predominant Prices.</i>		
(a) Comb Section—1 lb. . . . .	2/3 to 2/6	1/4 to 1/6 & 2/6
(b) Glass Jars.		
1 lb. . . . .	1/3 to 1/4	1/4 to 1/6
$\frac{1}{2}$ lb. . . . .	8½d. to 10½d.	10d., 10½d. & 1/-
$\frac{1}{4}$ lb. . . . .	6½d.	6d.
(c) Plain Crock—1 lb. . . . .	10½d.	1/-

186. *Country of Origin.*—The honey found in the course of the survey was offered for sale under 244 different designations or descriptions, of which about 50 indicated the particular district from which the honey came (*e.g.*, the county in the case of Home honey), about 90 were special brand names, such as "Beekist," "Imperial Bee," and "Golden Wattle," and 100 were distributors' labels.

187. Honeys of Empire origin, but not identifiable as the product of any particular country (Other Empire) were the most popular varieties in London, followed by Blended Imported, and, some distance behind, by New Zealand. In Glasgow, New Zealand honey was most often encountered, Blended Imported being next in importance, with United States and Other Empire closely following.

188. As between the two centres Australian, British West Indian, Other Empire, and Blended Imported were more popular in London than in Glasgow, while Canadian, New Zealand and United States were more often met with in Glasgow. Blended honeys and proprietary brands generally found a readier sale in London than in Glasgow.

Details have been summarised in the following table which also gives the most usual prices for 1 lb. glass jars.

TABLE 24.

*Shops stocking Honey from various Countries and most usual Prices.*

Country of Origin.	Number of Shops Stocking.		Percentage of Shops Stocking.		Most usual Price, 1 lb. Glass Jars.	
	London.	Glasgow.	London.	Glasgow.	London.	Glasgow.
Home .. .. .	106	46	13	13	1/10 & 2/-	2/- to 2/6
Canadian .. .. .	23	35	3	10	1/4	1/2
Australian .. .. .	76	5	10	1	1/3 & 1/4	—
New Zealand .. .. .	125	105	16	30	1/4	1/4 & 1/6
British West Indian .. .. .	55	6	7	2	†	—
Irish Free State .. .. .	4	8	*	2	Comb only	Comb only
Other Empire .. .. .	366	73	46	21	1/1 to 1/4 & 1/6	1/3 & 1/6
United States .. .. .	87	87	11	25	1/2	1/6
Other Foreign .. .. .	47	6	6	2	—	—
Blended Imported .. .. .	333	98	42	28	1/4	1/2 & 1/4

\* 0.5 per cent.

† No predominant price.



· APPENDIX I.

*Imports of Honey in Recent Years.*

Countries whence consigned.	1926.	1927.	1928.	1929.	1930.	Average 1926 to 1930.	Average Per- centage, 1926-30.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Per cent.
New Zealand .. ..	11,673	7,821	20,871	21,600	1,171	12,627	16.5
British West Indies ..	12,325	15,948	9,065	15,866	15,900	13,821	18.0
Canada .. ..	4,800	6,487	3,161	9,438	11,819	7,141	9.3
Australia .. ..	623	4,835	1,626	535	684	1,661	2.2
Other Empire Countries ..	287	717	473	409	2,522	881	1.1
<b>Total Empire Countries</b>	<b>29,708</b>	<b>35,808</b>	<b>35,196</b>	<b>47,848</b>	<b>32,096</b>	<b>36,131</b>	<b>47.1</b>
United States .. ..	15,497	21,215	18,755	23,404	15,311	18,836	24.6
Cuba and St. Domingo ..	10,280	10,807	2,690	3,241	3,450	6,094	7.9
Chile .. ..	3,111	5,272	2,569	6,525	6,325	4,760	6.2
Russia .. ..	886	8,032	6,467	5,218	2,742	4,669	6.1
France .. ..	726	1,026	467	595	437	650	0.8
Other Foreign Countries ..	3,907	2,255	4,814	10,229	6,636	5,568	7.3
<b>Total Foreign Countries</b>	<b>34,407</b>	<b>48,607</b>	<b>35,762</b>	<b>49,212</b>	<b>34,901</b>	<b>40,577</b>	<b>52.9</b>
<b>Grand Total .. ..</b>	<b>64,115</b>	<b>84,415</b>	<b>70,958</b>	<b>97,060</b>	<b>66,997</b>	<b>76,708</b>	<b>100.0</b>
<b>Retained Imports .. ..</b>	<b>60,829</b>	<b>73,023</b>	<b>57,655</b>	<b>91,492</b>	<b>64,623</b>	<b>69,524</b>	<b>—</b>

## APPENDIX II.

### *Marking of Imported Honey.*

In connection with the blending of imported honey, a statutory order under the Merchandise Marks Act of 1926 is now in force. The following is an extract from the order, which is known as The Merchandise Marks (Imported Goods) No. 3 Order, 1928 :—

1. It shall not be lawful to sell or expose for sale in the United Kingdom any imported honey, or any blend or mixture of honeys of which imported honey forms part, unless it bears an indication of origin.

2. The indication of origin shall be printed, stencilled, stamped or branded on the container, or on a label securely attached thereto, indelibly and in a conspicuous manner, in plain block letters not less than one-twelfth of an inch in height when the greatest dimension of the packet does not exceed six inches, and not less than one-eighth of an inch in height when the greatest dimension of the package exceeds six inches. For the purpose of this Part of this Order the expression "greatest dimension" shall mean the height, length or breadth, whichever is the greatest, of a rectangular or approximately rectangular package, and the height or maximum diameter, whichever is the greater, of a cylindrical, oval or conical package.

3. The form of the indication of origin in the case of blends or mixtures containing imported honey shall be, at the option of the person applying the indication, either :—

(a) in the case of honey derived entirely from countries within the Empire, the word "Empire"; and in the case of honey derived entirely from foreign countries, the word "Foreign"; or

(b) a definite indication of all the countries of origin of the honeys forming the blend or mixture; or

(c) the words "Blended imported"; provided that the indication "Blended imported" shall be applicable to any blend or mixture of honey, even though it contain honey produced in the United Kingdom.

4. This Part of this Order shall not apply to exposure for sale wholesale if the person exposing the goods is a wholesale dealer.

5. The provisions of this Part of this Order shall come into force at the expiration of six months from the date hereof.



## MILK PRICE MARGINS

A Report on the Differences between Producers' Prices, Wholesale Prices and Retail Prices of Liquid Milk in Certain Large Cities in Different Countries.

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JUNE 1932

LONDON:

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE  
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:  
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X9(1311:71):76-3.N3

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## PREFATORY NOTE.

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This memorandum was written at the request of the Agricultural Economics Committee of the Empire Marketing Board to test out how far the relationship of producers' prices and retail prices could be usefully approached from the angle of international comparison. It was not meant to be in any sense a complete and exhaustive study of the subject chosen but a preliminary searching of the field to see whether examination could usefully be pushed further. It trenches upon subjects of immediate practical interest in dealing with the difference between the price paid to the producer and that charged to the consumer for a staple foodstuff; it seeks to deal with this matter along the line of reasoned explanations. The writer was deeply indebted both in the collection and interpretation of price material to the officials of the Department of Overseas Trade, to Public Health Officials in Foreign Cities, and to milk traders, who gave time for interviews from their busy days.

R. B. FORRESTER.

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MEMORANDUM UPON THE DIFFERENCE BETWEEN  
PRODUCERS' PRICES, WHOLESALE AND RETAIL  
PRICES OF LIQUID MILK IN CERTAIN LARGE  
CITIES IN DIFFERENT COUNTRIES.

THE aim of this inquiry is to examine the differences or margins between the prices estimated to be paid to producers of milk and the prices paid by household consumers in certain large cities in a number of countries. This should cast light upon the payments made for dairy trade services in each case and upon the general character of the services rendered.

It might also indicate whether any general tendencies could be observed in the movement and amount of these margins and whether there was any great contrast between the margins of different cities in different countries.

The method of approach attempted in this memorandum is to collect and examine series of producers', wholesale and retail, milk prices in each of the large cities described in each country. It has been necessary to rely upon written material and general observation, as there was naturally no chance of collecting evidence from the accountancy point of view. The preliminary survey goes into a field of international comparisons which lies in many respects beyond what has commonly been covered by such investigations into distribution costs as those made by the "Linlithgow" Committee (Cmd. 1854 of 1923 Milk Report) and by the Royal Commission on Food Prices (Cmd. 2390 of 1925).

Price series have been assembled over a number of recent years for the following cities:—

- (1) London and Glasgow.
- (2) Berlin, Hamburg, and other German cities.
- (3) Paris and other French cities.
- (4) Copenhagen.
- (5) New York and Chicago.

The information is limited in certain directions both by its degree of reliability and by difficulties of interpretation, as will be explained in the course of the description; it has also been possible to include certain evidence of a more general character concerning other cities than those specially mentioned.

It ought to be stated that the cities named were picked because their relative size suggested that they would represent large scale distributive services and costs as distinct from small town and village methods, and further they fell sufficiently within the same range of climate, the same customs and habits with regard to milk consumption, and the same relationship to dairy production areas as to make comparison not impossible or meaningless. It is not suggested, however, that this selection of cities is representative of large scale milk distribution, but that it was a convenience to choose cities where some information was readily available for a preliminary study of this kind, and these cities would in any case have to be included in any more widespread inquiry.

*The Question of Price Quotations, their Significance and Reliability.*

In all cases an effort was made to obtain price series with a definite significance, so that their use in comparisons would be made as precise as conditions permitted; for this reason a preliminary explanation may be given of the way in which prices were commonly quoted and the questions which directly arise therefrom.

There are in fact five levels of prices which may be quoted in dealing with producers', wholesale, and retail prices of liquid milk in large cities :—

*The Farm Price.*

(1) *The Farm Price* or *Stable Price* is sometimes quoted where the net price to the producer is being stated, but it should be kept in mind that this price includes different services from different classes of producers; it may include beyond all ordinary expenses of production such services as cooling, delivery at a local railway station or country dairy depot; or again a farmer may arrange his milkings so as to give extra early deliveries for which he will be paid an addition. On the other hand it may include none of these things, or the producer may be paid extra for such services.

*The Price at Station of Delivery.*

(2) *The Price delivered at the Railway Terminus* of the city of consumption is the quotation usually available. This is referred to as "free Berlin" or "free Copenhagen." It includes all transport costs involved and all responsibility for the condition of the milk until it reaches the city wholesaler or retailer; all these costs are generally borne by the producer and deducted from his return. In



this case also there are difficulties, since the milk may come not directly from the producer, but from either a co-operative or private creamery or depot which will usually process the milk and despatch it to a city wholesaler or retailer ; the price might then cover cooling, cleaning, pasteurising, and allied processes.

*The " Wholesale " Price.*

(3) The price at which the wholesaler sells to the retailer after performing such services as cooling, cleaning, pasteurising, balancing of supplies, cleaning and provision of containers, and more rarely bottling, is the wholesale price in the strict sense of the term, but it is rarely quotable, as the separation of function between wholesaling and retailing is not clearly definable and the demarcation depends upon the character of trade organisation. A series of definite standard wholesale prices is found, for example, in Glasgow, but this city is almost alone in this respect.

*The Counter or Shop Price.*

(4) The price at which milk is sold loose in dairies, waggons and shops is quoted as the *shop price* and is the most usual form of retail price quotation on the continent. This means the price at which the consumer can have milk if he or she goes for it to a depot ; it is therefore a " counter " price.

It is to be understood that this price may cover milk which has been processed by large wholesalers, and milk which has come direct into sale from a city cow byre.

*The Domicile Price.*

(5) The price at which milk is delivered to the consumer's door-step is referred to as the " *prix à domicile* " or domicile price. This covers the extra expense of house to house delivery which is usual in Britain but less usual in Europe, unless specially arranged for and paid for. It is unusual except in Britain, Denmark, and the United States, for this price to cover bottled milk without extra charge.

These prices refer to the ordinary kinds of legally recognised full milk and not to skimmed milk, butter milk, or to the special qualities of graded milk, which are also sold in such cities as London, Berlin and Copenhagen.

The quality and control of milk vary somewhat between countries so that it cannot be said that there is a standard commodity for a given price either as regards butter fat, other solids, cleanliness, or

bacterial content ; it is proposed to proceed with the examination of prices, taking account so far as measurable of these differences between countries.

It is sufficient at this point to draw attention to the fact that in most of these cities there may operate at one time as many as four considerable business channels of distribution :—

- (1) Direct sale by producers to consumers.
- (2) Sale by producers to retailers.
- (3) Sale by producers to wholesalers and wholesale-retailers.
- (4) Sale by creameries to wholesalers and to retailers.

It follows that a given margin between producers' price and retail price covers different services in the same market.

Other matters which call for attention are :—

- (1) How far the quotations represent the genuine state of the market in each city, as distinct from formal or official statements of what prices were believed to be at certain periods.
- (2) The question of units of measure and of currency presents some arithmetical complications, and it was decided to convert into British measures where comparison made that necessary, although this does not effect comparisons of percentages. Where conversions involve the use of currency exchange rates, these have been stated and the method of using them.
- (3) The difficulty presented by the differences in international price levels and standards of living has only been touched upon incidentally.

It is necessary to explain generally how the tables have actually been used ; first the prices have been collected where possible over a series of years to show any obvious trends in the margin, secondly the difference between producers' prices and retail prices has been examined in detail so far as the evidence was available.

SECTION I.

THE LONDON MILK PRICES.

The two series of prices which can be quoted for London are (1) the price per imperial gallon delivered London terminal, and

(2) the retail domicile price, which is in this case the same as the counter or shop price. These prices have been cited over the period 1913-1929; and it may be stated that the figures represent rates ruling in the market, particularly in the later years after 1920. The tables have been summarised into annual average prices and are also shown in monthly rates to show the trends.

TABLE I.  
Summarised table\* showing London Milk Prices 1913-1929.

Year.	Average Pence per Imperial Gallon.		
	Price delivered London.	Margin.	Retail Domicile Price.
	I.	II.	III.
1913 .. ..	9 <sup>8</sup> / <sub>32</sub>	6 <sup>29</sup> / <sub>32</sub>	16
1914 .. ..	9 <sup>7</sup> / <sub>32</sub>	6 <sup>25</sup> / <sub>32</sub>	16
1915 .. ..	10 <sup>21</sup> / <sub>48</sub>	7 <sup>1</sup> / <sub>16</sub>	17 <sup>11</sup> / <sub>32</sub>
1916 .. ..	14 <sup>3</sup> / <sub>24</sub>	7 <sup>5</sup> / <sub>8</sub>	21 <sup>7</sup> / <sub>8</sub>
1917 .. ..	16 <sup>1</sup> / <sub>8</sub>	9 <sup>1</sup> / <sub>2</sub>	25 <sup>3</sup> / <sub>8</sub>
1918 .. ..	20 <sup>7</sup> / <sub>8</sub>	10 <sup>19</sup> / <sub>24</sub>	31 <sup>3</sup> / <sub>8</sub>
1919 .. ..	25 <sup>1</sup> / <sub>12</sub>	13 <sup>1</sup> / <sub>4</sub>	38 <sup>1</sup> / <sub>8</sub>
1920 .. ..	26 <sup>1</sup> / <sub>12</sub>	12 <sup>15</sup> / <sub>48</sub>	38 <sup>1</sup> / <sub>8</sub>
1921 .. ..	23 <sup>19</sup> / <sub>24</sub>	13 <sup>19</sup> / <sub>24</sub>	37 <sup>1</sup> / <sub>8</sub>
1922 .. ..	16	12	28
1923 .. ..	15 <sup>1</sup> / <sub>8</sub>	11 <sup>5</sup> / <sub>8</sub>	27 <sup>1</sup> / <sub>8</sub>
1924 .. ..	15 <sup>2</sup> / <sub>8</sub>	11 <sup>7</sup> / <sub>24</sub>	26 <sup>2</sup> / <sub>8</sub>
1925 .. ..	14 <sup>2</sup> / <sub>8</sub>	11 <sup>1</sup> / <sub>8</sub>	26
1926 .. ..	15 <sup>1</sup> / <sub>24</sub>	11 <sup>5</sup> / <sub>8</sub>	26 <sup>2</sup> / <sub>8</sub>
1927 .. ..	14 <sup>1</sup> / <sub>4</sub>	11 <sup>2</sup> / <sub>8</sub>	26
1928 .. ..	14 <sup>1</sup> / <sub>24</sub>	11 <sup>17</sup> / <sub>24</sub>	26
1929 .. ..	15	11 <sup>2</sup> / <sub>8</sub>	26 <sup>2</sup> / <sub>8</sub>

\*For detailed figures see Appendix I.

It appears from these figures (1) that prices have settled during the last few years at roughly 60 to 65 per cent. above 1913 prices

for the producers' delivered London price, 60 to 65 for the margin, and 60 to 65, for the retail domicile price.

(2) That the percentage of retail price which the delivered London price constitutes is approximately 58; if the allowance of  $1\frac{1}{2}d$ † per gallon for transport costs be made, as may fairly be done, then the percentage would fall to 52.

(3) If the detailed table in the Appendix be examined, it is seen (a) that in the pre-war years, there was a clearly marked seasonal swing within each year of producers' delivered price and margin in opposite directions leading to an even all the year round retail price. This has been changed in recent years to a position where the producers' price still swings seasonally with a tendency to make April and September winter months, but where the trade margin has become almost even all the year round, four winter months being slightly lower than the rest of the year. The fluctuation is transferred to the consumer by a variation in summer and winter prices of milk.

(4) The London "margin" may therefore be taken as  $11\frac{1}{2}d$ . to  $11\frac{3}{4}d$ . per imperial gallon all the year round; it is therefore 50 per cent. of the retail price in the summer season, falling to 39-43 per cent. in the winter period.

The precise meaning of the two series of prices and the services covered by the margin may be outlined:—

(a) *The Producers' Price Delivered London.*

(1) The producers' price delivered London has been since 1922 the result of a collective bargaining between the N.F.U. and the Dairy Trade Organisations, and the conditions under which it operates are clearly defined.\*

(2) The prices are fixed for 12 months in advance.

(3) The price is not paid for all a farmer's milk but for some proportion of a measured standard quantity varying from 90 to 115 per cent. and in some months covering all milk, so that there is a certain quantity of "surplus" milk for which farmers commonly receive much lower rates of payment, based upon the price of New Zealand and Canadian cheese in the British market.

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† Compare Cmd. 1854 of 1923, p. 23.

\* See N.F.U. Year book, 1930, and Ministry of Agriculture Economic Series No. 16, The Fluid Milk Market. Certain modifications have been made in 1931 and 1932.

(4) This rate is supposed, however, to be paid for all milk which goes into liquid consumption.

(5) Transport charges are a deduction from this price and average 1½d. per gallon. The greater portion of London's milk comes from distances varying from 40 miles up to 200 miles and a little comes over 300 miles; there is a tendency with the improvement in transport, due to use of tanks, for London to draw on all important surplus areas. At present Wilts, Somerset, Derby, Leicester, Stafford, Cheshire and the home counties of Berkshire, Oxford, and Buckingham are the most important areas.

(6) The London producers' price, therefore, includes transport, risk of arrival in bad conditions, cost of cooling. It would not commonly include the trading services, such as pasteurising, which are performed at the London depots.

(7) It must be borne in mind that much London milk arrives from country depots and is therefore in the hands of the dairy trade before its journey to London begins. In this case it is purchased at a price lower than the London terminal price by 1d. (1928-1929) and in addition any transport charge to the creamery must be met by the producer.

*(b) The Retail Domicile Price.*

(1) This is a price charged to domestic consumers for milk delivered in bottles to their doorstep; the same price holds at the counter; there is no difference now between the price for loose milk and that for bottled milk.

(2) The charge covers all the recognised methods of processing, such as clarifying, pasteurizing (whether by officially recognised methods or not), cooling, bottling, checking, despatching and delivery. It does not follow, however, that all milk sold to the public has been fully processed, but the great proportion of it now is.

(3) It is not the case that all milk is sold into consumption at this price; institutions, hotels, hostels, schools, restaurants, tea houses, etc., buy at a price which is termed wholesale, or semi-wholesale, which lies between the London terminal price and the retail domicile price, but it is not standardised. Further there is milk which may be surplus to requirements and which must be converted into cheese or other products at a relatively lower price.

(4) Of the  $11\frac{1}{2}d.$  margin it is commonly asserted that  $3\frac{1}{2}d.$  may be roughly estimated as covering wholesale services, balancing of supplies, processing, etc., and  $8d.$  may be allocated to the various costs of the elaborate delivery services; of these costs labour is the chief. The direct labour of delivery alone is estimated to cost from 50 to 55 per cent. of this sum. Wages are controlled by the Milk Distributive Trade Board and have not changed since 1923. In London two deliveries are commonly given, an early morning and a forenoon supplementary.

(5) The cost of the system of distribution does not fall wholly upon the sales of liquid milk, since other commodities are also sold over the counters and to a more limited extent from delivery waggons. Such other articles are butter, cheese, margarine, condensed milk, milk powder, honey, jam, eggs, patent cereal foods, bottled, tinned goods, and so on; but articles likely to produce dust or contaminations are not usually permitted to be sold in dairy shops under the Medical Officer's rules. It is commonly stated that there has been a great increase of recent years in the amount of these non-fluid milk sales.

(6) Taking London and its suburbs as an 8 million town, a further matter of business importance is the estimated consumption per head of the population, since a heavy milk drinking population would naturally reduce the per gallon cost of distribution. London is a city of relatively low demand; the quantity is calculated at from  $\frac{1}{3}$  to  $\frac{2}{3}$  of a pint per day per person, or 15 to 18 gallons per head per annum.\*

(7) The presumptive standard for British milk is 3 per cent. butter-fat and 8.5 per cent. non-fat solids, but most milk sold reaches 3.5 per cent. butter-fat and almost 9 per cent. of non-fat solids. There are also both trade and governmental controls of a sanitary and chemical form applied to both farmers and dairymen. It is commonly claimed that London's milk supply has been definitely improved in safety and keeping quality within the last 10 years, (a) by the creation of up-to-date processing plants, and (b) by the introduction of the bottling process.

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\* The estimates given present difficulties since they are commonly based upon the amount of milk "arriving" in London. It is open to doubt if this is a reasonable figure for consumption.

## SECTION II.

### GLASGOW MILK PRICES.

Three levels of prices are commonly quoted for fluid milk in Glasgow :—

- (1) The Producers' Price delivered Glasgow ;
- (2) The Wholesale Price in Glasgow ;
- (3) The Retail Domicile Price.

This is exceptional and it gives an opportunity to observe how the dairy trade organisations themselves divide up the total margin between wholesale and retail services. The prices are quoted for 1913 and for the years 1922-29; and it is stated that in the post war years the prices are believed to have represented the ruling prices in Glasgow, but it seems certain that considerable quantities of milk were sold by producers at less than the figures stated, and some price cutting took place in retail prices; this was considered so serious in 1926 and 1927, that it was one factor influencing the producers to launch the special milk marketing organisation, known as the "Scottish Milk Pool." The organisation of both producers and dairymen was weak in pre-war years, and the 1913 figures are therefore of doubtful value as ruling prices.

TABLE II.

*Summarised table\* showing average Glasgow milk prices in 1913 and 1922-29.*

Year.	Average Price delivered Glasgow per imperial gallon	Total margin.	Average Retail Price.
	<i>d.</i>	<i>d.</i>	<i>d.</i>
1913 .. ..	8	5	13
1922 .. ..	14	$9\frac{1}{3}$	$23\frac{1}{3}$
1923 .. ..	$15\frac{1}{12}$	$8\frac{11}{12}$	24
1924 .. ..	$15\frac{1}{12}$	$8\frac{11}{12}$	24
1925 .. ..	$15\frac{8}{12}$	$8\frac{11}{12}$	$24\frac{1}{3}$
1926 .. ..	15	9	24
1927 .. ..	14	9	23
1928 .. ..	$14\frac{1}{2}$	$9\frac{1}{6}$	$23\frac{2}{3}$
1929 .. ..	$14\frac{1}{2}$	$10\frac{9}{10}$	$25\frac{1}{6}$

\*For detailed price list see Appendix II p. 68.

(1) From Table II it appears that the Glasgow margin between 1922 and 1928 was 9*d.* and that the producers' price delivered Glasgow was 61 to 62 per cent. of the retail price.

(2) From Appendix II showing the monthly figures it can be observed that the division between wholesale and retail costs is 3½*d.* for wholesale and 5½*d.* for retail services, and that this figure is practically constant up to 1929 when there is a rise of a notable kind.

(3) Considering first the producers' price delivered Glasgow, it is the result of a collective bargain between producers' organisations and the dairy trade and it has many features of similarity with the London type of agreement. Prices are fixed for 12 months in advance and producers' surplus milk is defined by its relation to a standard quantity; once again the theory is that all the milk going into public consumption in its liquid form should be paid for at the full rate. Transport charges are a deduction from producers' price, and it is stated that 1*d.* per gallon would represent the normal figure for Glasgow milk. Unlike London, which, is distant from important milk fields, Glasgow lies close to the great Scottish milk fields and much of its supply comes from creameries and individual producers within 50 miles of the city; in addition there is the important area between Stranraer and Carlisle which is ready to export large quantities. The distances are such that road transport can be freely used and a number of well equipped creameries lie within 30 miles of the city; in these the milk is cooled, pasteurised, and the surplus is converted into cheese.

(4) The retail domicile price holds both for the counter and the doorstep and it also holds for the most part for bottled milk. It is necessary, however, to say that the proportion of bottled milk to loose milk is much less than in London and that the processing plants are less up-to-date in character, but considerable progress is being made in both directions.

(5) All milk sold is not fully processed and therefore the nominal margin may be obtained for fewer services.

(6) Glasgow itself has just over 1,000,000 population and in its neighbourhood in the Clyde valley there is another million of population; it therefore represents by far the most valuable Scottish market. It is not, however, a city of high milk consumption and it is doubtful if its consumption per head exceeds  $\frac{2}{3}$  of a pint per day.



(7) The margin of  $3\frac{1}{2}d.$  wholesale and  $5\frac{1}{2}d.$  retail, which has been stable for some years, is designed to cover the same range of expenses as in the case of London, and it therefore appears that the wholesale margin claimed is much the same in both cities, but the variety of services rendered seems greater in London, especially as the Scottish milk pool has attempted to relieve the dairy trade of the burden of surplus conversion.

(8) In Glasgow the retail distributive system differs somewhat from that in operation in London. It relies on dairy shops, vans, etc., but owing to the dense population living in flats, the deliveries, which are usually twice a day, are done much more by using a number of children to carry out orders from the shop; the parallel is the grocer's type of delivery system. The wage levels are also lower than in London as the rates correspond more nearly to "Area B" rates of the English Trade Board (i.e., towns and cities less than London). This partly explains the difference in the retail margins but the subject could stand further investigation.

(9) If the more detailed tables in Appendix II be examined, two points are noteworthy; the first is the steadiness of the liquid milk prices to producers and of the margin; it is remarkable that during a period of falling prices generally for agricultural products these levels were held. The second point is the appearance of instability in 1929-30 in the margin and the upward trend shown.

### SECTION III.

#### BERLIN MILK PRICES.

The prices for which it is possible to give regular quotations in the case of Berlin are :—

- (1) Producers' Price free Berlin, and
- (2) Shop Price in Berlin.

These prices have been quoted for the years 1925–28 as the German currency was only stabilised in 1924.

These prices are settled weekly by a Milk Price-fixing Commission, representing agricultural interests (two representatives) and traders (two representatives) together with an alternating chairman; this body succeeded to the task of the former war control committee; the committee has the powers of a private conference only and at least one great milk company now takes no part in its deliberations. (The firm of Bolle refused after December 1927 to be bound by its price decisions). It is believed, however, that the prices settled do have the effect of a market rate for the greater portion of Berlin's milk.

TABLE III.

*Annual Average Prices for the Years 1925–28.*

	Producers' Free Berlin Price.		Shop Price.	Pence per gallon.
	Pfg. per litre.	Pence per gall.	Pfg. per litre.	
1925 .. .. .	20·8	11·3	31·6	17·2
1926 .. .. .	18·1	9·8	28·8	15·6
1927 .. .. .	18·6	10·1	29·8	16·2
1928 .. .. .	18·8	10·2	30·3	16·5

Units used :—1 Imperial Gallon = 4·54 litres.  
1 Mark = 1 shilling.

It appears from the quotations in Tables III and Appendix III (1) that producers' prices free Berlin have settled down at between 9·8*d.* and 11·4*d.* for the different months of the year and that in 1928 the average was approximately 10½*d.* per imperial gallon

for "full" milk delivered Berlin; (2) that the shop or counter price showed a fixed margin of 6½d. per imperial gallon (11½ pfg. per litre) beyond the producers' price free Berlin.

The significance of these two series of prices may be outlined:—

*The Producers' Price Free Berlin.*

(1) The Berlin milk market is the chief influence in the East German fluid milk market, as it lies away from the chief German centres of population and does not require to compete for its supplies so much with other cities as with the butter market and the alternative uses of milk. The population was estimated at 4·1 millions in 1925 and the distance of the zones from which it draws its supplies is given as follows:—

		Year 1927. Rail Milk.	
Up to 19 miles	.. ..	..	6·2 per cent. of total.
19-38	" .. ..	..	23·0 " " " "
38-57	" .. ..	..	21·4 " " " "
57-75	" .. ..	..	13·6 " " " "
75-125	" .. ..	..	22·2 " " " "
Over 125	" .. ..	..	13·6 " " " "

A further short table may be given to show the geographical area from which Berlin draws its rail milk.

		1927 Daily Average Supply.	
		Litres.	per cent.
Brandenburg	.. ..	581,400	65·8
Pommerania	.. ..	170,600	19·3
Mecklenburgs	.. ..	86,100	9·7
Rest	.. ..	45,400	5·2
		883,500	100·0

It appears therefore that the City does not require to seek its supply at great distances as yet, since 65 per cent. of the train borne milk was from within a radius of 75 miles.

In addition it must be borne in mind that the railway milk is not the sole source of Berlin's supplies; there are no less than 24,400 cows within the city's boundaries, yielding approximately 290-300,000 litres per day. A further source of supply is termed "axle" milk and refers to milk brought by road; this is still a small element, the figure given being only 30-40,000 litres per day.

The total supply may therefore be stated as :—

	Litres per day.
Rail milk     ..   ..   ..   ..	883,500
City milk     ..   ..   ..   ..	290,000
Axle milk     ..   ..   ..   ..	30,000
	Total 1,203,500

The consumption per head per day is between .25 and .3 litres ; this is equal to about a  $\frac{1}{2}$  pint and is slightly above the estimated London consumption.

(2) The Producers' price free Berlin is, as already mentioned, fixed by a Milk Commission weekly, so that the contracts made by producers with the dairy trade refer to this basic price and only detail variations from it. Producers do not, therefore, know beforehand what they are to get for their milk ; the usual form of contract states the lower and upper limits of the quantity to be delivered in litres per day and a variation of 30 per cent. from lowest to highest is commonly permitted ; deliveries below or above the limits are paid for only at a butter price equivalent fixed by the commission. Weekly payments are the rule. For the containers and their cleanliness the buyers are responsible, unless special arrangements are made. The producer undertakes to give full milk of normal quality, fit to pass the sanitary and hygienic controls imposed by the city authorities. The length of the contract is for a year with three months notice on either side.

(3) The main deduction from the price free Berlin, which the farmer must pay, is the transport cost, which includes transport from the farm to the railway station or Creamery. The railway tariff at present in force came into operation in 1928 and is cheaper than the prewar tariff ; it is doubtful if the average cost of rail-transport per gallon is as much as  $\frac{1}{2}d.$  per gallon in the case of Berlin and this includes return of empties\*.

Distance in Kilometres.	100 litres carried Tariff in pfgs.	Distance in Kilometres.	100 litres carried Tariff in pfgs.
10	26	150	188
20	38	200	240
50	73	300	331
100	136		

\*Railway Tariff Illustration.

(4) The retail price in Berlin is a shop price for loose milk and in the case of rail milk it covers the usual processing and pasteurisation. It therefore differs in two respects from the London quotations (1) it is not a domicile price; (2) it is not bottled milk.

Upon this basis two analyses may be cited of the 6½d. margin of ordinary market milk.

The first is based upon the estimates given by Dr. Karl Brandt in his study of "The Present Position of the Berlin Milk Supply" \* (p. 165 onwards) for the average of 1927.

(a) Milk sent to Berlin by producers and processed after arrival.

(i) Producers' costs including transport to cooling station and to station of departure, transport to Berlin, washing cans, etc., at country cooling station 2·8 pfg. per litre = 1½d. to 1¾d. per gallon of which the actual rail charge would be approximately ½d. per gallon. This is a net deduction from the producers' price and is not part of the distributors' margin, although it is part of the cost of marketing milk.

(ii) Passing to the margin itself, it may be detailed as :—

	pfg. per litre.
(a) Charges covering upkeep of containers, their cleaning, replacement, etc., provision of oversight and control of arrivals and some allowance for risk and spillage .. ..	1·2
(b) From Berlin Stations to Town Dairies ..	·8
(c) From Wholesale plant to Retail shop transport .. .. .	1·2
Various risks covering unevenness of supplies and presence of surplus requiring conversion ..	1·0
Upkeep and cleaning of vessels used for the retailers' supplies .. .. .	·5
Actual processing and pasteurisation .. ..	1·5
Retail margin covering shop upkeep, heat, light, utensils, labour service, taxes, losses of milk, uneven supply etc... .. .	5·0

pfg. per litre 11·2

This is equivalent in pence per gallon to 6½d. approximately.

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\*Work published by the Society for the Study of Berlin's Milk Supply, 1929.

The second estimate is based upon information supplied by the German Ministry of Food and Agriculture although the Ministry is in no way responsible for the figures.

	pfg. per litre.
(a) Import cost as above .. .. .	1.2
(b) Station to Wholesale Plant .. .. .	.85
(c) Wholesale Span .. .. .	2.6
(d) Risk and loss margin .. .. .	1.0
(e) Wholesale Plant to retailer .. .. .	.85
(f) Retailer .. .. .	5.0

Total pfgs. per litre 11.50

This equals in pence per gallon,  $6\frac{1}{2}d.$

Milk sent to Berlin after treatment at country dairies works out at approximately the same price, but conditions appear to be such that the margin is about 1 pfg. per litre or roughly  $\frac{1}{2}d.$  a gallon higher and the producer therefore receives this amount less.

Axle milk is commonly sold at the same price as rail milk, but in general the total expenses are much less, consisting of the retail margin 5 pfg. per litre and a transport cost of 3 pfg. per litre, that is 8 pfg. per litre (equals  $4\frac{1}{2}d.$  to  $4\frac{1}{2}d.$  as against  $6\frac{1}{2}d.$ ). This milk is not usually pasteurised.

The supply produced within the city boundary is of course sold fresh and the only cost is the producers' expenses, but the price level is commonly kept 5 pfg. per litre or  $2.7d.$  per gallon above the ordinary rate.

(5) It may be asked what would the Berlin margin be if services of delivery and bottled milk were given similar to those available in London and Glasgow. It is doubtful if this can be fairly answered for reasons given later in this survey, but the evidence on these two points is as follows:—

If delivery to the doorstep is required from the dairy shops, then 5 pfg. per litre (= 2.7 pence per imp. gallon) is commonly added to the cost; this extends the margin to  $9d.$  In so far as large numbers of people fetch their own milk from the shops or from the waggons of the firm of Bolle, they do not pay this charge and a genuine difference of custom arises. The tendency appears to be, however, towards an extension of domicile delivery and it seems likely that Berlin will gradually develop a domicile service. A further point to bear in mind is that it is scarcely correct to compare a trade organisation which concentrates upon house to house delivery

as in London, with an organisation which does not look upon doorstep delivery as an essential part of the work of distributing milk and adds its cost on to the ordinary cost of retailing.

Bottled milk is not estimated to cover more than 5-7 per cent. of the Berlin supply and the trade margin is reckoned to be higher by 8-10 pfg. per litre for this class of milk (= 4½d. up to 5½d. per imp. gallon). It is clear that if this were to be reckoned a figure comparable with similar figures for London, the Berlin margin would actually be higher than the London margin. Certain reasons may be advanced, however, to show that these estimates represent special circumstances and are not a reliable guide for purposes of comparison. (1) The bottled milk being so small a proportion of the total, tends to include milk of special quality (children's milk, special milk, etc.) where both producer and distributor expect extra payment; (2) The introduction of bottled milk is specially costly in so far as the public has to be accustomed to a new vessel for delivery, which is liable to heavy breakage, loss, etc., and on the other hand the glass bottle system demands for its safe and hygienic working elaborate and expensive machines for cleaning, filling and capping, which require a good turnover for their economical working. There is a decided contrast between this type of large scale sale of milk in glass bottles after processing and the stage where a retailer fills up a few bottles and puts a cap on them all by hand. Berlin is only coming to that stage where she has to face all the costs and difficulties involved in the change-over to the glass bottle milk system.

(6) So far, prices have been spoken of without reference to the quality of the milk, which is termed market or full milk. Berlin has an elaborate system of control and inspection, which it is not proposed to describe at length in this survey, but the following points are mentioned to show the general character of the regulation and to bring out the points of contrast with the British system where that is feasible. The authorities concerned are (1) the Foodstuffs Police who deal with adulteration, falsification, and so on, (2) the Medical Division of Police Headquarters, who would deal with epidemics, etc. (3) the Veterinary Division of Police Headquarters deals with the town cow sheds, etc. (4) The Chief Public Health Office, which controls dairy premises, etc., and makes tests of cleanliness, butter-fat, etc. (5) the Milk Trade Registration which works through a body of representatives of the trade, and consumers under the aegis of the magistracy of Berlin.

The general weakness appears to be the control of conditions on distant farms, which are mainly tested by sampling at railway stations in Berlin, but the large dairy firms themselves naturally attempt some inspection of the farms which provide their supplies.

The kinds of milk recognised are (1) Market Milk, which must have 2·7 per cent. butter-fat and a specific gravity of 1028; (2) Skim Milk (Mager Milch) which falls below the above named limits; (3) Special milks, such as Children's milk, Sanitary milk, which must have at least 3 per cent. butter-fat and be produced under special hygienic control. Pasteurisation and Sterilisation are recognised processes.

Taking the quality points (1) the fat content of Berlin milk is distinctly lower than that of milk in cities such as London and Glasgow; whereas in the British cities an average of over 3·5 per cent. is quite usual, Berlin appears to average 3·0 to 3·2 and much of its supply is between 2·7 and 3 per cent. While the non-fat solids usually come up to the British minimum standard of 8·5 per cent., the tests for sediment and bacterial count are not satisfactory and in the summer months the losses of supply are considerable where the milk has come by rail.

The transport by rail is sometimes over 10 hours in duration and the waiting period at the station of departure is often two hours or over, apart from any delay at the Berlin station, so that much of this milk must be pasteurised; it comes in the following types of containers:—

- (1) 20 litres Cans (= 4·4 Imperial Gallons) 22·7 of total supply.
- (2) 40 litres Cans (= 8·8 Imperial Gallons) 11·7 per cent. of supply.
- (3) 40 litres Casks (= 8·8 Imperial Gallons) 59·6 per cent. of supply.
- (4) 125 litres Tanks (= 27·3 Imperial Gallons) 4·6 per cent. of supply.

The number of small cans exposed to extremes of heat and cold and the numbers of timber casks, with all the difficulties in cleaning them, certainly call for notice.

The general conclusion is that consumers in the two British towns are getting a better quality of milk for their price; this is difficult to reduce to figures, as it is partly represented in cleanliness and better keeping power, but it is clearly seen in butter-fat where the difference is as much as one sixth more butter-fat in the British towns.



(7) The structure of the Berlin milk trade organisation consists of:—

- (1) Wholesalers.
- (2) Wholesaler Retailers.
- (3) Retailers.
- (4) Town Cow Byres.

The milk may come to wholesalers from producers to be processed in their depots or be brought from country creameries; the proportion estimated for town processed milk is 63-67 per cent. of the rail milk.

The largest and most important company is the M.L.G. (Milchlieferungs Gesellschaft m.b.a.); it consists of 330 wholesalers and 3,500 retailers (out of an estimated total of 5,000 retailers in Berlin) and deals with 75 per cent. of the rail supply; it has 13 processing depots of which four are large. The firm of Bolle is a large and important single enterprise, which performs both wholesale and retail work and was estimated to deal with 150-160,000 litres per day (1927) (= 35,000 Imperial Gallons per day). It works through a system of distribution composed of delivery waggons and shops; its waggons represent the most considerable agency selling on the streets of Berlin; it also does a considerable trade in special high quality milk and uses an ultra-violet ray installation in this connection; the price of such special milks may rise to 80 pfg. a litre (= 3s. 7½d. per gallon).

There are at least four other organisations which have businesses of the 10,000 gallons a day type, but it may be said that the Berlin milk trade is dominated by six or seven companies and of these the M.L.G. is the chief.

The retail trade is done mainly through shops, which can sell allied articles, such as eggs, butter, jam, etc., but are prohibited from selling goods such as petroleum, herrings, coal, etc., where contamination and dust might be dangerous.

It thus appears that it is hardly possible to make any easy contrast between labour costs of the Berlin system, which is less complete at the delivery end, and the British system, which works a complete delivery system under trade board regulation of wages, but it seems unlikely that the wages paid in Berlin are equal to two-thirds of those paid in London and the differences in utilisation of labour and in the development of modern dairy equipment make any contrast of doubtful value.

SECTION IV.  
HAMBURG MILK PRICES.

The Prices quoted for Hamburg are :—

- (1) The Price on the farm.
- (2) The Shop Price in Hamburg.

The Tables cover the business years 1924 (May onwards)—1929 (to April).

In this case the quotations for first quality butter per 100 kilos have also been cited since the butter market plays a dominant part in its influence upon the liquid milk price in this area and the weekly settlement by representatives of producers and the dairy trade takes account of fluctuations in butter prices.

TABLE IV.  
*Annual Average Prices for the Year 1924–29.*

	Marks per 100 Kilos. Butter Price.	Producers' Stable Price.		Shop Price Full Milk.	
		Pfg. per litre.	Pence per gallon.	Pfg. per litre.	Pence per gallon.
1924–25 .. .. .	185·64	19·35	10·5	30·00	16·3
1925–26 .. .. .	186·50	19·36	10·5	30·36	16·5
1926–27 .. .. .	174·35	18·08	9·8	29·08	15·8
1927–28 .. .. .	178·75	18·58	10·2	29·60	16·1
1928–29 .. .. .	181·95	18·83	10·2	30·00	16·3

Units used :—1 Imperial Gallon = 4·54 litres.  
1 Mark = 1 shilling.

The series show the general position of milk prices in Hamburg as having settled at approximately 10½d. per gallon at the farm during recent years for full milk ; the margin, which covers cost of delivery to Hamburg in this case, is 6d. per gallon for shop milk with a tendency to move towards 6½d.

(1) Hamburg claims to have a relatively high consumption per head of milk, the figure given for 1926 being ·43 litres per day which is almost equal to  $\frac{1}{4}$  of a pint. The population is estimated at 1,100,000 (1927) and Altona which closely adjoins the city state has 186,000, but the consumption of this latter city is much lower, being given as a quarter of a litre or from  $\frac{2}{3}$  to  $\frac{1}{2}$  pint per person.

The amount of milk used is stated as 450,000 litres per day of which not more than 2 per cent. is sold in bottles or as special quality milk. It is reckoned 70 per cent. of the milk is put through a process of pasteurisation in the six creameries in the city.

Since the city has to its North and East a well known German dairy production area, the distance from which the milk travels is not great ; the estimate is that 300,000 litres per day arrive by axle, that is by automobile, trams, and waggons, while the remaining 150,000 litres is train milk ; the furthest distance from which milk travelled was 150 kilometers (93 miles) and little came so far.

(2) The large proportion of milk which comes by road introduces an uncertain element into the farm price which is quoted above. It is customary to add 1 pfg. per litre or roughly a  $\frac{1}{4}d.$  per gallon to get the price delivered Hamburg ; this may be not unduly inaccurate for the near in milk but it is an underestimate for the distance of 40 miles upwards so that in these cases there would be a deduction from the published farm price. Subtracting this 1 pfg. from the margin of 11 to 12 pfgs. per litre leaves 10 to 11 pfgs. to cover wholesaling and retailing which is less than the Berlin margin by 1 pfg.

A house delivery costs in Hamburg 2-3 pfgs. per litre more (= 1d. to  $1\frac{1}{4}d.$  per gallon) and bottled milk would raise the margin by another 8 pfgs. per litre (=  $4\frac{1}{4}d.$  per gallon.)

(3) The quality standards are laid down in the regulations of the State of Hamburg and are practically the same minima as in Berlin. The butter-fat content minimum limit is 2.7 per cent. and the specific gravity 1029 but in Hamburg special milk, children's milk, etc., do not require a higher butter-fat percentage than the minimum but must conform to certain conditions of inspection. As so much milk comes by axle, it is necessary to provide a system of inspection which is capable of testing milk as it comes into the city and the police public health body have an automobile fitted up as a milk testing laboratory which meets supplies on the road and tests them at once.

#### FURTHER NOTES UPON THE GERMAN POSITION.

(1) The producers' price for liquid milk in Germany is in all areas greatly influenced by the butter-price parity ; there are four main quotations used in this connection (1) the Berlin rate, which covers East and West Prussia (2) the Hamburg rate, which covers all North West Germany (3) the Cologne rate, which covers Western Germany,

(4) the Kempten rate (in Allgäu), which covers Southern Germany. Usually the Cologne rate is distinctly higher than Hamburg and Berlin prices and there is often a slightly higher average in Hamburg than in Berlin. The importance of the alternative value of milk should be borne in mind, as it partly explains the German tendency to have a fixed distributor's margin which never varies with the market variations. It also shows the weakness of comparing the producers' price with the distributors' margin, as there is little correlation between the two series; the influences upon the producers' price of milk and the distributors' margin are so different in Germany that a low producers' price might occur without any noticeable change in the distributors' position.

(2) It has been possible to collect a few cases of distributors' margins for other cities; these have not been the subject of special examination, but are quoted as further instances of German conditions.

TABLE V.

*Pfg. per litre. June, July, 1928.*

City.	Population in 1000's.	I Producers' Price.	II Price at City Station.	III Retail Shop Price.	Margin between II and III pfgs.
Stuttgart .. ..	343	18-20	20-22	30	8-10
Esslingen .. ..	40	18-21	21-23	31	8-10
Heilbronn .. ..	45	17-19	20-21	28	7-8
Ulm .. ..	59	17-18	20	28	8
Berlin .. ..	4,100	—	15·5	27	11·5
Hamburg .. ..	1,100	17	18	28	10
Karlsruhe .. ..	150	18-20	23-5	32	8-5
Mannheim .. ..	250	18-20	—	32	—
Munich .. ..	681	16	19·5	28	8·5
Pforzheim .. ..	78	18-19	—	30	11-12
Dortmund .. ..	325	16-19	19	27	8
Düsseldorf .. ..	430	—	18	26	8
Freiburg .. ..	91	20-21	23·5	32	8-5
Offenburg .. ..	17	19-21	22-23·5	32	8½-10
Dresden .. ..	620	17·5	20	30-31	10-11
Leipzig .. ..	680	19	20	30	10

(Figures given by the German Ministry of Food and Agriculture but the Ministry is in no way responsible for the figures.)

The following are quoted from Dr. Alfens Yung's study of milk supply in Saxon towns and relate to the years 1925 and 1926.

*Pfg. per litre.*

Town.	Population in 1000's.	Free Station.	Shop Retail.	Margin.
Dresden*	620	19-22	29-32	10
Leipzig*	680	19-22	29-32	10
Chemnitz	332	25-27	33-37	8-10
Plauen	112	24-26	32-34	8
Bautzen	37	21-22	26-28	5-6

\*In certain winter months the delivery price rose to as high as 24-26 pfgs. per litre, the margin remained at 10 pfgs.

Other margins given by Dr. Yung are :—

Hanover .. .. .	11 pfg. per litre.
Frankfort a.M. .. .. .	13 " " "
Mainz .. .. .	12 " " "
Heidelberg .. .. .	12 " " "
Breslau .. .. .	8 " " "
Königsberg .. .. .	5-7 " " "
Köln .. .. .	15 " " "

An additional Table has been drawn up from price information made available by the German Council of Agriculture; it covers eight towns in different areas in Germany from December, 1926, and bears out much that has already been said about the margin. Dresden has a relatively high margin (= 7·6*d.* per gallon). Mannheim, which has the reputation in Germany of having one of the best organised supplies of sound milk, has a margin of 6·8*d.* per gallon. On the other hand, Königsberg and Breslau are low at 4·4*d.* per gallon, and Paderborn, a small town in Westphalia, works out at 3·8*d.*

TABLE VI.—Showing Milk Prices in certain German Towns based upon information made available by the German Council of Agriculture.

*Pfgs. per litre.*

30		1926 Dec.	1927												
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
	Berlin ..	P.	20·2	18·0	18·4	18·3	—	—	15·0	17·5	19·7	22·0	21·5	20·5	20·5
		R.	31·2	29·0	30·0	28·5	—	—	26·0	28·5	30·8	33·8	33·0	33·0	31·3
		M.	11·0	11·0	11·6	10·2	—	—	11·0	11·0	11·1	11·8	11·5	12·5	10·8
	Königsberg ..	P.	16·8	17·7	17·6	16·6	—	—	13·5	13·5	14·7	15·5	17·0	17·0	18·2
		R.	23·5	24·0	24·0	22·8	—	—	20·0	20·0	21·2	22·0	24·0	24·0	26·0
		M.	6·7	6·3	6·4	6·2	—	—	6·5	6·5	6·5	6·5	7·0	7·0	7·8
	Dresden ..	P.	19·5	19·5	18·7	18·7	—	—	—	—	19·5	20·5	19·5	19·5	22·0
		R.	31·0	31·0	31·0	31·0	—	—	—	—	31·5	32·0	32·0	32·0	32·0
		M.	11·5	11·5	12·3	12·3	—	—	—	—	12·0	11·5	12·5	12·5	10·0
	Hamburg ..	P.	21·5	20·4	21·0	19·0	—	—	16·0	16·0	19·2	20·5	22·0	22·8	21·8
		R.	31·5	30·4	31·0	29·0	—	—	26·0	26·0	29·2	30·5	32·0	33·0	32·0
		M.	10	10	10	10	—	—	10	10	10	10	10	10·2	10·2
	Breslau ..	P.	18·8	17·8	18·5	17·2	—	—	16·0	16·0	17·2	19·0	19·2	19·8	18·5
		R.	26·8	25·8	26·5	25·2	—	—	24·0	24·0	25·2	27·0	27·2	27·8	26·5
		M.	8	8	8	8	—	—	8	8	8	8	8	8	8
	Paderborn ..	P.	19·0	19·0	19·0	19·0	—	—	14·0	14·5	16·0	16·0	18·0	21·0	21·0
		R.	25·0	25·0	19·0	19·0	—	—	20·0	20·5	22·0	22·0	25·0	28·0	28·0
		M.	6	6	6	6	—	—	6	6	6	6	7	7	7
	Karlsruhe ..	P.	20	20	20	20	—	—	20·8	21·0	—	—	20·0	—	22·0
		R.	32	32	32	32	—	—	30·4	30·5	32	32	32·0	32	32·0
		M.	12	12	12	12	—	—	9·6	9·5	—	—	12·0	—	10·0
	Mannheim ..	P.	—	—	—	—	—	—	—	—	—	—	—	—	21·0
		R.	—	—	—	—	—	—	—	—	—	—	—	—	32·0
		M.	—	—	—	—	—	—	—	—	—	—	—	—	11·0

P. = Producer Price.

R. = Retail Price.

M. = Margin or Difference.

TABLE VI.—Showing Milk Prices in certain German Towns—*contd.*  
Pfgs. per litre.

			1928.											
			Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Berlin ..	..	P.	17·0	17·5	18·5	17·6	18·7	16·0	—	17·0	18·0	20·7	20·6	19·7
		R.	28·4	29·5	30·5	29·3	30·3	28·0	30·0	30·5	32·5	32·2	32·0	31·8
		M.	11·4	12	12	11·7	11·6	12	—	13·5	14·5	11·5	11·4	12·1
Königsberg ..	..	P.	15·9	15·6	15·9	16·0	16·0	13·5	15·3	16·0	17·1	18·0	18·0	18·0
		R.	23·0	22·4	24·0	24·0	24·0	20·0	24·0	24·0	26·0	26·4	26·0	26·0
		M.	7·1	6·8	8·1	8	8	6·5	8·7	8	8·9	8·4	8	8
Dresden ..	..	P.	18·7	18·0	18·5	18·5	—	18·5	18·5	19·0	19·6	20·6	21·0	21·0
		R.	30·0	30·7	31·0	31·6	32·0	32·0	—	33·0	33·6	34·6	35·0	35·0
		M.	11·3	12·7	12·5	13·1	—	13·5	—	14	14	14	14	14
Hamburg ..	..	P.	20·0	20·0	21·0	18·6	18·0	17·0	18·5	20·0	21·2	22·0	22·0	22·0
		R.	30·0	30·0	31·0	28·6	28·0	27·0	28·7	30·0	32·0	33·0	33·9	34·0
		M.	10	10	10	10	10	10	10·2	10	10·8	11	11·9	12
Breslau..	..	P.	16·6	18·0	20·0	18·0	18·0	16·0	17·0	18·0	19·0	20·6	19·8	20·1
		R.	24·8	26·0	28·0	26·0	26·0	24·0	25·0	26·0	27·3	27·3	27·8	28·7
		M.	8·2	8	8	8	8	8	8	8	8·3	6·7	8	8·6
Paderborn ..	..	P.	20·3	19·0	19·0	19·0	16·5	14·0	15·3	16·0	19·0	19·0	21·0	21·0
		R.	27·0	25·7	25·0	25·0	22·5	20·0	21·3	22·0	25·0	25·0	28·0	28·0
		M.	6·7	6·7	6	6	6	6	6	6	6	6	7	7
Karlsruhe ..	..	P.	20·0	19·9	20·0	20·0	20·0	20·0	20·0	20·0	20·0	20·0	20·0	20·0
		R.	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0
		M.	12	12·1	12	12	12	12	12	12	12	12	12	12
Mannheim ..	..	P.	18·5	18·5	18·5	18·7	19·5	19·5	19·5	19·5	19·5	19·5	19·5	19·5
		R.	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0
		M.	13·5	13·5	13·5	13·3	12·5	12·5	12·5	12·5	12·5	12·5	12·5	12·5

P. = Producer Price.

R. = Retail Price.

M. = Margin of Difference.

TABLE VI.—Showing Milk Prices in certain German Towns—*contd.*  
Pigs. per litre.

	1929.									
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	
Berlin .. .. .	P.	17·5	17·7	16·7	16·5	17·3	16·3	17·5	19·5	22·5
	R.	29·0	29·2	28·2	27·8	29·0	28·0	29·0	31·2	33·5
	M.	11·5	11·5	11·5	11·3	11·7	11·7	11·5	11·7	11·0
Königsberg .. .. .	P.	18·0	18·0	18·0	18·0	18·0	16·0	16·8	18·0	18·0
	R.	25·5	25·5	26·0	26·0	26·0	24·0	24·6	26·0	26·0
	M.	7·5	7·5	8	8	8	8	7·8	8	8
Dresden .. .. .	P.	17·6	17·0	17·0	17·0	17·0	17·0	17·0	19·0	18·0
	R.	31·6	31·0	31·0	31·0	31·0	31·0	31·0	33·0	32·0
	M.	14	14	14	14	14	14	14	14	14
Hamburg .. .. .	P.	21·0	21·0	19·0	15·4	17·0	17·5	17·0	19·5	23·0
	R.	32·0	32·0	30·0	26·4	28·0	28·5	28·0	30·5	34·0
	M.	11	11	11	11	11	11	11	11	11
Breslau.. .. .	P.	18·0	18·5	18·0	16·0	17·5	16·0	17·2	18·0	—
	R.	26·0	26·5	26·0	24·0	25·5	24·0	25·2	26·0	—
	M.	8	8	8	8	8	8	8	8	—
Paderborn .. .. .	P.	21·0	21·0	21·0	19·0	18·0	18·0	18·0	18·0	19·6
	R.	28·0	28·0	28·0	26·5	25·0	25·0	25·0	25·0	26·6
	M.	7	7	7	7·5	7	7	7	7	7
Karlsruhe .. .. .	P.	20·0	20·0	20·0	20·0	20·0	20·0	19·9	20·0	20·0
	R.	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0
	M.	12	12	12	12	12	12	12·1	12	12
Mannheim .. .. .	P.	19·5	19·5	19·5	19·5	19·5	19·5	19·5	19·5	19·5
	R.	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0	32·0
	M.	12·5	12·5	12·5	12·5	12·5	12·5	12·5	12·5	12·5

P. = Producer Price.

R. = Retail Price.

M. = Margin of Difference.



It appears that even in smaller towns there are rarely, except in East Germany, margins under 8 pfgs. per litre (= 4.4*d.* per gallon). In the main group of larger towns the 10-12 pfgs. per litre represents the usual charge (= 5½-6½*d.* per gallon). Exceptional conditions usually explain margins higher than 6½*d.*

In dealing with the milk supplies of Berlin and Hamburg, it has been remarked that neither of them had more than a small percentage of their total requirements sold as bottled milk. It should be noted in fairness to the German dairy trade that there are German towns where quite considerable proportions of the supply are sold in glass bottles, Leipzig 33 per cent., Essen 25 per cent., Chemnitz 55 per cent., Kiel 30 per cent., Flensburg 50 per cent., Magdeburg 50 per cent.

It may be roughly estimated that 22-25 towns sell over 10 per cent. of their supply in bottles.

There is a strong current of opinion in Germany at present supported by Public Health authorities, medical testimony, agricultural and dairy trade interests in favour of development of a pure pasteurised supply of milk sold in bottles on American lines. It seems inevitable that this alteration in quality conditions will lead to a rise in the margins of the distributors.

## SECTION V.

MILK PRICES IN PARIS WITH SOME REFERENCE TO THE  
GENERAL MILK PRICE POSITION IN FRANCE.

The prices stated in the Tables are based upon different sources of information and must be used to check each other. The first table gives a list of wholesale and retail prices for the period 1920-29, supplied by a large Parisian dairy firm and it shows clearly the retail margin; it only states in general terms however the margin between producers' price delivered Paris and the wholesale price. The second table gives a list of retail and farm prices for certain towns in France and expresses the relationship to the equivalent milk price for butter and cheese. The third short table is meant to bring out the characteristic difficulty of interpreting the French figures, namely that they have a wide range of dispersion and cannot be regarded as standard quotations; even the producers' prices which have as a steadying element their relationship to butter, cheese, and condensed milk, show considerable variation.

TABLE VII.  
MILK PRICES IN PARIS.

	Producers' Price.	Francs per litre.			Average Exchange in Sterling.
		Wholesale.	Margin.	Shop Retail.	
Winter 1920-21 ..		.98	.12	1.10	51.5
Summer 1921 ..		.88	.12	1.	52.
Winter 1921-22 ..		.98	.12	1.10	53.5
Summer 1922 ..		.78	.12	.90	54.8
Winter 1922-23 ..		.88	.12	1.	65.2
Summer 1923 ..		.68	.12	.80	75.7
Winter 1923-24 ..		.98	.12	1.10	80.5
Summer 1924 ..		.78	.12	.90	85.2
Winter 1924-25 ..		.98	.12	1.10	94.
Summer 1925 ..		.88	.12	1.	102.6
Winter 1925-26 ..		1.16	.14	1.30	128.
Summer 1926 ..		1.05	.15	1.20	153.25
Winter 1926-27 ..		1.45	.15	1.60	138.6
Summer 1927 ..		1.25	.15	1.40	123.9
Winter 1927-28 ..		1.55	.15	1.70	124.
Summer 1928 ..		1.25	.15	1.40	124.06
Winter 1928-29 ..		1.58	.17	1.75	124
Summer 1929 ..		1.43	.17	1.60	124
Winter 1929 ..				1.80	124

34 Table based upon information supplied by a large Parisian Dairy Firm.

TABLE VIII.  
FRENCH MILK PRICES.  
Francs per Litre.

	Retail.	Margin.	Liquid Milk Farm.	Price. Butter Equivalent.	Price. Cheese Equivalent.
Dec. 1925 ..	1.18	.37	.81	.79	.78
March 1926 ..	1.22	.37	.85	.96	.85
June " ..	1.10	.33	.77	.66	.77
Sept. " ..	1.20	.36	.84	.72	.83
Dec. " ..	1.39	.38	1.01	1.06	1.00
March 1927 ..	1.39	.36	1.03	1.01	.96
June " ..	1.26	.41	.85	.74	.83
Sept. " ..	1.27	.42	.85	.77	.86
Dec. " ..	1.33	.37	.96	.86	1.00
March 1928 ..	1.34	.38	.96	.90	.98
June " ..	1.31	.38	.93	.90	1.18
Sept. " ..	1.43	.43	1.00	.86	1.10
Dec. " ..	1.55	.43	1.12	1.12	1.30
March 1929 ..	1.48	.34	1.14	1.17	1.17
June " ..	1.47	.52	.95	.93	.85
Sept. " ..	1.45	.47	.98	.86	.84

Table based upon the Price information of the Swiss Farmers Union. The figures do not purport to be an average of French prices but it is claimed that they show the fluctuations which have taken place.

TABLE IX.  
FRENCH MILK PRICES.  
*Showing the Range of Variation at Certain Dates.*  
Francs per Litre.

	Retail.	Farm.
Dec. 1926 .. .. .	1.30-1.70	.90-1.15
Sept. 1927 .. .. .	1.20-1.70	.75-1.10
Dec. " .. .. .		.70-1.10
March 1928 .. .. .		.75-1.15
June " .. .. .		.70-1.20
Sept. " .. .. .	1.20-1.50	.80-1.20
Dec. " .. .. .		1.05-1.20
March 1929 .. .. .	1.30-1.75	.90-1.20
June " .. .. .	1.20-1.70	.80-1.20

From Swiss Farmers Union.

TABLE X.  
APPROXIMATE PARISIAN MILK PRICES IN PENCE PER  
IMPERIAL GALLON.

	Producers' Price.	Wholesale.	Retail.
Summer 1927 .. ..	7.6	11.2	12.7
Winter 1927-28 .. ..	8.7	14.1	15.4
Summer 1928 .. ..	8.7	11.3	12.7
Winter 1928-29 .. ..	10.2	14.5	15.9
Summer 1929 .. ..	9	12.8	14.5
Winter 1929 .. ..	11	14.6	16.3

It appears that the price lists for Paris and France do not lend themselves to straightforward interpretation for two main reasons; (1) the currency inflation period stretches up to 1927 and even after monetary stabilization becomes a fact in 1928, there is the internal adjustment of all price levels to the new par of exchange where £1 = 124.2 francs; (2) the price lists are less generally representative of the market than in the case of either Britain or Germany and there is a greater degree of individual variation from the normal. Less exactitude in measurement should be expected therefore in this case.

Within these limits it may be said that milk prices in Paris had reached a level of 9d. to 10½d. per imperial gallon for producers by 1928-29, it being a regular feature of the French milk situation that the summer level of prices is distinctly lower than the winter level. The only exception from this well known variation is that in certain weeks of "grand chaleur" the prices may rise to winter levels owing to difficulties with both supplies and transport. The margin between producers' price and retail shop price had become 5d. to 5½d. and of this 1½d. or a little over covered the retail margin proper leaving 3½ to 4d. for the wholesale margin. The Paris margin is therefore roughly 1d.-1½d. per gallon below that of Berlin.

*The Milk Position in Paris.*

(1) The population of Paris is given as approaching 3,000,000 but the large dairy firms cater also for a considerable population in the Department of the Seine, and the total supply is given as 900-920,000 litres per day for a population of 4,567,000 an average

of one-fifth of a litre per head per day (= one-third pint per head per day). Of this supply it is estimated that 50,000 litres per day come from near in areas; the rest is train milk.

The chief regions sending supplies can be seen from the Railway System Annual Returns (1925).

Etat	..	129.3 million litres.
Orleans	..	68.0 "
P.L.M.	..	49.8 "
Nord	..	33.4 "
Est	..	31.0 "

The Norman districts come first and the Orleans area afterwards, supplies coming from as far as Vienne, La Creuse and even to the Charantes, the Southern line to the Côte D'Or and the Eastern and Northern lines from lesser distances. Some conception of the quantities brought from different distances can be obtained from the table of depôts which serve as collecting, cleaning, cooling, and often pasteurising plants.

			<i>Depôts.</i>
190 miles	over	300 kilometres	1
156-190 miles	"	250-300 "	6
125-156 "	"	200-250 "	14
94-125 "	"	150-200 "	28
62-94 "	"	100-150 "	33
31-62 "	"	50-100 "	49
under 31 "	"	under 50 "	4

The bulk of the Parisian supply is still obtained from distances of less than 125 miles. The French railway tariff upon milk cannot be deemed to be heavy; under the special rates in force for Paris, quantities can be despatched from 250 kilometres for  $\frac{3}{4}d.$  per gallon and the average charge will be rather in the nature of  $\frac{1}{2}d.$  per gallon. There are however difficulties with the service at some periods of the year owing to heat and a Society operates and hires out refrigerating vans over the longer distances (200 kilometres upwards); large insulated tanks are also being tried. For such extra services an additional charge is of course made.

The waggons employed to carry milk are of three main types: (1) Flat topped open waggons, the cans (20 litres size= $4\frac{1}{2}$  gallons), being in the open air; (2) covered and ventilated vans, especially

on the P.L.M. Railway; (3) closed vans, which cause difficulty in heat. It can scarcely be held that the open waggon is suitable for a milk service even if the transport takes place at night.

(2) The two main elements in the Parisian Dairy Trade are (a) Firms which perform both wholesaling and retailing; such are La Société Laitière Maggi, Les Etablissements Hauser, Amiot, et Ricard; their method is to sell through their own dépôts and vans. (b) Firms which wholesale and supply retailers with their requirements; such are La Laiterie des Fermiers Réunis and the Farmers' Cooperatives of the Norman area.

The latter kind of firm is estimated to deal with almost two-thirds of the total supply. These firms have both country and town dépôts where milk is heated and pasteurised but there is a tendency to pasteurise all "distance" milk at the country dépôts.

(3) The form of contract upon which the producers' price is stated includes usually the following points:—

(a) The collecting wholesaler takes all the farmers milk regularly.

(b) The milk must be "full" milk, clean and of good quality without any skimming or watering and meeting in all points the legal requirements.

(c) The milking is to be done with care and the output filtered and cooled as much as possible; it is to be kept in a cold place, free from any contamination. Each milking must be kept separate for collection.

(d) Payment is made monthly.

(e) The price will be fixed at so much per litre in advance either by the month or by the season (summer or winter) and varies according to the district concerned; or, the price may be fixed according to some agreed relationship to the price of butter on the French Market.

The producers' price is therefore usually a stable or farm price and the cost of collection and rail transport enter the dairy trade margin. This explains to some extent the relatively large wholesale margin of 3½d. to 4d. per gallon.

The French farmers' price is therefore better than it seems in two ways; (1) the contracts usually take all the output at one price; there is no surplus price at a lower level; (2) deductions

are not usually made either for collection or rail cost. Collecting charges are difficult to average, as much depends upon the character of the roads and the hilliness and difficulty of the area but collection does not cover more than 20 kilometres from a dépôt and is unlikely on the average to cost more than a  $\frac{1}{4}$ d. per gallon, so that if  $\frac{1}{2}$ d. per gallon be allowed for rail transport, then  $\frac{3}{4}$ d. might be taken to represent this cost.

One matter of importance must be kept in mind in connection with the producers' price; it can be seen from Table VIII that the equivalent milk price given by butter and cheese factories keeps well up with the price of liquid milk for consumption; it is clear that this represents the lowest offer the trade can normally make to the producer and it is hardly attractive enough to make him take special precautions in production. France after all is a country which, according to the estimates of her Ministry of Agriculture (1923), devotes only 32 per cent. of her milk output to human consumption; 32.4 per cent. is converted into butter, 13.5 per cent. into cheese and 21.3 per cent. goes to feed calves. The consumers' milk market has therefore nothing like the same dominance in France as it has in most districts in Britain, where 75 to 80 per cent. of the milk sold off farms is available for the consumers' market.

The French wholesale margin covers collection, rail transport, country processing or town processing, transport from the Parisian stations to the shops or dépôts together with provision of cans, cleaning of utensils, risk of spillage, control of variation of quantities between summer and winter, and of supply and demand, and conveyance to retail dépôts.

The retail price is a shop price covering shop upkeep and expenses; other articles are commonly sold and the grocers and pork butchers may deal with supplies as well as dairy shops proper.

Delivery is not given à domicile without special charge and there is practically no special milk or bottled milk available so that these important elements in the London margin lie outside the present economic position of the dairy trade in Paris.

For reasons already advanced in dealing with German conditions, it is of little value to contrast the labour cost of the system of distribution in Paris with that in London but it is of course true that the wage discrepancies are even more noticeable between London

and Paris than between London and Berlin. The comparative real wages in Paris are calculated as 57 where London is 100. (International Labour Office Calculation, 1929).

(4) The quality of French milk has been the subject of a somewhat polemical literature within recent years, mainly on the part of public health writers who have desired to raise the general standard of purity and cleanliness. The prices given in the Tables relate to "full" milk and it is necessary to point out how milk is defined in France and what milks are recognised.

The milk of commerce is cow's milk secured by a total and uninterrupted milking of a healthy animal, in proper condition. There is therefore no reference whatsoever to any minimum requirements in butter-fat or other solids. Skimmed milk (*lait écrémé*) is recognised and also semi-skimmed milk, which is defined as skimmed milk, still having more than 2 per cent. butter-fat content. If these three milks are sold together, they must be clearly distinguished by labels and coloured bands upon the containers.

Pasteurised milk is recognised if the process is approved by the "Conseil Supérieur d'Hygiène Publique de France". Sterilised milk is also defined and recognised. The body of legislation is directed to preventing adulteration, falsification, danger to public health. Special milks from establishments under medical and veterinary control may receive recognition.

The administrative system is under the French Ministry of Agriculture which finds its position somewhat delicate at times as farmers naturally regard the department as a guardian of their interests; the actual working is carried out by the Prefects in the departments.

There are :—

- (1) Inspectors under the Repression of Frauds laws.
- (2) Police Inspectors.
- (3) Directors of Veterinary services and Medical services.
- (4) Weights and Measures Inspectors.
- (5) Market Inspectors.

The difficulty in cities such as Paris is not so much checking the milk as it enters the city but rather in connecting up the city controls with the country areas from which the milk originates.



The absence of any fixed standards makes it difficult to contrast the milk of Paris with that of other areas but it would scarcely be claimed that the general standard was of the London level either in purity or cleanliness and keeping quality; the one matter on which there is definite evidence, namely, adulteration and falsification shows a somewhat disquieting state of affairs as the percentage of milks which have been tampered with is notably high, rising to 40-45 per cent. of the samples taken in some Departments.

(5) One further matter affecting the price and quality of French milk requires to be mentioned. The milk trade in Paris has for a number of years found itself a storm centre in what is known as "La Lutte contre la Vie Chère" and while war time legislation had passed away by 1922, legal judgments have led to the employment of articles 419 and 420 of the Penal Code against dairymen and producers under certain circumstances. The point depends upon whether the parties concerned have raised prices artificially as distinct from combining to regulate their trade in an efficient manner. If it is held that there is an element of monopoly involved, the trade may be fined for raising prices; the consequence of this interpretation of the code is really to confer upon Prefects and others a price fixing power within their own locality. Everything depends upon whether the public power is willing and capable of making a fair and reasonable examination of the economic condition of the trade; the French agriculturists claim that this has not been done and point to the fact that milk prices have lagged behind other prices in the general rise; they state that the policy has simply been to depress prices below their natural economic level by using government prestige as a weapon and that the result has been friction, particularly with the producers who have alternative uses for their milk and who therefore prefer either to restrict supplies or to send inferior supplies, and who have no incentive to improve the condition of their output.

It is not possible or necessary, in this survey, to consider whether this policy has had the results stated but it must be kept in mind in connection with the price and quality of milk in Paris.

#### FEATURES OF THE MILK SITUATION.

Certain information regarding the milk supplies of other French towns has been collected from a number of sources; it is of interest in bringing out certain general characteristics of the position but it cannot be taken as having more than a limited value and it is too unconnected to be set out in the form of tables.

(1) French milk consumption is low ; the only town with a reasonably high level of consumption is Strassburg, where the German influence is found.

(2) It may be noted that skim or separated milk plays a considerable part in the supply of a number of towns and there is reason to think that consumption of the "lait écrémé" is of significance in many towns although not officially returned as such. In a country with a high butter output, this is not unusual but it limits to some extent full milk sales and it opens the door to certain forms of substitution and mixture which are liable to mislead purchasers.

(3) The fall in the consumption of certain towns in the summer months is due to the heat difficulty affecting both demand and supply as well as to price alterations. It is not possible to say how far pasteurisation and sterilisation have progressed in towns outside of Paris but it is not believed to be at all general and in any case the application of heat may not receive the title of pasteurisation.

## SECTION VI.

## MILK PRICES IN COPENHAGEN AND IN CERTAIN OTHER DANISH TOWNS.

Annual and quarterly prices of full milk for consumption are quoted in the tables; the prices are actually fixed weekly after the butter market meeting in Copenhagen every Thursday.

The prices given are :—

- (1) The Retail Domicile Price.
- (2) A Farm Price.

The difference between the two series has varied within the last four years from  $10\frac{1}{2}$  to  $12\frac{1}{2}d.$ , per gallon and in 1929 has averaged  $11\frac{1}{2}d.$  Copenhagen, therefore, takes its place with the high margin group, ranking with London and Glasgow.

TABLE XI.  
Average Yearly Prices of Milk in Certain Danish Towns.  
*Ores per Litre.*

	Copenhagen.			Aarhus.			Odensee.		
	Retail Domicile.	Margin.	Farm.	Retail Domicile.	Margin.	Farm.	Retail Domicile.	Margin.	Farm.
1926 ..	$38\frac{1}{4}$	$20\frac{1}{2}$	$17\frac{1}{4}$	$27\frac{1}{2}$	$10\frac{1}{2}$	17	28	$12\frac{1}{4}$	$15\frac{1}{4}$
1927 ..	$35\frac{1}{4}$	18	$17\frac{1}{4}$	$27\frac{1}{4}$	$10\frac{1}{2}$	$16\frac{1}{4}$	29	$12\frac{1}{4}$	$16\frac{1}{4}$
1928 ..	$35\frac{1}{4}$	$17\frac{1}{4}$	$17\frac{1}{2}$	28	$10\frac{1}{2}$	$17\frac{1}{2}$	$29\frac{1}{4}$	$12\frac{1}{4}$	17
1929* ..	$36\frac{1}{2}$	19	$17\frac{1}{2}$	$27\frac{1}{2}$	$10\frac{1}{2}$	$16\frac{1}{2}$	$28\frac{1}{4}$	$12\frac{1}{2}$	$16\frac{1}{4}$

\*Three Quarters Only.

Average Yearly Prices of Milk in Certain Danish Towns.  
*Pence per Imperial Gallon.*

	Copenhagen.			Aarhus.			Odensee.		
	Retail Domicile.	Margin.	Farm.	Retail Domicile.	Margin.	Farm.	Retail Domicile.	Margin.	Farm.
1926 ..	23.2	12.5	10.7	16.6	6.3	10.3	16.9	7.4	9.5
1927 ..	21.4	10.9	10.5	16.5	6.4	10.1	17.5	7.7	9.8
1928 ..	21.4	10.8	10.6	16.9	6.3	10.6	17.7	7.4	10.3
1929* ..	22.1	11.5	10.6	16.5	6.5	10	17.4	7.6	9.8

\*Three Quarters Only.

TABLE XII.  
Quarterly Milk Prices in Certain Danish Towns.  
*Pence per Imperial Gallon.*

Quarter.	Copenhagen.			Aarhus.			Odensee.		
	Retail Domicile.	Total Margin.	Farm.	Retail Domicile.	Total Margin.	Farm.	Retail Domicile.	Total Margin.	Farm.
1926 Mar.	24·8	13·3	11·5	16·9	6	10·9	18·2	8·4	9·8
" June	22·4	12·1	10·3	16·3	6·5	9·8	16·3	7·2	9·1
" Sept.	23·0	12·7	10·3	16·3	6·5	9·8	16·3	7·2	9·1
" Dec.	22·4	11·5	10·9	16·9	6	10·9	16·9	6·6	10·3
1927 Mar.	22·4	11·5	10·9	16·3	6·5	9·8	16·9	6·6	10·3
" June	20·6	10·8	9·8	15·7	5·9	9·8	18·9	7·8	9·1
" Sept.	20·6	10·3	10·3	16·9	6·6	10·3	18·2	8·4	9·8
" Dec.	21·8	10·9	10·9	16·9	6	10·9	18·2	7·9	10·3
1928 Mar.	21·8	11·5	10·3	16·9	6·6	10·3	17·5	7·2	10·3
" June	20·6	10·3	10·3	16·9	6·6	10·3	16·9	7·1	9·8
" Sept.	21·4	10·7	10·7	16·9	6·2	10·7	17·9	7·4	10·5
" Dec.	21·7	10·5	11·2	16·9	6	10·9	18·3	7·4	10·9
1929 Mar.	22·5	11·6	10·9	16·9	6·4	10·5	18·2	8·1	10·1
" June	21·8	12·2	9·6	16	6·6	9·4	16·3	7·3	9·0
" Sept.	22·1	11·7	10·4	16·6	6·4	10·2	17·7	7·6	10·1

Calculations based upon Units:—  
1 Imperial Gallon = 4·55 litres.  
1d. = 7·5 ores.

Copenhagen with Frederiksberg and Genntofte is the only really large city in Denmark, having an estimated population of 750,000; Aarhus, the second town in size has 76,000, and Odensee the third, 53,000.

It is provided with milk from about 3,600 farms with an aggregate of 56,000 cows; among these are special farms (at least 20) supplying milk from tuberculine tested herds for children and farms (over 10) of large extent supply Jersey milk with exceptionally high butter-fat percentages. The estimate given of daily supply is 280-300,000 litres and in addition to this, quantities of cream, butter milk and skimmed milk are despatched. If the figure 300,000 litres be taken, and this seems the more probable quantity, the average consumption per head works out at  $\frac{2}{3}$  of a litre or over  $\frac{1}{2}$  of a pint per day; this is a distinctly high average figure.

The areas from which supplies are drawn lie mainly in Zealand but quantities also come from Holland-Falster and Funen up to the limit of 100 miles. There are more distant producers (Jutland) sending cream to Copenhagen but it is for the export trade.

The milk comes mainly by rail but also by road and it may be sent directly by the producers to the Copenhagen wholesale dairy firms or from country co-operative creameries to these city firms ; a small amount of milk is sold by producers from their carts in the town area.

(1) The producer's price for milk is based upon the fluctuations in the price of butter so that Danish producers benefit from the high standing of their butter in the international market. The following points from a typical contract, show how the price connection is made :—

(a) The dairy firm makes an annual contract with the producer for his whole output.

(b) A flat rate is paid and this is based upon

(i) The butter market figure for 25 kilos of milk.

(ii) The additional allowance for skim milk.

(c) The producer pays all carriage to Copenhagen which is averaged out at 1·20 ores to 3 ores per litre and accepts responsibility to the Copenhagen station or depôt.

(d) The prices fixed are valid for milk with a butter-fat percentage of 3·35 and extra payment is made for every ·05 per cent. butter-fat up to a stipulated figure but a deduction would be made if the milk fell below 3·35 in its fat content. There are often certain premiums for first class milk varying with the season. There are deductions for second or third class milk.

(e) The product must meet the special milk regulations of the City of Copenhagen.

The typical quotation for the town market is therefore for milk free Copenhagen, but in fact it is the stall or farm price which is usually available since in the case of Denmark with her large butter output, this is the more important. The margin of 19 ores per litre (= 11½ per gallon) therefore includes an allowance for which the farmer is responsible to cover carriage and other costs ; for farms near Copenhagen this is given as 1·20 ores per litre but the Danish Agricultural Council give figures where the difference between farm price and free Copenhagen price is from 2·1 to 4·1 ores per litre ; it may suffice for this survey to allow 3 ores per litre to be deducted from the margin of 19 to cover these costs. It must be kept in mind also that in so far as the wholesalers allow for butter-fat, there will

be additions to the farm price which are not revealed in the table since Copenhagen milk averages much nearer 3·6 per cent. butter-fat than 3·35. A last complication to be noted is that milk bought from country creameries may sell for roughly 2 ores per litre more than milk from farms in so far as the creamery performs services in processing before despatching it to the city.

(2) Turning to the retail price, this covers both bottling and to a considerable extent domicile delivery as well as processing; the two methods of selling are (1) where a large firm, wholesale and retail, utilises vans and depôts (2) where firms do the pasteurising and bottling and sell to smaller retail dealers who deliver to their own clientèle. It is estimated that where a division is made between wholesaling including bottling, etc., the retailer works on a margin of 14 to 15 per cent. of the total price per litre, that is if 36 ores per litre is the ruling price, the retailer takes 5 to 6 ores as his working margin (= 3½*d.* to 3¾*d.* per gallon). This leaves, therefore, 10 ores per litre to cover wholesale costs plus bottling (= just over 6*d.* per gallon). It will be noted that this arrangement varies from the usual British position where certain charges such as bottling are commonly classed with retail expenses.

(3) The pressure of international competition working through the farmers' co-operatives has established for Danish milk generally a high level of quality. This matter has been discussed in a special report to the British Ministry of Health (Cmd. 3004 of 1928) and the system of production and control has been the subject of favourable comment. There is in Denmark a dual system of control and regulation; the one regulates the sale of milk and cream for consumption and the other the use of milk in manufacture. It is open to a city to make special regulations concerning its milk supply provided the standard is higher than that of the national regulations. This Copenhagen has done, and the Health Committee of the municipality has in operation through its veterinary department a control at all places of production and a control of milk offered for sale. Broadly viewed, the law requires a minimum butter-fat content of 3·25 per cent. in whole milk; skimmed milk and half skimmed milk are also defined and Jersey milk is recognised (minimum fat content 4·75 per cent.). The term "children's milk" is confined to the output of tuberculine tested herds. Such processes as pasteurisation are recognised only if performed by authorised methods. Regulations cover farms, dairy premises, and methods of working;

these are similar to the rules used in Britain. It may be said that the quality of Copenhagen's milk supply is in general higher than that of cities in Germany and France and at least equal to the best British practice; Copenhagen has certain advantages over London in that its supply lies near at hand and reaches the consumer quickly and further it draws on supplies which have to be kept at a uniformly high level to avoid any criticism of the export quality of its butter.

(4) The Structure of the trade has already been alluded to— There are three large companies\* dealing with a great portion of the trade; trading is by both vans and shops, both giving domicile delivery; the vans may cover big districts up to 1,000 customers going out at 6 a.m., and are worked by a senior vanman together with three or four assistants (15–21 years of age). It was not possible to obtain any close comparison with British labour costs as the systems of distribution are not exactly parallel but the wages of the senior workman seemed to stand comparison with British levels.

(5) A brief reference may be made to the Aarhus and Odensee margins. Aarhus in Jutland has a  $6\frac{1}{2}d.$  margin and Odensee, which lies more in the main milk districts, one of  $7\frac{1}{2}d.$  per gallon; this represents the same type of service as Copenhagen but no processing is deemed necessary in towns of this size.

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\* The Danish Milk Co. and Copenhagen Milk Co.,  
The "Trifolium" Danish Estates Co.,  
The Enighaeten Consumers' Co-operative.

## SECTION VII.

### MILK PRICES IN NEW YORK.

Numerous lists of wholesale and retail milk prices for the New York market are available for recent years, but present some difficulty as to their comparability. Three series have therefore been selected which bear upon the points raised in this survey. The prices quoted relate to :—

- (1) Producers' Prices at Country Stations.
- (2) Producers' Prices Arrival New York.
- (3) Retail Prices for the Family Trade.

Table XIII covers the years 1921–25, and Table XIV gives figures for 1927 and 1928. From Table XIII it is seen that producers' prices at country plants remained at 14*d.* per Imperial gallon over the period 1921–25, then from the other two tables a movement up can be observed towards 15–16*d.* in 1926–27 to 16½*d.* in 1928. The retail price for the family trade has moved from 34–35*d.* per Imperial Gallon to 37*d.* in 1927 and to 37½*d.* in 1928.

The margin has moved from 17*d.* per gallon, excluding 2½*d.* freight, to 18½*d.* in 1927 and 1928.

It would have been desirable to quote four sets of New York prices, namely :—

- (1) Retailed bottled milk delivered at the homes, which is actually the rate used in this survey.
- (2) Bottled milk sold from stores and milk depôts. (Retail Shop Bottled.)
- (3) Bottled milk sold to hotels, restaurants, stores, etc. (Wholesale Bottled.)
- (4) Loose or bulk milk sold to stores, restaurants, etc. (Wholesale Bulk.)

The second rate may be a little lower than the first or exactly the same; the third rate is higher than the fourth and when loose milk is sold from stores, it is commonly three or four cents a quart cheaper than the first rate.

The available material did not permit, however, of tables recording these more detailed rates.

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\*All figures are either taken from or based upon the material published by the U.S. Department of Agriculture.



TABLE XIII.  
SHOWING COMPONENT PARTS OF THE RETAIL PRICE OF BOTTLED MILK  
IN NEW YORK CITY, 1921-25.\*

*Pence per gallon, one American gallon being taken as .86 of a British gallon and 1d. as equal 2 cents.*

Month.	Country Plant.				Freight.	Distributors' Margin.				Retail Price.			
	1921-22.	1922-23.	1923-24.	1924-25.		1921-22.	1922-23.	1923-24.	1924-25.	1921-22.	1922-23.	1923-24.	1924-25.
May .. ..	12 <sup>1</sup> / <sub>2</sub>	9 <sup>3</sup> / <sub>4</sub>	12 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	19 <sup>3</sup> / <sub>4</sub>	18	17 <sup>1</sup> / <sub>2</sub>	19 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>	30 <sup>1</sup> / <sub>2</sub>	32 <sup>1</sup> / <sub>2</sub>	32 <sup>3</sup> / <sub>4</sub>
June .. ..	11	9 <sup>3</sup> / <sub>4</sub>	12 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	19 <sup>1</sup> / <sub>4</sub>	18	17 <sup>1</sup> / <sub>2</sub>	19 <sup>3</sup> / <sub>4</sub>	32 <sup>3</sup> / <sub>4</sub>	30 <sup>1</sup> / <sub>2</sub>	32 <sup>1</sup> / <sub>2</sub>	32 <sup>3</sup> / <sub>4</sub>
July .. ..	12	12	12 <sup>1</sup> / <sub>2</sub>	10 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	18	18	17 <sup>1</sup> / <sub>2</sub>	19 <sup>3</sup> / <sub>4</sub>	32 <sup>1</sup> / <sub>2</sub>	32 <sup>1</sup> / <sub>2</sub>	32 <sup>1</sup> / <sub>2</sub>	32 <sup>3</sup> / <sub>4</sub>
Aug. .. ..	15 <sup>1</sup> / <sub>2</sub>	13 <sup>3</sup> / <sub>4</sub>	13 <sup>1</sup> / <sub>2</sub>	12 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	16 <sup>3</sup> / <sub>4</sub>	18	16	16 <sup>1</sup> / <sub>2</sub>	34 <sup>3</sup> / <sub>4</sub>	34 <sup>1</sup> / <sub>2</sub>	31 <sup>3</sup> / <sub>4</sub>	31 <sup>1</sup> / <sub>2</sub>
Sept. .. ..	15 <sup>1</sup> / <sub>2</sub>	15 <sup>1</sup> / <sub>2</sub>	15 <sup>3</sup> / <sub>4</sub>	13 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	16 <sup>3</sup> / <sub>4</sub>	16 <sup>3</sup> / <sub>4</sub>	16 <sup>1</sup> / <sub>2</sub>	16	34 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>	31 <sup>3</sup> / <sub>4</sub>
Oct. .. ..	18	15 <sup>1</sup> / <sub>2</sub>	16 <sup>1</sup> / <sub>2</sub>	13 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	13 <sup>3</sup> / <sub>4</sub>	16 <sup>3</sup> / <sub>4</sub>	15 <sup>3</sup> / <sub>4</sub>	16	34 <sup>1</sup> / <sub>2</sub>	34 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>	31 <sup>3</sup> / <sub>4</sub>
Nov. .. ..	18	18	15 <sup>1</sup> / <sub>2</sub>	16 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	13 <sup>3</sup> / <sub>4</sub>	13 <sup>3</sup> / <sub>4</sub>	17 <sup>1</sup> / <sub>2</sub>	16	34 <sup>1</sup> / <sub>2</sub>	34 <sup>1</sup> / <sub>2</sub>	35	34 <sup>3</sup> / <sub>4</sub>
Dec. .. ..	18	18	15	16 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	13 <sup>3</sup> / <sub>4</sub>	13 <sup>3</sup> / <sub>4</sub>	17 <sup>1</sup> / <sub>2</sub>	16	34 <sup>1</sup> / <sub>2</sub>	34	34 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>
Jan. .. ..	16 <sup>1</sup> / <sub>2</sub>	16 <sup>3</sup> / <sub>4</sub>	13	16 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	15 <sup>3</sup> / <sub>4</sub>	18	17 <sup>1</sup> / <sub>2</sub>	16	34 <sup>3</sup> / <sub>4</sub>	37 <sup>1</sup> / <sub>2</sub>	33	34 <sup>3</sup> / <sub>4</sub>
Feb. .. ..	16	15 <sup>1</sup> / <sub>2</sub>	9 <sup>3</sup> / <sub>4</sub>	15 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	16 <sup>1</sup> / <sub>2</sub>	16 <sup>3</sup> / <sub>4</sub>	17 <sup>1</sup> / <sub>2</sub>	16	34 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>	29 <sup>3</sup> / <sub>4</sub>	34
March .. ..	11 <sup>3</sup> / <sub>4</sub>	15	9 <sup>3</sup> / <sub>4</sub>	15 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>2</sub>	20 <sup>1</sup> / <sub>2</sub>	17 <sup>1</sup> / <sub>2</sub>	17 <sup>1</sup> / <sub>2</sub>	16 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>	29 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>
April .. ..	11 <sup>1</sup> / <sub>4</sub>	15	9 <sup>3</sup> / <sub>4</sub>	15	2 <sup>1</sup> / <sub>2</sub>	18 <sup>1</sup> / <sub>2</sub>	17 <sup>1</sup> / <sub>2</sub>	17 <sup>1</sup> / <sub>2</sub>	17 <sup>1</sup> / <sub>2</sub>	32 <sup>1</sup> / <sub>2</sub>	34 <sup>3</sup> / <sub>4</sub>	29 <sup>3</sup> / <sub>4</sub>	34 <sup>3</sup> / <sub>4</sub>
Arth. Average	14 <sup>3</sup> / <sub>2</sub>	14 <sup>1</sup> / <sub>2</sub>	13	13 <sup>3</sup> / <sub>4</sub>	2 <sup>1</sup> / <sub>2</sub>	17	17	17	17	34	34	32 <sup>1</sup> / <sub>2</sub>	33 <sup>1</sup> / <sub>2</sub>

\*Based upon material in U.S.D.A. Bulletin of Dairy Statistics, 1929.

TABLE XIV.  
MILK STANDARD OR GRADE B. RETAIL PRICE DELIVERED TO  
FAMILY TRADE AND DELIVERED COUNTRY PLANT, 1927-28.

*New York. Pence per Imperial Gallon.*

Units.—1d. = 2 cents.; 1 British gallon = 6/5 U.S. gallon.

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1927	36	36	36	36	36	36	36	36	38·4	38·4	38·4	38·4	Retail Family Trade. Country Price. Margin. Margin Less Transport (2 <sup>1</sup> / <sub>2</sub> d.).
	15·6	15·1	15·1	15·1	14·9	14·9	14·9	14·9	—	17·0	17·4	17·4	
	20·4	20·9	20·9	20·9	21·1	21·1	21·1	21·1	—	21·4	21·0	21·0	
	17·9	18·4	18·4	18·4	18·6	18·6	18·6	18·6	—	18·9	18·5	18·5	
1928	38·4	36·0	36·0	36·0	36·0	36·0	36·0	38·4	38·4	38·4	38·4	38·4	Retail. Country. Margin. Margin Less Transport (2 <sup>1</sup> / <sub>2</sub> d.).
	17·1	17·1	16·8	14·8	14·8	14·8	14·5	16·8	16·8	17·0	17·0	17·0	
	21·3	18·9	19·2	21·2	21·2	21·2	21·5	21·6	21·6	21·4	21·4	21·4	
	18·8	16·4	16·7	18·7	18·7	18·7	19·0	19·1	19·1	18·9	18·9	18·9	

(1) The New York market includes New York City, Greater New York, and surrounding areas in New York State and New Jersey, with a population of approximately 8·7 millions and the consumption per head is calculated as 1 pint (English) per head per day excluding cream, which is also heavily purchased. This large demand has been attributed to the general growth of well-being, the effect of prohibition, and the presence of a large semitic element in the population, together with a supply which claims to have reached the highest commercial standards for pure and safe milk. It is estimated that 80 per cent. of the supply comes from New York State and the remainder from adjoining counties of Vermont, New Jersey, and Pennsylvania, but the haulage distance is very considerable, stretching up to 450-500 miles, while cream travels even further. There is very little milk within 50 miles of New York and the average length of haul is given now as over 200 miles. Ninety-eight per cent. of the milk comes by rail as the position of the city gives little chance to alternative methods of transport and the latest types of tanks and cars are employed.

The milk shed is, however, large and only 40-45 per cent. of the milk is shipped as fluid milk; 20 per cent. is used for cream and the remainder for manufacture.

The chief features of the movement of this milk to market are (1) the use of country plants owned by Farmers' Co-operatives and by milk distributors, where the output is received, weighed, tested and sent on to New York either in 40 quart cans (=8½ Imperial Gallons) or in tanks. The containers up to the country plant are owned by producers or their organisations, from the country depôt onwards by the distributors or farmers' co-operatives. Few country plants either pasteurise or bottle, that being done mainly in the city plants. (2) The freight rate on the 201-210 mile zone is given as 1·1 cents per quart in 40 quart cans (=2½d. per Imperial Gallon) but the rate rises to 1·6 cents per quart on quart bottles. In general the rates are said to favour distance producers.\* (3) The country plants usually have rail sidings and load into the vans, but there is considerable expense in trucking at the New York end as the processing plants are not on the railway.

\* Rates on 40 quart can :-

Miles	1-40	..	..	23·5-27·5 cents.
"	41-100	..	..	29·5-35·5 "
"	101-190	..	..	36·0-44·0 "
"	191-400	..	..	45·0-59·5 "
"	401-500	..	..	60·0-71·5 "

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(2) The producers' price is determined by collective bargaining between farmers' organisations and the distributors ; a separate price is fixed for each use of milk ; the liquid milk price is the highest, but a farmer would not commonly receive this price ; a pooled or averaged price which bears the burden of surplus uses of milk is what he usually receives ; in other words, the influence of cream, butter, cheese, and condensed milk prices effect the determination so that it cannot be said that farmers realise the so-called fluid milk price in full.

(3) The three usual channels of distribution in New York are :—

(a) In bottles from route waggons of the retailers.

(b) In bottles or in bulk from stores.

(c) To hotels, restaurants, cafés, steamships, etc.

It is estimated that one third of the consumption goes through each channel.

The first class of trade is mainly in the hands of a small number of large firms of which the Borden's Farm Products Co., Inc., and the Sheffield Farms Co. Inc., are well known.

The wholesale trade is in the hands of large numbers of firms who sell to retail stores, hotels, chain and grocery stores, delicatessen shops, bakeries and dairy depôts ; the Sheffield Farms Co., Inc., operates a chain of grocery stores which sell milk, in addition to its delivery system with dairy depôts. Most shops sell both bottled and bulk milk ; the bottled milk is sold at the same price as from a wagon, but milk in bulk is 4-5 cents a quart less (=9*d.* to 12*d.* an Imperial Gallon less). The New York City Health authorities permit the sale of bulk milk in stores, but not in the streets. This bulk milk goes to the shops in 40 quart cans (8½ Imperial Gallons) and the consumers fetch it in their own containers ; it is used in the poorer and congested tenement areas and gives a near parallel to conditions on the continent of Europe.

If, therefore, 18½*d.* per Imperial gallon be taken as the nominal New York margin, i.e., difference between domicile retail price and producers' price free New York, then the first allowance must be made for the fact that much bulk milk going through stores, etc., and to hotels is not sold at that margin. Leland and Spencer, in their study of the New York milk market, suggest that the real margin is probably 14½*d.*-15*d.*

This covers :—

- (a) cost of working country plants ;
- (b) cost of carriage of milk from New York terminals to processing depôts ;
- (c) cost of operating city plants (pasteurising, bottling, etc.) and of balancing supplies ;
- (d) cost of door to door delivery system ;
- (e) administrative and miscellaneous expenses.

Information and analysis are not available to divide up or apportion these different elements in cost and it should not be assumed that each service is, as it were, called upon to pay its way. It seems apparent, however, that bottling and delivery systems are responsible for more than half of the New York margin.

(4) The quality of the milk sold in the city is the subject of a sanitary code ; the three main grades sold for human consumption are :—

- (a) Grade A Raw from tuberculine tested cows produced under carefully regulated conditions ; this represents about  $1\frac{1}{4}$ —2 per cent. of the consumption.
- (b) Grade A Pasteurised represents 14—15 per cent.
- (c) Grade B Pasteurised, the standard grade, represents 80—83 per cent. of the total.

Grade A pasteurised sells at a differential of  $7\frac{1}{4}d.$  per Imperial gallon over Grade B. The New York Health Committee Control all milk destined for the city both at the producer's farms and throughout the process of distribution. The sanitary, chemical and bacterial controls are used and the butter-fat minimum is 3 per cent. but most milk is bought on the 3·5 per cent. standard. Pasteurisation is compulsory except for Grade A raw. It may be said that New York has a control as careful as that of any other great city, and in the opinion of many, superior to that of any European city. Its methods are in fact continuously cited at Dairy Congresses as representing something which European countries should strive after and if possible put into operation. Some part of the margin may be attributed to the special attention required in cleanliness and in the extra safety of the product for the consumer.

SECTION VIII.  
MILK PRICES IN CHICAGO.

The general position of milk prices in Chicago may be briefly indicated; in the years, 1927 and 1928, the retail price has been uniform at  $33\frac{1}{2}d.$  per Imperial Gallon and the producers' price at farm or country station has averaged  $12\frac{1}{2}d.$ ; this gives a margin including transport cost of  $21d.$ ; the average transport cost is not believed to be above  $2d.$  per gallon in this area so that the dealers' margin is approximately  $19d.$  or  $\frac{1}{2}d.$  more than is the case of New York.

(1) The Chicago milk market serves a population of 3,500,000 in the city and its suburbs and consumption per head has been calculated as  $\cdot62$  lbs. for milk alone and  $1\cdot01$  lbs. if cream be included\*; this is equal to  $\frac{1}{2}$  pint and  $\frac{4}{5}$  of a pint respectively. This city has not therefore a notably high per head consumption; apparently it is the less wealthy sections where most milk is sold. Chicago lies relatively near to the greatest dairy district in the U.S.A. so that any notable rise in producers' prices is inclined to bring in a supply of Wisconsin milk. At present the most distant plant despatching supplies is 230 miles from the city but the main sources lie between 50 and 100 miles away. The transport rate which covers this supply is not more than 40 cents per 100 lbs. (=  $2d.$  per Imperial gallon). The tank car may however alter the relative profitableness of the Chicago market for more distant producers. The system of distribution consists (a) of a number of wholesale-retailers who operate a complete retail delivery system but also deal wholesale (b) of a number of wholesalers who sell both bottled and bulk milk to hotels, restaurants, institutions, factories, etc., as well as to the grocery stores and delicatessen shops (c) of jobbing companies who deal in milk, cream, and ice-cream acting as a sort of accommodation market to other traders. This group may deal with supplies up to considerable distances (d) of milk brokers who act as intermediaries between farmers and the smaller city dealers. This business is now on a small scale.

(2) The producers' price is fixed by collective bargaining as in the case of New York and there has been considerable friction in this area over the relationship between the producers' price and the distributors' margin. There is also continuous difficulty between the inner and outer sources of supply since so much milk used for

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\* See H. A. Ross, The Marketing of Milk in the Chicago Dairy District.

other purposes is on the fringe of the market. A considerable amount of Chicago's milk is pasteurised and bottled at country plants and so must pay much higher transport rates than that indicated above but the main portion of the supply is shipped in cans both by rail and road to the processing plants in the city. The explanation of the 19¢ per gallon margin must therefore lie along the same lines as in the case of New York. Two special points are emphasized, however, by H. A. Ross in his study of this market (1) that the handling of surplus presented more than usual difficulty and (2) that labour costs are heavy in delivery\*. The quality of Chicago milk ranks high as the city control is active ; pasteurisation is compulsory for all ordinary milk and supplies are commonly purchased on a 3·5 per cent. butter-fat basis.

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\* Ross states that at the time he was writing (1925) the Milk Drivers' Union had obtained a minimum guaranteed wage of \$45 for a 6 day week plus commission on all deliveries beyond a certain quota.

SECTION IX.  
THE SIGNIFICANCE OF MARGINS.

(1) The eight cities, which have been the subject of special consideration, are all in the group of exceptional size and some attempt may now be made to interpret broadly their position with regard to the costs of obtaining their fluid milk supply.

A Table has been drawn up which summarises the main points surveyed in the earlier descriptions of each city. There are three groups :—

- i. The high margin group of U.S. cities, where a full hygienic service and delivery system is found.
- ii. The medium margin of the British and Danish group, where the most complete form of hygienic service and delivery found in Europe is given.
- iii. The low margin of the German and French group, where there is a complete service neither in treatment nor in delivery.

It seems fairly obvious that the margins move with the services rendered and the guarantees of safety, which the public requires from the trade and from producers. The case of Berlin and Hamburg bring this out where extra services have to be paid for by additions to the standard rate.

(2) Associated with this matter is the recent evolution of the dairy trade upon American lines ; this has meant considerable investment in machinery for cleaning, pasteurising, cooling, together with further investment for bottling machines, capping machines and washing plant, so that all the many types of containers may be thoroughly cleansed. The trade has drawn in additional capital on a large scale for many years and at present the tendency has been for large firms, who have easier access to capital, to pioneer this change over from the relatively small scale methods of distribution, which required small capital. The result is not yet fully worked out as the change is only in progress in Europe, but this demand for a safe milk processed on American lines is one influence which, by its expense, not only keeps the margin from falling, but tends to expand it ; there is no reason to think that this pressure from medical and scientific research has fully worked itself out as the more recent efforts towards special milks, such as Grade A.T.T. in Britain and children's milk in Denmark do not lead one to think that they can be produced and marketed cheaply either by producers or by the dairy trade.



TABLE XV.  
 CONDITIONS OF SUPPLY IN CERTAIN CITIES IN 1928-29.  
*Prices in Pence per Imperial Gallon.*  
 (All figures are subject to the qualifications embodied in the text.)

	Population.	Per head Pints.	Margin.	Maximum Radius of Supply	Trend of Margin since 1925.	Butter-Fat	Pasteurisation.	Bottle Containers.	International Labour Office Real Wage Calculation.
London ..	8,000,000	$\frac{1}{2}$ - $\frac{3}{4}$ excludes cream	11 $\frac{1}{2}$ - 11 $\frac{3}{4}$	330	Very slight increase 1928	3% Minimum 3.5% Normal	General but not compulsory	Large percentage no extra charge	100
Glasgow ..	1,100,000	$\frac{2}{3}$ excludes cream	9 $\frac{1}{2}$ - 10 $\frac{1}{2}$	120	Slight increase in 1929	3% Minimum 3.5% Normal	Fair percentage Not compulsory	Over 50% no extra charge	—
Berlin ..	4,100,000	$\frac{1}{2}$ excludes cream	6 $\frac{1}{2}$	200	Slight upward movement since 1928	2.7% Minimum 3-3.2% Normal	Usual for Train Milk	Small percentage extra charge	70-73
Hamburg ..	1,100,000	$\frac{1}{2}$	6	95	Slight upward trend since 1926	2.7% Minimum 3-3.1% Normal	Partly	Very small percentage extra charge	—
Copenhagen	750,000	$\frac{1}{2}$ excludes cream	9-10	100	—	3.25% Minimum 3.6% Normal	Usual for ordinary milk	Usual no extra charge	108
Paris and Suburbs	4,500,000	$\frac{1}{2}$	5-5 $\frac{1}{2}$	200	Upward with rising prices	No legal min. variable but inclined to be low	Mostly heated	Insignificant extra charge	58-59
New York ..	8,700,000	1 excludes cream	18 $\frac{1}{2}$	450-500	—	3.5% Normal	Compulsory for Standard Milk	All Domicile milk no extra charge	—
Chicago ..	3,500,000	$\frac{1}{2}$ excludes cream	19	up to 230	Slightly upward to 1928	3.5% Normal	Compulsory for Standard Milk	All Domicile milk no extra charge	208

The other influence of higher capitalisation upon the trade has been to enlarge and strengthen the position of the wholesalers, so that this function covers collection, processing, storing, balancing of supplies, bottling, conversion of surplus left over and delivery to the retailer ; in fact in all the great cities surveyed it is obvious that a handful of great firms do the most of the processing, etc., while hosts of small firms retail both the treated milk and that which comes in untreated.

On the other hand the new standards of cleanliness and keeping power required in milk will be more cheaply attained when they become general and technical advance may make it possible to obtain better transport without extra cost, to use non-returnable empties in the household delivery trade and so on.

(3) A second general feature of the city Tables which have been given is that in no case has there been any fall in the margin (apart from currency influences) within the years after 1924-25 ; if anything the reverse has been the case. The most important costs in labour and transport have scarcely changed at all and in certain cities the difficulties with surplus milk are said to have increased (*cf.* Berlin).

(4) It seems necessary to point out that the margin referred to in this survey is not a measure of marketing costs for milk ; it is only a measure of the difference between producers' price and the price of milk to the consumer. Reference has already been made to the position that a dairy firm does not usually sell all its purchased milk at the consumers' price ; in some cases less than half may go into this channel, so that the dairyman's margin is commonly much less than the so-called " nominal " margin. It is not possible to say how much less without an analysis of sales at different prices and the results would vary with the firms considered. Further the retail costs are complicated by public policy with regard to the articles which may be sold from the same shops as milk. The general policy is to prevent milk being sold where dust and contamination might be present, but there is a wide range of commodities, such as dairy produce, eggs, margarine, tinned and bottled goods, patented and branded goods which are packed, which can be safely sold with milk and assist in bearing their share of the cost of distribution. Where bottled milk is very generally used, as in New York, convenience may allow such containers to be distributed from ordinary stores. In general, the sale of loose or bulk milk must be more carefully watched than where glass bottles are employed.

The other issue raised is where it has been suggested as in the case of Berlin that a margin of  $6\frac{1}{2}d.$  could be explained by an analysis into the costs of certain operations, such as transport, processing, etc. ; this is technically misleading as clearly it is not  $6\frac{1}{2}d.$  which has to be explained from the dairy trade point of view, but rather some other figure such as  $5d.$  or  $5\frac{1}{2}d.$ , unless all the milk is sold at the full retail price. Nevertheless the division of the "conventional" trade margin to give what is known as a price structure may be judged useful, firstly as a general guide to marketing costs, since any rise in marketing costs is likely to reflect itself in the "nominal" margin, secondly as a useful guide from the consumer's point of view to the measurement of rises and falls in prices, of the article bought especially if the reasons for fluctuations are observed.

The study of "nominal" margins is therefore a complement and not a substitute for analysis of the expenses of firms, which is devoted to the study of the efficient working of different wholesale and retail firms and to observation of the rate of profit earned. Such work cannot be done satisfactorily unless with the support of the dairy trade even with special powers from a Government. The only effort in this direction was that of the Linlithgow Committee (Milk Report, 1923) but its analysis was limited to the books of a few firms for one year only and served to show the difficulties and limitations of such work as applied to the very varied types of firms engaged in the distribution of fluid milk.

(5) The method commonly used in the U.S.A. and elsewhere of comparing the producers' price with the "nominal" margin of distribution is, as has been suggested earlier, of doubtful value. It implies that there is some close correlation between producers' prices and marketing costs, whereas this is not necessarily so.

(a) Milk prices depend upon other demands than that for fluid milk ; in fact in some countries producers' prices are dominated by butter and cheese levels and variations in the dairy trade margins would scarcely effect producers' prices.

(b) Marketing costs may vary quite independently of production costs ; they comprise entirely different factors.

(c) Countries where elaborate distributive services are offered to the public naturally show a larger proportion of distribution costs to production costs.

(d) There is, however, a connection in this respect that the consumers' price for milk regulates his demand for it and therefore any

fall in the costs of marketing should react favourably upon production and conversely any fall in production costs which permits the dairy trade to buy milk more cheaply reacts favourably upon the dairy trade position, but there is no sound basis for the view that because producers get less therefore distributors should do their work for proportionally less. No doubt there is a connection in this sense that if milk is overproduced and the price is low to the distributor, he can do a bigger turnover and spread his costs over a larger sale and therefore he should have a lower margin. If this measure were taken, it appears that in the large towns the distribution costs (nominal) would cover roughly 60 per cent. of the consumers' price in the U.S.A., in Britain, 40-44 per cent., in Denmark 50 per cent., in Germany 37 per cent. and in France 30-33 per cent. These figures underestimate the percentage since in all cases the producers bear certain of the marketing costs connected with the despatch of their milk.

(6) No claim is made that the price lists used in this survey are fully reliable indicators of market conditions, but they were the most complete available and as they have been given over a series of years in most cases, it is suggested that they are sufficiently accurate to indicate the trend of the nominal margin. It must be borne in mind that much milk, including all special qualities, is sold above the quoted prices and also surplus milk and some quantity of supply under; there are other differential payments to take account of such as extras for services, the cream trade, etc.

(7) The evidence upon labour costs is too slight for any conclusion to be suggested; it appears that wages cost is much the highest in U.S.A., Britain and Denmark rank about the same, and Germany and France have the lowest rates, but the systems of distribution and services involved vary too much for any comparison to have value. The real wages of the countries concerned have been quoted from the calculation of the International Labour Office, but these are of limited value, being based upon a few categories of workmen only and upon an international "basket of provisions."

(8) It is suggested that an index number of distributive costs based upon the nominal margins for certain cities in this country and if possible for other countries might be a useful indicator of the movement of milk distributive costs. It is possible that this idea might be expanded to cover a number of food articles and to take its place with other index numbers of prices which are compiled, such as those



APPENDIX I.

LONDON MONTHLY MILK PRICES PER IMPERIAL GALLON (1913-1930).

Date	Price delivered London	Margin	Retail (Domicile)
<i>1913</i>			
Jan. .. .. .	d. 10½	d. 5½	d. 16
Feb. .. .. .	10½	5½	16
Mar. .. .. .	10½	5½	16
Apr. .. .. .	7½	8½	16
May .. .. .	7½	8½	16
June .. .. .	7½	8½	16
July .. .. .	7½	8½	16
Aug. .. .. .	7½	8½	16
Sept. .. .. .	7½	8½	16
Oct. .. .. .	10½	5½	16
Nov. .. .. .	10½	5½	16
Dec. .. .. .	10½	5½	16
<i>1914</i>			
Jan. .. .. .	10½	5½	16
Feb. .. .. .	10½	5½	16
Mar. .. .. .	10½	5½	16
Apr. .. .. .	8	8	16
May .. .. .	8	8	16
June .. .. .	8	8	16
July .. .. .	8	8	16
Aug. .. .. .	8	8	16
Sept. .. .. .	8	8	16
Oct. .. .. .	10½	5½	16
Nov. .. .. .	10½	5½	16
Dec. .. .. .	10½	5½	16
<i>1915</i>			
Jan. .. .. .	10½	5½	16
Feb. .. .. .	10½	5½	16
Mar. .. .. .	10½	6½	17
Apr. .. .. .	9½	7½	17
May .. .. .	9½	8	17½
June .. .. .	9½	8	17½
July .. .. .	9½	8	17½
Aug. .. .. .	9½	8½	18
Sept. .. .. .	9½	8½	18
Oct. .. .. .	13½	4½	18
Nov. .. .. .	13½	6½	20
Dec. .. .. .	13½	6½	20

APPENDIX I—*contd.*  
LONDON MONTHLY MILK PRICES PER IMPERIAL GALLON (1913-1930).

Date	Price delivered London	Margin	Retail (Domicile)
<i>1916</i>			
Jan.	d. 13½	d. 6½	d. 20
Feb.	13½	6½	20
Mar.	13½	6½	20
Apr.	14	6	20
May	12	10	22
June	12	10	22
July	14	8	22
Aug.	14	8½	22½
Sep.	14	9	23
Oct.	16½	6½	23
Nov.	16½	7½	24
Dec.	16½	7½	24
<i>1917</i>			
Jan.	16½	7½	24
Feb.	16½	7½	24
Mar.	16½	7½	24
Apr.	14	10	24
May	14	10	24
June	14	10	24
July	14	10	24
Aug.	14	10	24
Sept.	14	10	24
Oct.	18½	9½	28
Nov.	20½	11½	32
Dec.	22½	9½	32
<i>1918</i>			
Jan.	24	8	32
Feb.	24	8	32
Mar.	22½	9½	32
Apr.	21½	10½	32
May	13½	10½	24
June	13½	10½	24
July	15½	12½	28
Aug.	16½	15½	32
Sept.	16½	15½	32
Oct.	28½	7½	36
Nov.	28½	7½	36
Dec.	28½	11½	40

APPENDIX I—*contd.*

LONDON MONTHLY MILK PRICES PER IMPERIAL GALLON (1913-1930).

Date	Price delivered London	Margin	Retail (Domicile)
<i>1919</i>			
Jan.	d. 28½	d. 11½	d. 40
Feb.	28½	11½	40
Mar.	28½	11½	40
Apr.	28½	11½	40
May	16	12	28
June	15	13	28
July	18	18	36
Aug.	20	12	32
Sept.	22	14	36
Oct.	26	18	44
Nov.	32	16	48
Dec.	39	9	48
<i>1920</i>			
Jan.	39½	8½	48
Feb.	33½	10½	44
Mar.	31½	12½	44
Apr.	26½	13½	40
May	16½	15½	32
June	16½	15½	32
July	18½	13½	32
Aug.	19½	12½	32
Sept.	21½	10½	32
Oct.	26	14	40
Nov.	29	11	40
Dec.	33½	10½	44
<i>1921</i>			
Jan.	32½	11½	44
Feb.	32½	11½	44
Mar.	29	15	44
Apr.	25	15	40
May	14½	17½	32
June	14½	17½	32
July	18½	13½	32
Aug.	22½	13½	36
Sept.	23½	12½	36
Oct.	22½	13½	36
Nov.	23½	12½	36
Dec.	24½	11½	36



APPENDIX I—*contd.*

LONDON MONTHLY MILK PRICES PER IMPERIAL GALLON (1913-1930).

Date	Price delivered London	Margin	Retail (Domicile)
<i>1922</i>			
Jan. . . . .	d. 20	d. 12	d. 32
Feb. . . . .	20	12	32
Mar. . . . .	20	12	32
Apr. . . . .	12	12	24
May . . . . .	12	12	24
June . . . . .	12	12	24
July . . . . .	12	12	24
Aug. . . . .	12	12	24
Sept. . . . .	12	12	24
Oct. . . . .	20	12	32
Nov. . . . .	20	12	32
Dec. . . . .	20	12	32
<i>1923</i>			
Jan. . . . .	20	12	32
Feb. . . . .	20	12	32
Mar. . . . .	20	12	32
Apr. . . . .	12	12	24
May . . . . .	12	12	24
June . . . . .	12	12	24
July . . . . .	12	12	24
Aug. . . . .	12	12	24
Sept. . . . .	12	12	24
Oct. . . . .	17	11	28
Nov. . . . .	17	11	28
Dec. . . . .	20	12	32
<i>1924</i>			
Jan. . . . .	20	12	32
Feb. . . . .	20	12	32
Mar. . . . .	17	11	28
Apr. . . . .	12	12	24
May . . . . .	12	12	24
June . . . . .	12	12	24
July . . . . .	12	12	24
Aug. . . . .	12	12	24
Sept. . . . .	12	12	24
Oct. . . . .	18½	9½	28
Nov. . . . .	18½	9½	28
Dec. . . . .	18½	9½	28

APPENDIX I—*contd.*  
LONDON MONTHLY MILK PRICES PER IMPERIAL GALLON (1913-1930).

Date		Price delivered London	Margin	Retail (Domicile)
<i>1925</i>		d.	d.	d.
Jan.	.. .. .	18½	9½	28
Feb.	.. .. .	18½	9½	28
Mar.	.. .. .	18½	9½	28
Apr.	.. .. .	12	12	24
May	.. .. .	12	12	24
June	.. .. .	12	12	24
July	.. .. .	12	12	24
Aug.	.. .. .	12	12	24
Sept.	.. .. .	12	12	24
Oct.	.. .. .	17	11	28
Nov.	.. .. .	17	11	28
Dec.	.. .. .	17	11	28
<i>1926</i>				
Jan.	.. .. .	17	11	28
Feb.	.. .. .	17	11	28
Mar.	.. .. .	17	11	28
Apr.	.. .. .	16	12	28
May	.. .. .	12	12	24
June	.. .. .	12	12	24
July	.. .. .	12	12	24
Aug.	.. .. .	12	12	24
Sept.	.. .. .	16	12	28
Oct.	.. .. .	16½	11½	28
Nov.	.. .. .	16½	11½	28
Dec.	.. .. .	16½	11½	28
<i>1927</i>				
Jan.	.. .. .	16½	11½	28
Feb.	.. .. .	16½	11½	28
Mar.	.. .. .	16½	11½	28
Apr.	.. .. .	12	12	24
May	.. .. .	12	12	24
June	.. .. .	12	12	24
July	.. .. .	12	12	24
Aug.	.. .. .	12	12	24
Sept.	.. .. .	12	12	24
Oct.	.. .. .	16½	11½	28
Nov.	.. .. .	16½	11½	28
Dec.	.. .. .	16½	11½	28

APPENDIX I—*contd.*

LONDON MONTHLY MILK PRICES PER IMPERIAL GALLON (1913-1930).

Date	Price delivered London	Margin	Retail (Domicile)
<i>1928</i>			
Jan. .. .. .	d. 16½	d. 11½	d. 28
Feb. .. .. .	16½	11½	28
Mar. .. .. .	16½	11½	28
Apr. .. .. .	12	12	24
May .. .. .	12	12	24
June .. .. .	12	12	24
July .. .. .	12	12	24
Aug. .. .. .	12	12	24
Sept. .. .. .	12	12	24
Oct. .. .. .	16	12	28
Nov. .. .. .	17	11	28
Dec. .. .. .	17	11	28
<i>1929</i>			
Jan. .. .. .	17	11	28
Feb. .. .. .	17	11	28
Mar. .. .. .	16	12	28
Apr. .. .. .	16	12	28
May .. .. .	12	12	24
June .. .. .	12	12	24
July .. .. .	12	12	24
Aug. .. .. .	12	12	24
Sept. .. .. .	16	12	28
Oct. .. .. .	16	12	28
Nov. .. .. .	17	11	28
Dec. .. .. .	17	11	28
<i>1930</i>			
Jan. .. .. .	17	11	28
Feb. .. .. .	17	11	28
Mar. .. .. .	16	12	28
Apr. .. .. .	12	12	24
May .. .. .	12	12	24
June .. .. .	12	12	24
July .. .. .	12	12	24
Aug. .. .. .	12	12	24
Sept. .. .. .	16	12	28

APPENDIX II.  
GLASGOW MILK PRICES, 1922-1930.  
(Per Imperial Gallon.)

Date	Producers Price delivered Glasgow		Margin	Wholesale Price		Margin	Retail Price		Surplus Milk Price
	s. d.	d.		s. d.	d.		s. d.	s. d.	
<b>1922</b>									
Nov. .. ..	1 7	3½		1 10½	5½		2 4		
Dec. .. ..	1 7	3½		1 10½	5½		2 4		
<b>1923</b>									
Jan. .. ..	1 7	3½		1 10½	5½		2 4		
Feb. .. ..	1 7	3½		1 10½	5½		2 4		
Mar. .. ..	1 3	3½		1 6½	5½		2 0	1 1	
Apr. .. ..	1 0	3		1 3	5		1 8	1 0	
May .. ..	11	3½		1 2½	5½		1 8	8	
June .. ..	11	3½		1 2½	5½		1 8	7½	
July .. ..	11	3½		1 2½	5½		1 8	8½	
Aug. .. ..	1 3	3½		1 6½	5½		2 0	8½	
Sept. .. ..	1 3	3½		1 6½	5½		2 0	11	
Oct. .. ..	1 3	3½		1 6½	5½		2 0	10½	
Nov. .. ..	1 7	3½		1 10½	5½		2 4		
Dec. .. ..	1 7	3½		1 10½	5½		2 4		
<b>1924</b>									
Jan. .. ..	1 7	3½		1 10½	5½		2 4		
Feb. .. ..	1 7	3½		1 10½	5½		2 4		
Mar. .. ..	1 3	3½		1 6½	5½		2 0	9	
Apr. .. ..	1 0	3		1 3	5		1 8	8	
May .. ..	11	3½		1 2½	5½		1 8	8½	
June .. ..	11	3½		1 2½	5½		1 8	7½	
July .. ..	11	3½		1 2½	5½		1 8	8	
Aug. .. ..	1 3	3½		1 6½	5½		2 0	8½	
Sept. .. ..	1 3	3½		1 6½	5½		2 0	8½	
Oct. .. ..	1 3	3½		1 6½	5½		2 0	8½	
Nov. .. ..	1 7	3½		1 10½	5½		2 4		
Dec. .. ..	1 7	3½		1 10½	5½		2 4		

APPENDIX II—*contd.*  
 GLASGOW MILK PRICES, 1922-1930.  
 (Per Imperial Gallon).

Date	Producers Price delivered Glasgow	Margin	Wholesale Price	Margin	Retail Price	Surplus Milk Price
<i>1925</i>						
Jan. .. ..	s. d. 1 7	d. 3½	s. d. 1 10½	d. 5½	s. d. 2 4	d.
Feb. .. ..	1 7	3½	1 10½	5½	2 4	
Mar. .. ..	1 3	3½	1 6½	5½	2 0	9½
Apr. .. ..	1 0	3	1 3	5	1 8	9½
May .. ..	11	3½	1 2½	5½	1 8	9½
June .. ..	11	3½	1 2½	5½	1 8	9
July .. ..	11	3½	1 2½	5½	1 8	9½
Aug. .. ..	1 3	3½	1 6½	5½	2 0	10
Sept. .. ..	1 3	3½	1 6½	5½	2 0	10
Oct. .. ..	1 7	3½	1 10½	5½	2 4	11
Nov. .. ..	1 7	3½	1 10½	5½	2 4	
Dec. .. ..	1 7	3½	1 10½	5½	2 4	
<i>1926</i>						
Jan. .. ..	1 7	3½	1 10½	5½	2 4	
Feb. .. ..	1 7	3½	1 10½	5½	2 4	
Mar. .. ..	1 3	3½	1 6½	5½	2 0	9½
Apr. .. ..	1 3	3½	1 6½	5½	2 0	9
May .. ..	11	3½	1 2½	5½	1 8	8½
June .. ..	11	3½	1 2½	5½	1 8	8½
July .. ..	11	3½	1 2½	5½	1 8	8
Aug. .. ..	1 3	3½	1 6½	5½	2 0	7½
Sept. .. ..	1 3	3½	1 6½	5½	2 0	7½
Oct. .. ..	1 7	3½	1 10½	5½	2 4	7½
Nov. .. ..	1 3	3½	1 6½	5½	2 0	
Dec. .. ..	1 3	3½	1 6½	5½	2 0	
<i>1927</i>						
Jan. .. ..	1 3	3½	1 6½	5½	2 0	
Feb. .. ..	1 3	3½	1 6½	5½	2 0	
Mar. .. ..	1 3	3½	1 6½	5½	2 0	8
Apr. .. ..	1 3	3½	1 6½	5½	2 0	7½
May .. ..	11	3½	1 2½	5½	1 8	7½
June .. ..	11	3½	1 2½	5½	1 8	8½
July .. ..	11	3½	1 2½	5½	1 8	8
Aug. .. ..	1 3	3½	1 6½	5½	2 0	8½
Sept. .. ..	1 3	3½	1 6½	5½	2 0	9
Oct. .. ..	1 3	3½	1 6½	5½	2 0	9½
Nov. .. ..	1 3	3½	1 6½	5½	2 0	9½
Dec. .. ..	1 3	3½	1 6½	5½	2 0	9½

APPENDIX II—*contd.*  
 GLASGOW MILK PRICES, 1922-1930.  
 (Per Imperial Gallon).

Date	Producers Price delivered Glasgow	Margin	Wholesale Prices	Margin	Retail Price	Surplus Milk Price
<i>1928</i>						
Jan. .. ..	s. d. 1 3	d. 3½	s. d. 1 6½	d. 5½	s. d. 2 0	d.
Feb. .. ..	1 3	3½	1 6½	5½	2 0	
Mar. .. ..	1 3	3½	1 6½	5½	2 0	9
Apr. .. ..	1 3	3½	1 6½	5½	2 0	9
May .. ..	11	3½	1 2½	5½	1 8	9
June .. ..	11	3½	1 2½	5½	1 8	9
July .. ..	11	3½	1 2½	5½	1 8	9
Aug. .. ..	1 3	3½	1 6½	5½	2 0	
Sept. .. ..	1 3	3½	1 6½	5½	2 0	
Oct. .. ..	1 3	3½	1 6½	5½	2 0	
Nov. .. ..	1 6	4½	1 10½	5½	2 4	8½
Dec. .. ..	1 6	4½	1 10½	5½	2 4	8½
<i>1929</i>						
Jan. .. ..	1 6	4½	1 10½	5½	2 4	8½
Feb. .. ..	1 6	4½	1 10½	5½	2 4	8½
Mar. .. ..	1 3	3½	1 6½	5½	2 0	
Apr. .. ..	1 3	3½	1 6½	5½	2 0	
May .. ..	1 0	6	1 6	6	2 0	
June .. ..	11	3½	1 2½	5½	1 8	
July .. ..	11	3½	1 2½	5½	1 8	
Aug. .. ..	1 1	5½	1 6½	5½	2 0	
Sept. .. ..	1 3	3½	1 6½	5½	2 0	
Oct. .. ..	1 5	5	1 10	6	2 4	

APPENDIX III.  
BERLIN MILK PRICES.  
(Pf. per litre.)

Date	Wholesale	Margin	Retail
<i>1927</i>			
1.1- 7.1 .. ..	18	11	29
8.1- 14.1 .. ..	18	11	29
15.1- 21.1 .. ..	18	11	29
22.1- 28.1 .. ..	18	11	29
29.1- 4.2 .. ..	18	11	29
5.2- 11.2 .. ..	18	11	29
12.2- 18.2 .. ..	18	11	29
19.2- 25.2 .. ..	19½	11½	31
26.2- 4.3 .. ..	19½	11½	31
5.3- 11.3 .. ..	19	11	30
12.3- 18.3 .. ..	17½	10½	28
19.3- 25.3 .. ..	17	11	28
26.3- 1.4 .. ..	17	11	28
2.4- 8.4 .. ..	17	11	28
9.4- 15.4 .. ..	17	11	28
16.4- 22.4 .. ..	16	11	27
23.4- 29.4 .. ..	14	11	25
30.4- 6.5 .. ..	15	11	26
7.5- 13.5 .. ..	16	11	27
14.5- 20.5 .. ..	17	11	28
21.5- 27.5 .. ..	16	11	27
28.5- 3.6 .. ..	16	11	27
4.6- 10.6 .. ..	14	11	25
11.6- 17.6 .. ..	15	11	26
18.6- 24.6 .. ..	15	11	26
25.6- 1.7 .. ..	16	11	27
2.7- 8.7 .. ..	16	11	27
9.7- 15.7 .. ..	18	11	29
16.7- 22.7 .. ..	18	11	29
23.7- 29.7 .. ..	18	11	29
30.7- 5.8 .. ..	17	11	28
6.8- 12.8 .. ..	19	11	30
13.8- 19.8 .. ..	21	11	32
20.8- 26.8 .. ..	21	11	32
27.8- 2.9 .. ..	20½	11½	32
3.9- 9.9 .. ..	22½	11½	34
10.9- 16.9 .. ..	22½	11½	34
17.9- 23.9 .. ..	22½	11½	34

APPENDIX III—*contd.*  
(Pf. per litre.)

Date	Wholesale	Margin	Retail
<i>1927—contd.</i>			
24. 9-30. 9 .. ..	21½	11½	33
1.10- 7.10 .. ..	21½	11½	33
8.10-14.10 .. ..	21½	11½	33
15.10-21.10 .. ..	21½	11½	33
22.10-28.10 .. ..	21½	11½	33
29.10- 4.11 .. ..	21½	11½	33
5.11-11.11 .. ..	20½	11½	32
12.11-18.11 .. ..	20½	11½	32
19.11-25.11 .. ..	21½	11½	33
26.11- 2.12 .. ..	21½	11½	33
3.12- 9.12 .. ..	20½	11½	32
10.12-16.12 .. ..	20½	11½	32
17.12-23.12 .. ..	19½	11½	31
24.12-30.12 .. ..	18½	11½	30
<i>1928</i>			
31.12.27-5.1 .. ..	17½	11½	29
6.1-12.1 .. ..	17½	11½	29
13.1-19.1 .. ..	16½	11½	28
20.1-26.1 .. ..	16½	11½	28
27.1- 2.2 .. ..	16½	11½	28
3.2- 9.2 .. ..	17½	11½	29
10.2-16.2 .. ..	17½	11½	29
17.2-23.2 .. ..	18½	11½	30
24.2- 1.3 .. ..	18½	11½	30
2.3- 8.3 .. ..	18½	11½	30
9.3-15.3 .. ..	18½	11½	30
16.3-22.3 .. ..	18½	11½	30
23.3-29.3 .. ..	18½	11½	30
30.3- 5.4 .. ..	18½	11½	30
6.4-12.4 .. ..	16½	11½	28
13.4-19.4 .. ..	18	12	30
20.4-26.4 .. ..	17½	11½	29
27.4- 3.5 .. ..	18½	11½	30
4.5-10.5 .. ..	18½	11½	30
11.5-17.5 .. ..	19½	11½	31
18.5-24.5 .. ..	18½	11½	30
25.5-31.5 .. ..	18½	11½	30
1.6- 7.6 .. ..	17½	11½	29
8.6-14.6 .. ..	16½	11½	28
15.6-21.6 .. ..	15½	11½	27



APPENDIX III—*contd.*

(Pf. per livre.)

Date	Wholesale	Margin	Retail
<i>1928—contd.</i>			
22. 6-28. 6 .. ..	15½	11½	27
29. 6- 5. 7 .. ..	16½	11½	28
6. 7-12. 7 .. ..	18½	11½	30
13. 7-19. 7 .. ..	18½	11½	30
20. 7-26. 7 .. ..	20½	11½	32
27. 7- 2. 8 .. ..	19½	11½	31
3. 8- 9. 8 .. ..	18½	11½	30
10. 8-16. 8 .. ..	18½	11½	30
17. 8-23. 8 .. ..	19½	11½	31
24. 8-30. 8 .. ..	19½	11½	31
31. 8- 6. 9 .. ..	19½	11½	31
7. 9-13. 9 .. ..	20½	11½	32
14. 9-20. 9 .. ..	22½	11½	34
21. 9-27. 9 .. ..	21½	11½	33
28. 9- 4.10 .. ..	21½	11½	33
5.10-11.10 .. ..	20½	11½	32
12.10-18.10 .. ..	20½	11½	32
19.10-25.10 .. ..	20½	11½	32
26.10- 1.11 .. ..	20½	11½	32
2.11- 8.11 .. ..	21½	11½	33
9.11-15.11 .. ..	20½	11½	32
16.11-22.11 .. ..	20½	11½	32
23.11-29.11 .. ..	20½	11½	32
30.11- 6.12 .. ..	20½	11½	32
7.12-13.12 .. ..	20½	11½	32
14.12-20.12 .. ..	20½	11½	32
21.12-27.12 .. ..	18½	11½	30
28.12-3.1.29 .. ..	17½	11½	29

**APPENDIX IV.**  
**HAMBURG MILK PRICES.**  
*Weekly Milk and Butter Prices, 1924-29.*  
Units. Butter Price, Marks per 100 kilos. Milk, Pfennigs per litre.  
**BUSINESS YEAR, 1924-1925.**

Date	Butter Price	Farm Price	Margin	Shop Price
2.5.24 .. .. .	175·0	17·5		
9.5.24 .. .. .	185·0	18·5		
16.5.24 .. .. .	182·0	18·2		
23.5.24 .. .. .	160·0	16·0		
30.5.24 .. .. .	140·0	14·0		
6.6.24 .. .. .	141·96	14·0		
13.6.24 .. .. .	140·62	14·0		
20.6.24 .. .. .	137·68	13·1	8·9	22·0
27.6.24 .. .. .	144·57	13·7	9·3	23·0
4.7.24 .. .. .	161·03	15·3	9·7	25·0
11.7.24 .. .. .	169·99	16·2	9·8	26·0
17.7.24 .. .. .	170·87	16·3	9·7	26·0
24.7.24 .. .. .	165·86	16·5	9·5	26·0
31.7.24 .. .. .	165·95	16·5	9·5	26·0
7.8.24 .. .. .	178·01	17·8	10·2	28·0
14.8.24 .. .. .	182·87	19·3	9·7	29·0
21.8.24 .. .. .	185·67	19·5	10·5	30·0
28.8.24 .. .. .	182·89	19·25	10·75	30·0
4.9.24 .. .. .	183·58	19·3	10·7	30·0
11.9.24 .. .. .	176·77	19·3	10·7	30·0
18.9.24 .. .. .	186·78	19·3	10·7	30·0
25.9.24 .. .. .	204·64	21·5	10·5	32·0
2.10.24 .. .. .	211·30	22·2	9·8	32·0
9.10.24 .. .. .	204·56	21·5	8·5	30·0
16.10.24 .. .. .	204·15	22·7	9·3	32·0
23.10.24 .. .. .	205·71	22·9	9·1	32·0
30.10.24 .. .. .	209·94	24·7	9·3	34·0
6.11.24 .. .. .	201·33	23·7	10·3	34·0
13.11.24 .. .. .	198·56	23·4	10·6	34·0
20.11.24 .. .. .	195·11	23·0	11·0	34·0
27.11.24 .. .. .	203·33	23·5	10·5	34·0
4.12.24 .. .. .	206·17	23·5	10·5	34·0
11.12.24 .. .. .	215·48	24·0	10·0	34·0
18.12.24 .. .. .	220·78	24·5	10·5	35·0
25.12.24 .. .. .	204·43	22·7	11·3	34·0
1.1.25 .. .. .	200·32	21·5	10·5	32·0

APPENDIX IV—*contd.*  
BUSINESS YEAR, 1924-1925.

Date	Butter Price	Farm Price	Margin	Shop Price
8.1.25 .. .. .	178·49	19·8	10·2	30·0
15.1.25 .. .. .	180·18	19·5	10·5	30·0
22.1.25 .. .. .	181·27	19·5	10·5	30·0
29.1.25 .. .. .	193·05	20·0	10·0	30·0
5.2.25 .. .. .	200·29	21·0	11·0	32·0
12.2.25 .. .. .	209·03	22·0	11·0	33·0
19.2.25 .. .. .	209·53	22·0	11·0	33·0
26.2.25 .. .. .	211·39	22·0	11·0	33·0
5.3.25 .. .. .	209·23	22·0	11·0	33·0
12.3.25 .. .. .	213·58	22·0	11·0	33·0
19.3.25 .. .. .	209·35	21·0	10·0	31·0
26.3.25 .. .. .	191·31	19·0	11·0	30·0
2.4.25 .. .. .	183·17	17·0	11·0	28·0
9.4.25 .. .. .	165·78	15·0	11·0	26·0
16.4.25 .. .. .	162·64	15·0	11·0	26·0
23.4.25 .. .. .	164·26	15·0	11·0	26·0
30.4.25 .. .. .	163·32	15·0	11·0	26·0

BUSINESS YEAR, 1925-1926.

Date	Butter Price	Farm Price	Margin	Shop Price
7.5.25 .. .. .	165·64	15·0	11·0	26·0
14.5.25 .. .. .	160·81	15·0	11·0	26·0
21.5.25 .. .. .	160·75	16·0	11·0	27·0
28.5.25 .. .. .	153·49	15·0	11·0	26·0
4.6.25 .. .. .	157·13	15·0	11·0	26·0
11.6.25 .. .. .	163·61	17·0	11·0	28·0
18.6.25 .. .. .	169·80	17·0	11·0	28·0
25.6.25 .. .. .	184·85	17·0	11·0	28·0
2.7.25 .. .. .	186·47	18·0	10·0	28·0
9.7.25 .. .. .	177·99	17·7	10·3	28·0
16.7.25 .. .. .	177·46	19·0	11·0	30·0
23.7.25 .. .. .	177·70	21·0	11·0	32·0

APPENDIX IV—*contd.*  
 BUSINESS YEAR, 1925-1926.

Date	Butter Price	Farm Price	Margin	Shop Price
30.7.25	189.45	21.0	11.0	32.0
6.8.25	198.57	21.0	11.0	32.0
13.8.25	204.78	23.0	11.0	34.0
20.8.25	204.93	23.0	11.0	34.0
27.8.25	202.74	23.0	11.0	34.0
3.9.25	194.63	21.0	11.0	32.0
10.9.25	195.90	21.0	11.0	32.0
17.9.25	200.06	21.0	11.0	32.0
24.9.25	203.68	23.0	11.0	34.0
1.10.25	211.27	23.0	11.0	34.0
8.10.25	226.01	25.0	11.0	36.0
15.10.25	223.83	24.5	11.5	36.0
22.10.25	224.50	24.5	11.5	36.0
29.10.25	210.05	23.0	11.0	34.0
5.11.25	207.61	23.0	11.0	34.0
12.11.25	208.65	23.0	11.0	34.0
19.11.25	210.33	23.0	11.0	34.0
26.11.25	208.15	22.0	11.0	33.0
3.12.25	200.45	22.0	11.0	33.0
10.12.25	191.92	20.0	11.0	31.0
17.12.25	181.13	20.0	11.0	31.0
24.12.25	164.26	18.0	11.0	29.0
31.12.25	161.33	17.0	11.0	28.0
7.1.26	158.03	17.0	11.0	28.0
14.1.26	160.99	17.0	11.0	28.0
21.1.26	174.04	17.0	11.0	28.0
28.1.26	184.64	19.0	11.0	30.0
4.2.26	191.47	19.0	11.0	30.0
11.2.26	191.76	19.0	11.0	30.0
18.2.26	194.37	19.0	11.0	30.0
25.2.26	196.64	19.0	11.0	30.0
4.3.26	195.55	19.0	11.0	30.0
11.3.26	185.90	19.0	11.0	30.0
18.3.26	184.02	19.0	11.0	30.0
25.3.26	180.25	17.0	11.0	28.0
1.4.26	180.18	17.0	11.0	28.0
8.4.26	169.70	17.0	11.0	28.0
15.4.26	163.35	15.0	11.0	26.0
22.4.26	163.01	15.0	11.0	26.0
29.4.26	164.64	15.0	11.0	26.0

APPENDIX IV—*contd.*  
BUSINESS YEAR, 1926-1927.

Date	Butter Price	Farm Price	Margin	Shop Price
6.5.26 .. .. .	164-95	15-0	11-0	26-0
13.5.26 .. .. .	164-62	15-0	11-0	26-0
20.5.26 .. .. .	160-07	15-0	11-0	26-0
27.5.26 .. .. .	153-85	15-0	11-0	26-0
3.6.26 .. .. .	150-63	15-0	11-0	26-0
10.6.26 .. .. .	155-81	15-0	11-0	26-0
17.6.26 .. .. .	161-06	15-0	11-0	26-0
24.6.26 .. .. .	161-20	15-0	11-0	26-0
1.7.26 .. .. .	161-37	15-0	11-0	26-0
8.7.26 .. .. .	162-28	15-0	11-0	26-0
15.7.26 .. .. .	161-72	17-0	11-0	28-0
22.7.26 .. .. .	165-27	17-0	11-0	28-0
29.7.26 .. .. .	175-36	17-0	11-0	28-0
5.8.26 .. .. .	177-54	19-0	11-0	30-0
12.8.26 .. .. .	177-87	19-0	11-0	30-0
19.8.26 .. .. .	172-52	19-0	11-0	30-0
26.8.26 .. .. .	167-09	17-0	11-0	28-0
2.9.26 .. .. .	168-33	17-0	11-0	28-0
9.9.26 .. .. .	169-18	19-0	11-0	30-0
16.9.26 .. .. .	175-25	19-0	11-0	30-0
23.9.26 .. .. .	179-96	19-0	11-0	30-0
30.9.26 .. .. .	180-38	19-0	11-0	30-0
7.10.26 .. .. .	180-98	19-0	11-0	30-0
14.10.26 .. .. .	178-62	19-0	11-0	30-0
21.10.26 .. .. .	179-17	19-0	11-0	30-0
28.10.26 .. .. .	180-80	19-0	11-0	30-0
4.11.26 .. .. .	181-81	21-0	11-0	32-0
11.11.26 .. .. .	180-71	21-0	11-0	32-0
18.11.26 .. .. .	178-27	21-0	11-0	32-0
25.11.26 .. .. .	175-11	19-0	11-0	30-0
2.12.26 .. .. .	176-38	19-0	11-0	30-0
9.12.26 .. .. .	190-65	21-0	11-0	32-0
16.12.26 .. .. .	189-71	21-0	11-0	32-0
23.12.26 .. .. .	186-78	21-0	11-0	32-0
30.12.26 .. .. .	186-19	21-0	11-0	32-0
6.1.27 .. .. .	178-59	19-0	11-0	30-0
13.1.27 .. .. .	175-44	19-0	11-0	30-0
20.1.27 .. .. .	175-97	19-0	11-0	30-0
27.1.27 .. .. .	176-58	19-0	11-0	30-0

APPENDIX IV—*contd.*  
BUSINESS YEAR, 1926-1927.

Date	Butter Price	Farm Price	Margin	Shop Price
3.2.27 .. .. .	185·71	19·0	11·0	30·0
10.2.27 .. .. .	186·76	21·0	11·0	32·0
17.2.27 .. .. .	191·92	21·0	11·0	32·0
24.2.27 .. .. .	192·52	21·0	11·0	32·0
3.3.27 .. .. .	188·72	19·0	11·0	30·0
10.3.27 .. .. .	178·21	19·0	11·0	30·0
17.3.27 .. .. .	176·19	17·0	11·0	28·0
24.3.27 .. .. .	170·28	17·0	11·0	28·0
31.3.27 .. .. .	170·53	17·0	11·0	28·0
7.4.27 .. .. .	176·96	17·0	11·0	28·0
14.4.27 .. .. .	177·96	17·0	11·0	28·0
21.4.27 .. .. .	170·98	15·0	11·0	26·0
28.4.27 .. .. .	161·21	15·0	11·0	26·0

BUSINESS YEAR, 1927-1928.

Date	Butter Price	Farm Price	Margin	Shop Price
5.5.27 .. .. .	154·78	15·0	11·0	26·0
12.5.27 .. .. .	155·11	15·0	11·0	26·0
19.5.27 .. .. .	155·14	15·0	11·0	26·0
26.5.27 .. .. .	154·31	15·0	11·0	26·0
2.6.27 .. .. .	154·32	15·0	11·0	26·0
9.6.27 .. .. .	154·93	15·0	11·0	26·0
16.6.27 .. .. .	153·13	15·0	11·0	26·0
23.6.27 .. .. .	153·51	15·0	11·0	26·0
30.6.27 .. .. .	153·85	15·0	11·0	26·0
7.7.27 .. .. .	154·97	15·0	11·0	26·0
14.7.27 .. .. .	154·85	15·0	11·0	26·0
21.7.27 .. .. .	154·98	15·0	11·0	26·0
28.7.27 .. .. .	156·43	17·0	11·0	28·0
4.8.27 .. .. .	160·96	17·0	11·0	28·0

APPENDIX IV—*contd.*

BUSINESS YEAR, 1927-1928.

Date	Butter Price	Farm Price	Margin	Shop Price
11.8.27 .. .. .	175.55	19.0	11.0	30.0
18.8.27 .. .. .	175.45	19.0	11.0	30.0
25.8.27 .. .. .	174.18	19.0	11.0	30.0
1.9.27 .. .. .	178.57	19.0	11.0	30.0
8.9.27 .. .. .	187.50	19.0	11.0	30.0
15.9.27 .. .. .	189.87	19.0	11.0	30.0
22.9.27 .. .. .	198.85	21.0	11.0	32.0
29.9.27 .. .. .	199.84	21.0	11.0	32.0
6.10.27 .. .. .	199.15	21.0	11.0	32.0
13.10.27 .. .. .	197.12	21.0	11.0	32.0
20.10.27 .. .. .	197.21	21.0	11.0	32.0
27.10.27 .. .. .	190.24	21.0	11.0	32.0
3.11.27 .. .. .	192.60	21.0	11.0	32.0
10.11.27 .. .. .	194.54	21.0	11.0	32.0
17.11.27 .. .. .	205.17	23.0	11.0	34.0
24.11.27 .. .. .	206.82	23.0	11.0	34.0
1.12.27 .. .. .	196.85	21.0	11.0	32.0
8.12.27 .. .. .	196.77	21.0	11.0	32.0
15.12.27 .. .. .	185.25	21.0	11.0	32.0
22.12.27 .. .. .	196.09	21.0	11.0	32.0
29.12.27 .. .. .	179.50	19.0	12.0	31.0
5.1.28 .. .. .	176.50	19.0	12.0	31.0
12.1.28 .. .. .	171.00	19.0	12.0	31.0
19.1.28 .. .. .	171.63	19.0	12.0	31.0
26.1.28 .. .. .	173.68	19.0	12.0	31.0
2.2.28 .. .. .	180.28	19.0	12.0	31.0
9.2.28 .. .. .	185.48	19.0	12.0	31.0
16.2.28 .. .. .	186.10	19.0	12.0	31.0
23.2.28 .. .. .	188.57	19.0	12.0	31.0
1.3.28 .. .. .	192.80	20.0	11.0	31.0
8.3.28 .. .. .	202.48	20.0	11.0	31.0
15.3.28 .. .. .	191.42	20.0	11.0	31.0
22.3.28 .. .. .	191.08	20.0	11.0	31.0
29.3.28 .. .. .	191.50	19.0	11.0	30.0
5.4.28 .. .. .	185.53	19.0	11.0	30.0
12.4.28 .. .. .	179.04	17.0	11.0	28.0
19.4.28 .. .. .	174.78	17.0	11.0	28.0
26.4.28 .. .. .	175.72	17.0	11.0	28.0

APPENDIX IV—*contd.*  
BUSINESS YEAR, 1928-1929.

Date	Butter Price	Farm Price	Margin	Shop Price
3.5.28 .. .. .	176-10	17-0	11-0	28-0
10.5.28 .. .. .	176-30	17-0	11-0	28-0
17.5.28 .. .. .	176-34	15-0	11-0	26-0
24.5.28 .. .. .	168-64	15-0	11-0	26-0
31.5.28 .. .. .	164-75	15-0	11-0	26-0
7.6.28 .. .. .	163-33	16-0	11-0	27-0
14.6.28 .. .. .	163-62	16-0	11-0	27-0
21.6.28 .. .. .	163-84	16-0	11-0	27-0
28.6.28 .. .. .	164-51	17-0	11-0	28-0
5.7.28 .. .. .	165-15	17-0	11-0	28-0
12.7.28 .. .. .	168-06	18-0	11-0	29-0
19.7.28 .. .. .	178-40	19-0	11-0	30-0
26.7.28 .. .. .	178-65	19-0	11-0	30-0
2.8.28 .. .. .	177-12	19-0	11-0	30-0
9.8.28 .. .. .	178-65	19-0	11-0	30-0
16.8.28 .. .. .	180-65	19-0	11-0	30-0
23.8.28 .. .. .	183-82	19-0	11-0	30-0
30.8.28 .. .. .	182-25	19-0	11-0	30-0
6.9.28 .. .. .	184-59	20-0	11-0	31-0
13.9.28 .. .. .	191-33	21-0	11-0	32-0
20.9.28 .. .. .	192-49	21-0	11-0	32-0
27.9.28 .. .. .	194-67	21-0	11-0	32-0
4.10.28 .. .. .	195-18	21-0	11-0	32-0
11.10.28 .. .. .	195-71	21-0	11-0	32-0
18.10.28 .. .. .	191-51	21-0	11-0	32-0
25.10.28 .. .. .	192-07	21-0	11-0	32-0
1.11.28 .. .. .	200-19	22-0	12-0	34-0
8.11.28 .. .. .	196-80	22-0	12-0	34-0
15.11.28 .. .. .	200-40	22-0	12-0	34-0
22.11.28 .. .. .	201-79	22-0	12-0	34-0
29.11.28 .. .. .	196-05	22-0	12-0	34-0
6.12.28 .. .. .	196-11	22-0	12-0	34-0
13.12.28 .. .. .	204-20	22-0	12-0	34-0
20.12.28 .. .. .	211-81	22-0	12-0	34-0
27.12.28 .. .. .	199-19	20-0	12-0	32-0
3.1.29 .. .. .	188-74	20-0	12-0	32-0
10.1.29 .. .. .	188-34	20-0	12-0	32-0



APPENDIX IV—*contd.*

BUSINESS YEAR, 1928-1929.

Date	Butter Price	Farm Price	Margin	Shop Price
17.1.29 .. .. .	188-28	20-0	12-0	32-0
24.1.29 .. .. .	188-20	20-0	12-0	32-0
31.1.29 .. .. .	188-31	20-0	12-0	32-0
7.2.29 .. .. .	189-56	20-0	12-0	32-0
14.2.29 .. .. .	190-31	20-0	12-0	32-0
21.2.29 .. .. .	190-39	20-0	12-0	32-0
28.2.29 .. .. .	184-85	20-0	12-0	32-0
7.3.29 .. .. .	183-11	18-0	12-0	30-0
14.3.29 .. .. .	182-20	18-0	12-0	30-0
21.3.29 .. .. .	168-30	16-0	12-0	28-0
28.3.29 .. .. .	158-15	14-0	12-0	26-0
4.4.29 .. .. .	153-44	14-0	12-0	26-0
11.4.29 .. .. .	153-63	14-0	12-0	26-0
18.4.29 .. .. .	155-50	17-0	12-0	29-0
25.4.29 .. .. .	155-50	17-0	12-0	29-0

APPENDIX V.  
MILK PRICES IN CERTAIN DANISH TOWNS.  
*Ores per litre.*

	Copenhagen		Aarhus		Odensee	
	Retail Domicile	Farm	Retail	Farm	Retail	Farm
1926 Mar. .. ..	41·0	19·0	28·0	18·0	30·0	16·0
"   June .. ..	37·0	17·0	27·0	16·0	27·0	15·0
"   Sept. .. ..	38·0	17·0	27·0	16·0	27·0	15·0
"   Dec. .. ..	37·0	18·0	28·0	18·0	28·0	17·0
1927 Mar. .. ..	37·0	18·0	27·0	16·0	28·0	17·0
"   June .. ..	34·0	16·0	26·0	16·0	28·0	15·0
"   Sept. .. ..	34·0	17·0	28·0	17·0	30·0	16·0
"   Dec. .. ..	36·0	18·0	28·0	18·0	30·0	17·0
1928 Mar. .. ..	36·0	17·0	28·0	17·0	29·0	17·0
"   June .. ..	34·0	17·0	28·0	17·0	28·0	16·0
"   Sept. .. ..	35·3	17·8	28·0	17·7	29·6	17·4
"   Dec. .. ..	35·8	18·6	28·0	18·0	30·3	18·1
1929 Mar. .. ..	37·2	18·0	28·0	17·3	30·0	16·8
"   June .. ..	36·0	15·9	26·5	15·5	27·0	14·9
"   Sept. .. ..	36·5	17·2	27·5	17·1	29·3	16·8

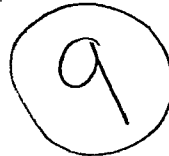
Prices are given by the Danish Agricultural Council.

DANISH MILK PRICES AS REPORTED BY THE SWISS FARMERS' UNION.  
*Ores per litre.*

	Retail Price	Wholesale	Milk for Cheese	Butter	Condensing
1925 Dec. .. ..	37·0	19·7	15·5	14·0	16·0
1926 Mar. .. ..	34·7	18·1	13·7	13·5	15·0
"   June .. ..	33·0	16·2	12·0	12·0	14·5
"   Sept. .. ..	37·0	18·5	12·7	12·7	—
"   Dec. .. ..	34·5	18·2	14·0	14·5	17·0
1927 Mar. .. ..	32·7	17·3	13·5	13·0	15·5
"   June .. ..	31·5	16·2	12·7	12·7	14·2
"   Sept. .. ..	36·0	18·5	13·7	13·7	—
"   Dec. .. ..	31·0	18·0	14·5	14·5	15·0
1928 Mar. .. ..	36·0	17·0	13·5	13·5	16·0
"   June .. ..	34·0	17·0	13·0	13·0	14·5
"   Sept. .. ..	31·6	17·6	14·0	14·0	16·5
"   Dec. .. ..	32·4	18·3	14·4	14·4	—
1929 Mar. .. ..	32·6	17·4	13·7	13·7	15·5
"   June .. ..	29·8	15·4	12·0	12·0	14·5
"   Sept. .. ..	31·1	17·0	14·3	14·3	16·0

E.M.B. 52.

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# DAIRY PRODUCE SUPPLIES IN 1931

PREPARED IN THE STATISTICS  
AND INTELLIGENCE BRANCH OF  
THE EMPIRE MARKETING BOARD



JUNE, 1932

LONDON:

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE  
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses:  
Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh;  
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff;  
15, Donegall Square West, Belfast;  
or through any Bookseller.

1932

Price 1s. *od.* Net.

88-501-52.

X9(λ311:7):732.3.N3

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## FOREWORD.

THE Market Intelligence Services for various agricultural products, which have been conducted by the Empire Marketing Board during the past few years, include, in addition to current information as to supplies available or immediately in prospect, brief annual reviews of the supply position in the United Kingdom for each of the products with which the respective services are concerned. In 1931, in response to a number of requests from readers of the Weekly Fruit Intelligence Notes, some of the more important special articles which had appeared during the previous year were reprinted in one volume, "Fruit Supplies in 1930". The welcome accorded to this volume both by producers and by fruit merchants throughout the Empire, and the number of applications received by the Board in recent months for copies of the issues of Weekly Dairy Produce Notes in which reviews of the trade in the various kinds of dairy produce in the year 1931 have appeared, are evidence that a volume setting out in their correct perspective the import and other statistics relating to dairy produce and pig products for the year 1931 is likely to prove of interest and value to Empire producers and traders. In addition to the comprehensive figures given for the United Kingdom, certain of the more important statistics of the external trade in dairy produce of other countries have also been included.

Although figures of world production of dairy products are lacking, the importance of the milk and dairy industry in the world needs no emphasis. Just as agriculture is, in almost every country in the world, the largest single industry, so it will generally be found that in most countries, at any rate in temperate climates, dairying, including pig breeding, is the chief source of revenue of the agricultural community.

Most of the statistics given in this volume have already appeared in the Dairy Produce Notes, but here they have been brought together for convenience of reference. The trade figures for 1931 are in all cases provisional and subject to revision, but the amendments made when the Annual Statement of Trade of the United Kingdom is issued (generally towards the end of the year) are not, as a rule, important. Where such alterations have been made in the aggregate figures for earlier years, they have been carried into effect in the December totals of the monthly figures, but these alterations are of little significance.

## DAIRY PRODUCE SUPPLIES IN 1931.

### INTRODUCTORY.

The United Kingdom is the world's largest importer of dairy products and the volume of these commodities imported annually comprises a significant proportion of the country's total import trade. Including pig products (and in most of the principal countries now shipping pig products to the United Kingdom, pig rearing is intimately related to the dairying industry), eggs and poultry products, the value of these imports averages fully 30 per cent. of the total imports of food, drink and tobacco. Butter imports alone have been greater in value than those of any other food commodity in the past two years, and in 1931 the declared value of imports of bacon was greater than that of wheat.

TABLE I.—*Imports by Quantity of Dairy Produce, Poultry and Pig Products into the United Kingdom.*

Commodity.	Average.		1927.	1928.	1929.	1930.	1931.
	1911-13.	1924-26.					
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Butter .. ..	4,149	5,653	5,819	6,113	6,397	6,822	8,071
Cheese .. ..	2,318	3,000	2,949	3,005	2,994	3,112	2,885
Milk, Fresh ..	6	55	84	100	56	49	83
Cream .. ..	9	80	125	148	139	136	179
Condensed Milk	1,210	2,283	2,520	2,673	2,651	2,602	2,801
Milk Powder (a)	46	152	165	234	284	267	366
	000	000	000	000	000	000	000
	gt. hds.	gt. hds.	gt. hds.	gt. hds.	gt. hds.	gt. hds.	gt. hds.
Eggs .. ..	19,908	21,423	24,340	26,466	24,964	26,541	25,920
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Egg Products ..	(b)	621	678	683	782	851	802
Poultry (dead) ..	(c) 262	360	506	490	554	570	667
Bacon .. ..	4,787	7,610	8,482	8,853	8,278	9,191	11,138
Hams .. ..	803	1,449	889	942	1,029	1,003	831
Pork, Fresh ..	391	819	317	388	296	289	383
Pork, Frozen and	259	268	234	289	359	437	432
Salted.							
Lard .. ..	1,627	831	2,397	2,447	2,621	2,505	2,549

(a) Including preserved milk, other kinds.  
(c) Average for 1912 and 1913 only.

(b) Not available.

TABLE II.—Imports by Value of Dairy Produce, Poultry and Pig Products into the United Kingdom.

Commodity.	Average.		1927.	1928.	1929.	1930.	1931.
	1911-13 (a)	1924-26.					
	000£.	000£.	000£.	000£.	000£.	000£.	000£.
Butter .. ..	24,346	50,378	48,205	52,045	54,706	46,870	46,358
Cheese .. ..	7,196	14,397	13,494	14,997	13,913	12,603	9,060
Milk, Fresh ..	3	32	36	59	36	31	54
Cream .. ..	35	431	667	796	702	629	748
Condensed Milk	2,140	5,223	5,040	5,250	4,786	4,315	4,337
Milk Powder (b)	87	564	522	729	823	718	757
Eggs .. ..	8,651	15,810	15,914	17,766	17,856	16,378	13,768
Egg Products ..	(c)	3,348	3,338	3,252	3,621	3,408	2,884
Poultry (dead) ..	(d) 881	2,070	2,757	2,688	2,960	2,881	3,131
Bacon .. ..	15,483	40,770	38,679	40,348	43,742	41,152	33,136
Hams .. ..	2,905	7,891	4,654	4,609	5,473	4,960	3,217
Pork, Fresh ..	1,044	4,042	1,348	1,550	1,298	1,242	1,259
Pork, Frozen and Salted.	349	1,161	912	1,014	1,306	1,642	1,282
Lard .. ..	4,142	8,939	7,585	7,505	7,807	6,853	5,911

(a) Figures for 1911-13 include imports into all Ireland from foreign countries and exclude imports into Great Britain and Northern Ireland from the Irish Free State.

(b) Including preserved milk, other kinds.

(c) Not available.

(d) Average for 1912-13 only.

Tables I and II above show, by quantity and value respectively, the total imports of each of the principal dairy, pig and poultry products during the five years 1927 to 1931, compared with the averages for 1911-13 and 1924-26. The figures for the 1911-13 period include imports into what is now the Irish Free State and exclude imports into Great Britain and Northern Ireland from the Irish Free State, and are therefore not strictly comparable with the later years.

Generally speaking, the trend in volume of these imports, although occasionally obscured by cyclical movements, has been upward, and in 1931, new records were established for butter, bacon, poultry, cream and certain types of preserved milk. The general fall in commodity prices, however, which has been a marked feature of the past two years, resulted in aggregate values, in spite of the heavier imports, being appreciably less than in 1930.



### IMPORTS OF FRESH MILK.

Compared with home production, imports of fresh milk into the United Kingdom are insignificant.

In the five years, 1909 to 1913, imports, mainly from France, aggregated slightly over 20,000 cwts., more than half of which was entered in 1911. Small but fluctuating quantities were received in the immediate post-war years, the highest figure of 17,766 cwts. occurring in 1921. Until April 1923 imports, of course, excluded any quantities brought into Great Britain and Northern Ireland from Southern Ireland, but following the inclusion of quantities from the Irish Free State, imports of fresh milk increased to a peak of nearly 100,000 cwts., or well over a million gallons, in 1928. Considerably reduced quantities were imported in the two following years, but an increase again occurred in 1931, when imports totalled 83,110 cwts. (approximately 930,000 gallons) and exceeded the 1930 figure by nearly 69 per cent.

The bulk of the imports of fresh milk represents traffic across the land boundary from the Irish Free State, and this movement accounted for fully 90 per cent. of imports from the Irish Free State in the five years, 1926 to 1930. Imports from foreign countries, apart from relatively large increases in 1927 and 1928, have been practically negligible in recent years and were entirely absent in 1929 and 1930. In 1931, however, the total from these sources reached 13,457 cwts. (all registered in the two months, November and December), and was the largest since 1921.

Total imports of fresh milk from 1926 to 1931 were as follows :—

TABLE I.—*Imports of Fresh Milk, 1926-31.*

Year.	From the Irish Free State.	From Foreign Countries.	Total.
	cwts.	cwts.	cwts.
1926 .. ..	73,415	184	73,599
1927 .. ..	80,985	2,859	83,844
1928 .. ..	90,140	9,623	99,763
1929 .. ..	56,054	—	56,054
1930 .. ..	49,259	—	49,259
1931 .. ..	69,653	13,457	83,110

Towards the end of 1931, there was a slight temporary shortage of home-produced milk, which resulted for a few weeks in the importation of milk from Continental countries into Great Britain, and a heavier movement from the Irish Free State. Prior to this the imports showed little variation from the previous year's level and probably consisted chiefly of cross-border traffic.

Table II shows the monthly imports of fresh milk into the United Kingdom throughout 1931 and the countries from which they were consigned, with comparative figures for 1930.

TABLE II.—*Monthly Imports of Fresh Milk into the United Kingdom.*

Month.	1931.						1930.
	Irish Free State.	Foreign Countries.				Total.	
		Denmark.	Netherlands.	France.	Norway.		
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. ..	4,731	—	—	—	—	4,731	3,964
February .. ..	2,514	—	—	—	—	2,514	2,922
March .. ..	3,254	—	—	—	—	3,254	3,553
April .. ..	2,395	—	—	—	—	2,395	3,392
May .. ..	3,649	—	—	—	—	3,649	3,443
June .. ..	3,143	—	—	—	—	3,143	3,843
July .. ..	5,863	—	—	—	—	5,863	4,451
August .. ..	4,935	—	—	—	—	4,935	3,659
September .. ..	3,330	—	—	—	—	3,330	4,998
October .. ..	4,589	—	—	—	—	4,589	7,753
November .. ..	14,572	415	2,765	—	—	17,752	3,536
December .. ..	16,678	1,285	6,179	1,831	982	26,955	3,690
Total .. ..	69,653	1,700	8,944	1,831	982	83,110	49,259

#### IMPORTS OF CREAM.

The output of cream in Great Britain, including sales off farms and by creameries, etc., but excluding quantities consumed in farm households, amounted in 1924-25 to rather over 3,000,000 gallons. No later figures are available. Imports of cream increased from comparatively small proportions to a peak in 1928. Importation was on a smaller scale in the two following years, but the 1931 figure was the largest ever recorded, the total of 179,235 cwts. exceeding the 1930 figure by 32 per cent.

The Irish Free State is the chief source of imported cream on the United Kingdom market. Imports from that country have declined appreciably since 1927, but the quantity imported in 1931 was 18 per cent. greater than in 1930. Imports across the land boundary averaged about 14 per cent. of total supplies from the Irish Free State in the five years 1926 to 1930, but accounted for only 9 per cent. in 1931.

Imports of cream from foreign countries have increased rapidly in the past decade and account for the increase in total imports of this commodity. There is little doubt that this movement largely represents the development of the tinned cream trade, although no distinction between fresh and tinned cream is made in the returns. Denmark has become the chief foreign supplying country, sending over 65,000 cwts. in 1931, or 40 per cent. more than in 1930. Imports from the Netherlands, which were slightly reduced in 1930, totalled 28,000 cwts. in 1931, or more than twice as much as in the previous year. Imports of cream from Switzerland have declined from the peak of 7,000 cwts. in 1929 and totalled only 4,250 cwts. in the year under review. Supplies from other countries are relatively unimportant, but, in the aggregate, accounted for rather larger quantities in 1931 than in 1930.

Imports of cream from foreign countries exceeded those from the Irish Free State for the first time in 1930. In 1931 foreign sources of supply improved their position and accounted for over 55 per cent. of total imports of cream.

Exports of imported cream are comparatively negligible, although the quantity re-exported in 1931, totalling 3,294 cwts., was above the level of recent years.

Table I gives details of the imports of cream in 1924, and in the five years 1927 to 1931.

Imports of cream are at their maximum during the summer months and lightest in winter. Throughout 1931 imports were on a higher level than in 1930, the quantity imported in the first half of the year showing an increase of 12 per cent. In the second six months, however, the increase amounted to 54 per cent. and was especially pronounced in November, when home production was particularly light and the importation of some foreign fresh cream occurred. As in recent years July was the month of heaviest importation, while the smallest quantity was imported in February; in 1930 imports were at their lightest in January.

TABLE I.—Imports of Cream into the United Kingdom.

Country whence consigned.	1924.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
Irish Free State .. ..	48,487	91,253	87,716	76,586	67,119	79,059
Other Empire Countries	—	35	63	64	36	10
Denmark .. .. .	3,852	18,496	34,611	39,484	46,993	65,728
Netherlands .. .. .	4,512	8,578	15,678	14,324	13,470	28,044
Switzerland .. .. .	4	4,601	5,889	7,030	6,850	4,254
Norway .. .. .	1,552	668	1,842	620	566	894
Germany .. .. .	(a)	(a)	1,193	434	679	759
Other Foreign Countries	9	1,180	1,300	62	243	487
Total Empire Countries ..	48,487	91,288	87,779	76,650	67,155	79,069
Total Foreign Countries ..	9,929	33,523	60,513	61,954	68,801	100,166
Total All Countries .. ..	58,416	124,811	148,292	138,604	135,956	179,235
Re-exports .. .. .	818	584	1,008	810	1,334	3,294
Net Imports .. .. .	57,598	124,227	147,284	137,794	134,622	175,941

(a) Included in " Other Foreign Countries ".

Table II gives the monthly imports of cream into the United Kingdom during the past four years, excluding imports from the Irish Free State across the land boundary.

TABLE II.—Monthly Imports of Cream into the United Kingdom. (a)

Month.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	9·8	6·8	6·7	7·6
February .. .. .	10·0	7·2	6·9	7·0
March .. .. .	12·9	6·0	7·7	8·7
April .. .. .	11·1	10·2	9·8	11·8
May .. .. .	11·6	11·7	14·2	15·9
June .. .. .	13·8	10·2	15·5	17·3
July .. .. .	16·4	19·3	17·5	24·8
August .. .. .	16·4	14·7	12·5	19·3
September .. .. .	9·9	10·9	9·5	12·2
October .. .. .	9·7	11·0	9·9	12·7
November .. .. .	8·1	7·3	7·5	20·0
December .. .. .	6·5	14·1	10·5	14·8
Total .. .. .	136·2	129·4	128·2	172·1

(a) Excluding imports from the Irish Free State across the land boundary.

Table III shows the monthly imports of cream from each of the principal sources in 1931, imports across the land boundary being again excluded.

TABLE III.—*Monthly Imports of Cream into the United Kingdom during 1931.*

Month.	Irish Free State. (a)	Denmark.	Netherlands.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	3·8	2·0	1·8	0·0	7·6
February .. .. .	3·1	2·5	1·3	0·1	7·0
March .. .. .	2·8	4·0	1·5	0·4	8·7
April .. .. .	4·2	4·9	1·9	0·8	11·8
May .. .. .	4·3	8·8	1·7	1·1	15·9
June .. .. .	7·5	6·2	3·3	0·8	17·3
July .. .. .	11·4	10·1	3·0	0·3	24·8
August .. .. .	6·4	9·0	3·5	0·4	19·3
September .. .. .	4·8	4·9	1·9	0·6	12·2
October .. .. .	5·8	3·7	2·6	0·6	12·7
November .. .. .	8·4	5·7	4·9	1·0	20·0
December .. .. .	9·4	3·9	0·6	0·8	14·8
Total .. .. .	71·9	65·7	28·0	6·4	172·1

(a) Excluding imports across the land boundary.

## THE BUTTER MARKET IN 1931.

### SUPPLIES.

The ever-increasing volume of butter entering world trade in post-war years is reflected in the remarkable increase in supplies to the United Kingdom, by far the most important market. Each year since 1928 has seen a new record established, and the total quantity of butter imported in 1931 amounted to 8,071,167 cwts., or 18 per cent. greater than in 1930; 53 per cent. above the figure for 1924; and nearly double the average for the five years 1909-13. Exports of imported butter also increased (by over 100 per cent. in comparison with 1930), but yet accounted for less than 5 per cent. of total imports, and retained imports still show an increase of 16 per cent. compared with 1930.

No estimate of the quantity of butter produced in the United Kingdom is available later than 1924, but if the figure of 850,000 cwts. calculated at that time be taken as approximately unchanged, and consumption of imported butter at 7,300 tons per week (see page 29), the *per capita* consumption of home and imported butter in 1931 was roughly 20·6 lb., as compared with an average of 15·6 lb. in the four years 1924 to 1927.

Several features of special significance characterised the butter market in 1931. The more important of these may be briefly summarised as follows:—(1) a favourable season in New Zealand and, more especially, in Australia and, aided by exchange differences, a consequent large increase in imports from these sources; (2) the expansion of exports from Russia compared with the low level ruling in the past few years; (3) the reappearance of Canada, from May onwards, as an exporter on a moderate scale; (4) the difficult economic conditions in Germany causing a marked reduction in imports into that country and the consequent diversion of supplies to other countries, particularly the United Kingdom; (5) a further significant increase in imports into certain European countries, especially France, Belgium and Switzerland, and the attempt to limit these imports by the imposition of increased duties and other restrictions, notably in the case of France; these measures have since been extended and their full effect upon production and upon United Kingdom supplies has probably not yet been felt; (6) the large and regular movement of butter into consumptive channels in this country, so that, in spite of heavy imports, cold storage stocks were kept well below the 1930 level until towards the end of the year.

*Sources of Supply.*—Details of the countries of consignment of the imports during 1931 show that record quantities were received from each of the three principal sources. Denmark, with an increase of 6 per cent. over 1930, maintained its position of chief supplier, although accounting for only 31 per cent. of total imports as compared with 34 per cent. in the preceding year. Imports from New Zealand, amounting to little short of 2 million cwts., were 24 per cent. greater than in 1930, and compare with only 250,000 cwts. in 1913. The quantity recorded from Australia totalled 1,500,000 cwts., or no less than 64 per cent. above the 1930 figure and 2½ times the 1913 figure. New Zealand and Australia accounted for 24 per cent. and 19 per cent. respectively of total supplies in 1931, as compared with 23 per cent. and 14 per cent. in 1930.

Russia, which increased its supplies by two-and-a-half times, jumped from eighth to fourth place, although the volume of imports from that country was still well below the pre-war level. Supplies from the Irish Free State, which declined in 1930, showed a further decrease of 27 per cent. during the past year, and were the smallest since separate returns have been available. Imports from Argentina had recovered in 1930 from their decreasing tendency, but were reduced by nearly 10 per cent. in 1931. Among European supplying countries, imports from Finland and Estonia were on a larger scale than in 1930, but Swedish, Polish and Latvian supplies were reduced. Other features of interest were a further increase in imports from Lithuania and a relatively large advance in the small quantity imported from Norway.

Imports from Canada, which have been negligible since 1926 amounted to over 78,000 cwts. in 1931, while shipments from South Africa registered a further increase.

In spite of the smaller imports from the Irish Free State, supplies of butter from Empire countries increased by no less than 30 per cent. over 1930. Empire butter comprised almost 50 per cent. of the total imports as against 45 per cent. in 1930. Never in any previous year have Empire countries accounted for so large a proportion of the United Kingdom's butter imports.

Table I gives details of the imports of butter in 1913, and the five years 1927 to 1931.

In this and subsequent tables of a similar type the particulars refer to the country from which the goods were consigned (i.e. the place from which they were procured by the importer), and not necessarily to the country of origin. From an inquiry conducted by the Board of Trade during 1931, it is apparent that, in the case of butter, the country whence consigned is nearly always also the country of origin; in only a few instances were significant differences obtained. Thus, the quantity shown as consigned from Sweden amounted to 211,733 cwts., although Sweden was given as the country of origin for 228,458 cwts. As the quantity consigned from Denmark exceeded that returned as of Danish origin by 17,488 cwts., it is probable that the Danish total included certain quantities of Swedish butter imported into Denmark and subsequently exported to the United Kingdom. Butter consigned from Germany totalled 7,947 cwts., but only 3,957 cwts. were of German origin. The difference was probably due in part to the larger figure including some butter of Russian origin.

TABLE I.—Imports of Butter into the United Kingdom.

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
New Zealand .. .. .	252	1,252	1,222	1,304	1,564	1,935
Australia .. .. .	594	489	873	768	951	1,559
Irish Free State .. ..	(a)	587	559	566	522	381
Canada .. .. .	1	—	2	—	—	78
Union of South Africa and South West Africa Terri- tory. . . . .	—	—	—	12	26	40
Kenya .. .. .	(b)	(b)	(b)	1	6	6
Other Empire Countries ..	1	1	1	1	1	1
Denmark .. .. .	1,707	1,995	2,016	2,204	2,319	2,466
Russia .. .. .	751	351	336	290	165	404
Finland .. .. .	(c)	205	199	234	234	254
Sweden .. .. .	332	166	176	248	280	212
Estonia .. .. .	(c)	60	78	110	96	125
Netherlands .. .. .	153	170	129	130	89	96
Latvia .. .. .	(c)	38	50	81	49	39
Lithuania .. .. .	(c)	1	1	13	21	40
Poland .. .. .	(d)	15	29	69	65	33
Norway .. .. .	20	—	—	6	2	13
Germany .. .. .	—	1	3	10	8	8
France .. .. .	249	66	70	45	7	1
Argentina .. .. .	73	420	366	303	414	375
United States of America	—	1	2	—	—	1
Other Foreign Countries ..	6	1	1	2	3	4
Total Empire Countries ..	848	2,329	2,657	2,652	3,070	4,000
Total Foreign Countries ..	3,291	3,490	3,456	3,745	3,752	4,071
Total All Countries ..	4,139	5,819	6,113	6,397	6,822	8,071

(a) Not separately distinguished before April, 1923.

(b) Included in "Other Empire Countries."

(c) Included in Russia.

(d) Included in Russia, Germany and Austria-Hungary.

*Seasonal Variation.*—Arrivals throughout 1931, except in March, were maintained at a higher rate than in the previous year. In the first few months greatly increased quantities from Australia and New Zealand more than balanced the decline in supplies from the Continent, imports from Sweden and the Baltic countries being



particularly reduced. Imports from the Southern Dominions continued on a large scale and in the six months to the end of June, when total imports from all sources were 10 per cent. greater than a year earlier, the quantity from the Southern Hemisphere showed an increase of 28 per cent., while supplies from the Continent were on the whole less than in the first half of 1930. These then commenced to show a rapid increase, partly seasonal and partly due to financial difficulties in Germany causing a reduction in the quantity taken by that country, and supplies in July exceeded 800,000 cwts., a record level for any month. During the latter half of the year, imports both from Europe and from the Southern Hemisphere remained considerably greater than in 1930, although in the final month European supplies on the aggregate were below the previous year's level.

The month of heaviest supply was July, or one month later than in 1930 and two months later than in 1929. The period of smallest imports, which in 1930 was in November, occurred during March in the year under review.

Table II shows the monthly imports of butter in 1913 and the seven years 1925 to 1931.

TABLE II.—*Monthly Imports of Butter into the United Kingdom.*

Month.	1913.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January ..	365	541	673	476	527	602	643	675
February ..	350	620	431	371	583	483	524	597
March ..	303	490	468	549	624	606	567	563
April ..	371	626	536	427	462	605	584	671
May ..	326	540	468	554	478	636	604	723
June ..	364	575	528	680	632	611	687	757
July ..	462	466	562	611	606	603	541	808
August ..	335	423	465	465	585	527	542	658
September ..	328	396	429	463	327	372	497	597
October ..	270	322	412	383	413	375	515	641
November ..	307	362	397	401	442	448	463	597
December ..	358	492	450	439	434	529	655	784
Total ..	4,139	5,853	5,819	5,819	6,113	6,397	6,822	8,071

Table III, which shows the monthly imports of butter from the chief sources in 1931, indicates the complementary nature of Southern and Northern Hemisphere supplies. Imports from Denmark, however,

show comparatively little variation and regulated shipments have done much to even the flow of butter from New Zealand. The greatest seasonal variation occurs in imports from the Irish Free State and Eastern Europe, and the peak of these supplies, coinciding with fairly heavy New Zealand and Australian arrivals in July, accounted in great measure for the large total quantity registered during that month.

Fig. 1 shows in diagrammatic form the monthly imports of butter from New Zealand, Australia and the Irish Free State during 1931.

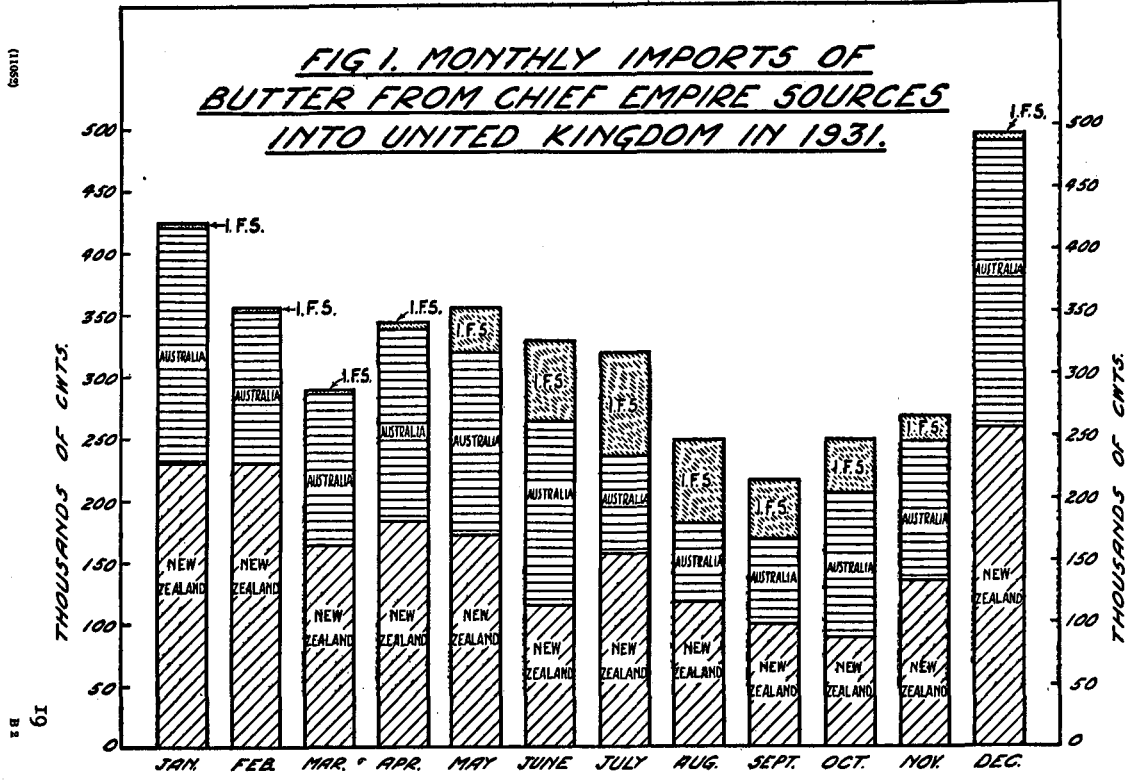
TABLE III.—*Monthly Imports of Butter from Chief Countries of Consignment in 1931.*

Month.	Australia.	New Zealand.	Irish Free State.	Denmark.	Sweden, Norway, Finland	Russia and Baltic Countries <sup>(a)</sup>	Argentina.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January ..	191	231	3	158	35	1	51	5	675
February ..	123	230	2	154	37	—	47	4	597
March ..	123	163	2	181	38	1	48	7	563
April ..	153	182	6	214	43	6	46	21	671
May ..	148	170	35	216	46	45	39	24	723
June ..	148	114	67	252	41	74	25	36	757
July ..	79	156	83	244	59	144	6	37	808
August ..	65	115	68	229	37	119	—	25	658
September ..	68	98	46	219	37	86	9	34	597
October ..	114	89	44	224	39	87	16	28	641
November ..	115	131	21	190	32	63	36	9	597
December ..	232	256	4	185	34	15	52	6	784
Total ..	1,559	1,935	381	2,466	478	641	375	236	8,071

(a) Estonia, Latvia, Lithuania and Poland.

*Exports of Imported Butter.*—The re-export trade in butter, which had tended downwards in 1928 and 1929, expanded considerably in 1930 and 1931 following the low level to which prices had fallen. Total re-exports in 1931 were rather more than twice as heavy as in 1930 and heavier than in any previous year except 1922. The increase compared with a year earlier was most pronounced in the early part of the year, the comparison in the last few months being affected by the restrictions imposed by France and by the relatively

**FIG. 1. MONTHLY IMPORTS OF BUTTER FROM CHIEF EMPIRE SOURCES INTO UNITED KINGDOM IN 1931.**



large quantities taken by Germany towards the end of 1930; in November the figures were less than a year earlier, but the December figures again showed an increase and reached their highest point of the year.

Shipments to Continental countries accounted chiefly for the increase in re-exports and France, which took nearly seven times as much as in 1930, was the principal market in 1931. Then followed Belgium, Germany and the Netherlands in that order, these countries, particularly Belgium, showing considerable increases compared with a year earlier. Re-exports to the Irish Free State have fallen off since 1928 and a further decline occurred in 1931, probably due in part to tariff restrictions. Canada took rather more than the small 1930 figure and the quantity sent to Empire countries was larger than in the previous year, but below the level of other recent years.

Details of the exports of imported butter in 1913 and 1927 to 1931 are given in Table IV.

TABLE IV.—*Re-exports of Butter from the United Kingdom.*

Destination.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Irish Free State .. ..	(a) 38·0	38·0	48·2	35·5	29·1	26·3
Canada .. .. .	6·6	23·0	1·7	19·1	2·8	7·8
Other Empire Countries..	25·9	21·1	16·0	14·3	18·5	22·2
France .. .. .	7·0	41·9	19·2	12·6	13·9	95·0
Belgium .. .. .	18·9	14·2	12·2	14·2	16·3	66·4
Germany .. .. .	2·1	27·6	18·6	5·3	45·7	59·6
Netherlands .. .. .	21·5	20·2	19·7	13·8	26·2	46·9
Denmark .. .. .	0·9	3·5	1·0	0·3	4·6	(b)
Italy .. .. .	3·7	2·1	4·8	—	1·9	(b)
Switzerland .. .. .	(b)	10·5	13·3	5·6	9·7	(b)
United States of America	13·1	29·0	7·0	0·2	1·4	0·3
Other Foreign Countries	6·0	5·9	2·8	1·8	3·1	49·1
Total Empire Countries ..	32·5	82·1	65·9	68·9	50·4	56·3
Total Foreign Countries ..	73·2	154·9	98·6	53·8	122·8	317·3
Total All Countries ..	105·7	237·0	164·5	122·7	173·2	373·6

(a) Not separately recorded.

(b) Included in "Other Foreign Countries".

### PRICES.

The world fall in commodity prices in general was continued in 1931 and, as in 1930, butter shared in the decline.

The increased consumption of butter towards the end of 1930, induced by the low level to which prices had fallen, resulted in a rapid strengthening of the market, which continued into 1931. Prices remained fairly steady in January, and an expansion of orders from certain European countries caused a rapid rise until the middle of February, when values reached their highest point of the year. Thereafter a sharp decline was experienced and, with the seasonal increase in European production and continued large supplies from the Southern Hemisphere, prices fell almost continuously until about the middle of May, when the effect of a late Continental season in retarding production resulted in a short period of increasing prices. European production, however, recovered and continued on a high level during the summer months, and this fact, coupled with the extra weight of supplies consequent on the German situation, kept prices at a low level and reduced the spread between Danish and New Zealand prices to small dimensions. An improvement in prices during August followed a renewal of German buying, but the advance was of short duration and prices receded after the middle of the month. A decline in the rate of imports and a continued large movement into consumption caused prices to show a firmer tendency throughout September, a movement which was perhaps accelerated by the departure from the gold standard. At the beginning of October, values for New Zealand equalled the corresponding 1930 figure for the first time in the year and, in spite of a fairly regular decrease thereafter, continued above the 1930 level until the beginning of December. (Butter prices experienced a substantial reduction during the last few months of 1930.) During the final month of 1931, the price decline became more pronounced and values for box butters at the end of the year were the lowest in post-war years. Prices for Danish butter rose to a peak towards the end of October, but thereafter tended to decline until the beginning of December, when the relative scarcity of this description compared with box butter caused prices to rise and practically to equal the rate ruling a year earlier.

For the whole year, the average prices for finest New Zealand and Australian salted were less than in 1930 by 13 per cent. and 14 per cent. respectively, while Danish showed a drop of 13 per cent.

Monthly prices of these, the three most important kinds of butter on the United Kingdom market, are given for 1929, 1930 and 1931 in Table V. The figures are taken from the weekly quotations of the London Provision Exchange, and represent the average of the highest weekly quotations during the month.

Weekly prices for Danish and New Zealand finest salted at London in 1930 and 1931 are shown in diagrammatic form in fig. 2.

TABLE V.—Average Price of Butter at London.

Month.	New Zealand Finest Salted.			Australian Finest Salted.			Danish.		
	1929.	1930.	1931.	1929.	1930.	1931.	1929.	1930.	1931.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January ..	185 6	156 9	117 0	184 3	153 6	112 0	192 3	173 6	136 6
February ..	180 0	149 6	122 0	180 0	146 0	119 6	193 6	175 6	148 6
March ..	168 3	137 0	119 0	166 0	133 9	117 9	179 0	158 6	137 0
April ..	164 0	128 0	111 0	159 3	125 0	108 9	165 0	140 0	124 0
May ..	167 0	130 9	110 6	161 6	129 0	107 9	167 0	134 0	120 0
June ..	171 0	134 0	112 0	166 3	130 3	107 6	174 3	139 6	119 0
July ..	172 6	137 0	113 6	167 3	134 6	108 6	174 9	150 6	118 6
August ..	174 0	134 6	114 6	168 6	133 0	110 0	176 0	148 6	124 6
September ..	181 0	128 0	114 6	175 6	126 6	108 9	195 9	151 0	130 9
October ..	183 6	118 0	121 0	178 0	114 6	115 3	200 9	151 0	134 0
November ..	174 6	110 6	113 0	172 9	106 6	107 9	191 0	139 6	132 0
December ..	164 0	112 0	103 6	159 6	108 9	102 6	178 0	138 0	137 0
Average ..	173 9	131 3	114 3	170 0	128 6	110 6	182 3	150 0	130 0

Average monthly prices for certain other types of imported butter are given in Table VI, the prices being from the weekly quotations of the London Provision Exchange, except Swedish and Finnish, for which the prices issued by the Manchester Wholesale Provision Association are adopted; both these descriptions move in a somewhat similar manner to Danish, but at a slightly lower level. Dutch creamery unsalted butter, the dearest imported type, was in unusually short supply towards the end of the year and showed a relatively large increase in price.

FIG 2. PRICES OF NEW ZEALAND  
AND DANISH BUTTER AT LONDON.

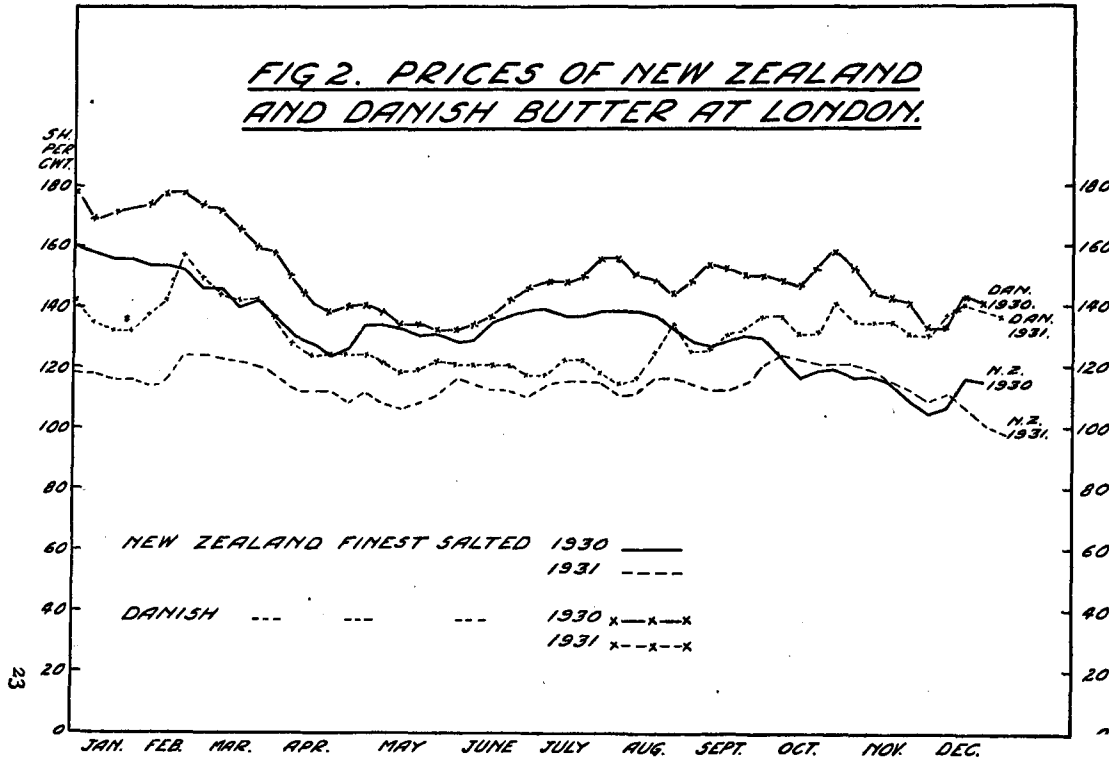


TABLE VI.—Average Monthly Prices of Butter during 1931.

Month.	New Zealand Finest Unsalted.	Australian Finest Unsalted.	Irish Creamery (Salted).	Swedish. †	Argentine Finest Unsalted.	Dutch Creamery Unsalted.	Estonian Salted.	Finnish. †	Russian (Siberian).
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January ..	118 9	114 6	—	130 9	112 0	145 6	—	130 9	—
February ..	127 0	122 0	—	138 9	121 6	151 0	—	138 9	—
March ..	127 0	122 6	—	132 0	120 0	135 0	—	131 6	—
April ..	117 0	113 6	—	123 9	109 0	123 0	—	123 0	—
May ..	114 6	110 6	*109 9	117 9	107 3	116 6	107 3	118 3	103 6
June ..	116 6	110 0	*111 9	117 6	109 6	118 0	108 0	118 0	102 0
July ..	117 6	110 6	*114 9	116 3	110 6	122 0	108 0	117 3	96 6
August ..	116 0	112 0	†112 0	121 3	110 0	116 0	110 0	120 9	93 9
September ..	114 0	108 6	—	124 0	109 0	123 9	107 6	125 3	93 6
October ..	120 9	115 3	—	130 0	115 3	142 9	114 9	129 3	102 6
November ..	119 6	110 6	—	130 9	105 6	140 6	—	130 9	95 3
December ..	119 0	109 9	—	133 3	99 6	148 0	—	132 9	95 3

\* Three weeks.

† One week.

‡ Official quotation of the Manchester Wholesale Provision Association.

Home-produced butter prices tend to vary seasonally with production rather than with imported supplies, but values for this description in 1931 also shared in the general price decline. As in 1930, however, the decline was rather less marked than in imported butter. The average price of first quality farm butter at country provision markets in England and Wales, as quoted weekly in the *Agricultural Market Report*, was 1s. 5½d. per lb. in 1931, as compared with 1s. 7½d. in 1930. The highest weekly average in 1931 was 1s. 7½d., which occurred in January and again in December; the lowest weekly average of 1s. 2½d. occurred in June. In 1930 the highest average was 2s. 0½d. in January and the lowest 1s. 4d. in June.

Table VII shows the average monthly prices for first quality farm butter at country markets in England and Wales in 1929, 1930 and 1931.



TABLE VII.—Average Price of First Quality Butter at Country Markets in England and Wales.

Month.	1929.	1930.	1931.
	Per lb. s. d.	Per lb. s. d.	Per lb. s. d.
January .. .. .	2 1	1 11½	1 7½
February .. .. .	2 0½	1 11	1 7½
March .. .. .	2 0½	1 9½	1 7½
April .. .. .	1 10½	1 7½	1 5½
May .. .. .	1 7½	1 4½	1 3
June .. .. .	1 6½	1 4½	1 2½
July .. .. .	1 8	1 6½	1 3½
August .. .. .	1 10	1 7	1 4½
September .. .. .	1 10½	1 7	1 4½
October .. .. .	2 0	1 6½	1 5
November .. .. .	2 0	1 6½	1 5½
December .. .. .	2 0½	1 7½	1 7
Average for Year .. .. .	1 10½	1 7½	1 5½

COLD STORAGE HOLDINGS AND APPARENT CONSUMPTION OF IMPORTED BUTTER.

In order to estimate the movement of butter into consumption channels over a period, information regarding stocks of butter in cold storage is essential.

With the co-operation of cold-store proprietors and traders, the Empire Marketing Board arranged for the collection and publication on a voluntary basis of stocks of butter in cold storage at fortnightly intervals, commencing from December, 1929. Returns so furnished are estimated to include approximately 95 per cent. of all the butter in cold storage in Great Britain and are thus capable of affording a sufficiently reliable indication of the movement of stocks as a whole. It should be noted that the figures do not include stocks in steamers in process of discharging, nor stocks in ordinary storage. It is not considered that the omission of these latter "invisible" stocks seriously affects the figures over a fairly long period, particularly in the past two years when buying has been largely confined to the fulfilment of immediate requirements.

As imports of butter in the first half of the year are heavier than in the second six months, there is a movement into cold storage until the summer months, in order to allow for the period when

supplies are normally short. In 1931, however, imports did not reach their maximum until July, largely as a result of a more than usually prolonged Southern Hemisphere season combined with heavy imports from European countries consequent on the difficult financial situation in Germany. As a result, the net movement of butter into storage continued until early in August, or a month later than in the preceding year. Until that point the inward movement had been less pronounced than a year earlier, increased imports being more than offset by a continued heavy movement of butter into consumption channels. From August until the beginning of November the stock position corresponded closely to that of the previous year. In the last two months of 1930, low prices had stimulated consumption to such an extent that stocks experienced a rapid decline. In the same period of 1931, imports were on a much heavier scale and, although consumption was maintained above the 1930 level, the decline in holdings was relatively less pronounced. At the beginning of 1931 stocks of butter in cold storage were 90,000 boxes lighter than a year earlier, but at the end of the year they exceeded the corresponding 1930 figure by the equivalent of 181,000 boxes.

A feature of the cold storage position in 1931, compared with 1930, was the comparative reduction in stocks of box butter, although this class showed the greater increase in imports. At the period of maximum stocks in 1930, holdings of box butter exceeded one million boxes, but at no time in 1931 did stocks reach 630,000 boxes. The later outward movement, however, was rather less rapid than in 1930 and from the middle of November stocks of box butter were slightly greater than a year earlier.

Stocks of cask butter in cold storage are negligible until early summer. In the first half of 1931 the quantity in storage was slightly less than a year earlier, but July and August witnessed a large increase to a peak of 242,000 casks, or more than double the highest point recorded in 1930. At the end of August cask butter represented almost 50 per cent. of all butter in cold storage, whereas at the date of maximum stocks of cask butter in 1930 it accounted for no more than 25 per cent. Until the end of the year stocks of cask butter in cold storage were on a higher level than in 1930.

The movement of cold storage stocks of butter in 1930 and 1931, is shown in Table I in fortnightly periods. Fig. 3 gives similar details for box, cask and all butters in diagrammatic form.

**FIG 3. STOCKS OF BUTTER IN COLD-STORAGE IN GREAT BRITAIN.**

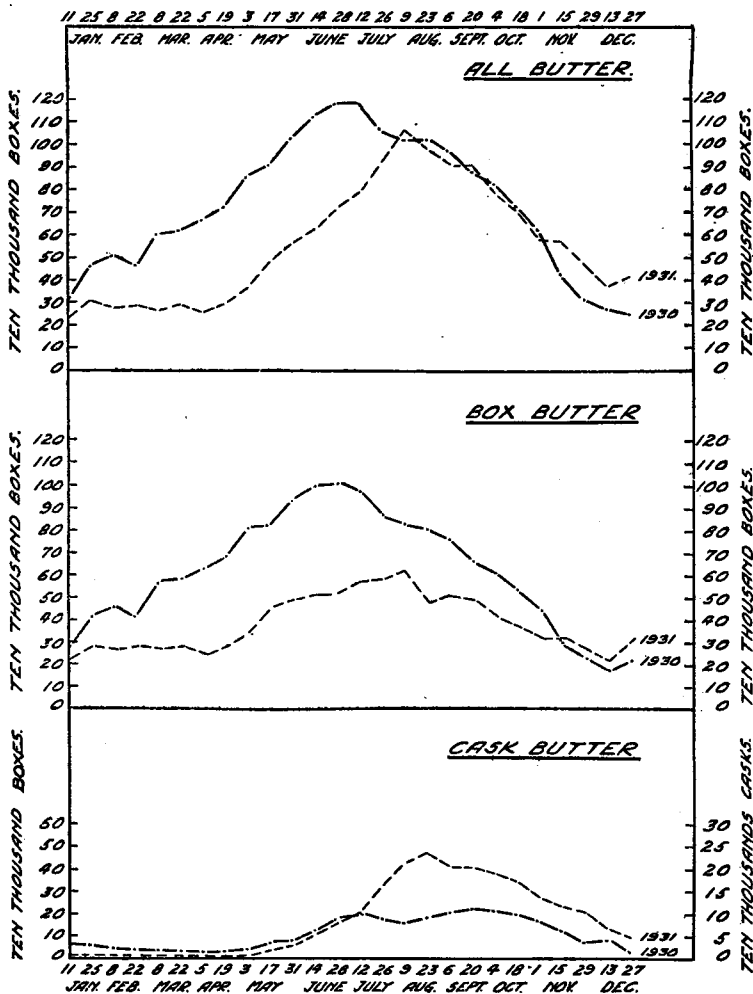


TABLE I.—Stocks of Butter in Cold Storage in Great Britain.

Date (1931).	1930.			1931.		
	Boxes.	Casks.	Total (a) (as boxes).	Boxes.	Casks.	Total (a) (as boxes).
	000.	000.	000.	000.	000.	000.
January 10th .. ..	268	28	325	211	12	235
January 24th .. ..	411	26	464	283	9	303
February 7th .. ..	458	25	509	267	6	281
February 21st .. ..	418	21	462	293	3	301
March 7th .. ..	561	20	601	260	3	267
March 21st .. ..	588	16	622	285	2	291
April 4th .. ..	631	15	662	244	3	251
April 18th .. ..	692	17	728	286	5	298
May 2nd .. ..	810	21	853	350	6	363
May 16th .. ..	842	31	905	454	15	485
May 30th .. ..	949	40	1,031	503	28	560
June 13th .. ..	1,001	64	1,131	513	53	621
June 27th .. ..	1,015	89	1,194	537	89	716
July 11th .. ..	984	101	1,188	579	109	798
July 25th .. ..	880	90	1,062	593	164	923
August 8th .. ..	835	84	1,004	629	211	1,053
August 22nd .. ..	810	95	1,002	496	242	981
September 5th .. ..	764	101	968	516	202	921
September 19th .. ..	663	111	888	500	206	913
October 3rd .. ..	606	110	829	421	183	787
October 17th .. ..	534	104	743	381	171	725
October 31st .. ..	450	81	614	313	139	592
November 14th .. ..	303	67	438	328	125	578
November 28th .. ..	244	38	320	268	106	481
December 12th .. ..	186	45	276	243	72	389
December 26th .. ..	216	17	252	329	52	434

(a) Including other packages.

By means of the figures of fortnightly cold storage holdings and the recorded imports of butter into the main ports in Great Britain, it is possible to obtain a fairly reliable indication of the trend of consumption of imported butter. These figures do not accurately represent the movement into consumption channels over short periods. In many cases, Customs entries may have been passed while goods were as yet undischarged from the steamer; on the other hand,

entries of goods landed may be held over from one week to the next. In spite of these reservations, which render short-period comparisons liable to considerable error, it is probable that the figures given in the table below represent with fair accuracy the movement of imported butter into consumption from month to month.

The apparent consumption of imported butter, which in the first half of 1930 averaged approximately 6,000 tons per week, increased considerably in the second six months, following the marked decline in prices. The heavier movement continued in 1931 to an even greater extent, the increase up to June being well over 20 per cent. compared with a year earlier. Consumption continued at a high level in the second half of the year, but owing to the expansion which had taken place in the same period of 1930 the increase in 1931 was not so marked as in the first six months. For the year as a whole apparent consumption (including re-exports) averaged approximately 7,650 tons per week, as compared with under 6,600 tons in 1930. Excluding re-exports, which were more than double the previous year's figures, the apparent consumption of imported butter in 1931 averaged approximately 7,300 tons per week as compared with 6,400 tons in 1930, an increase of 14 per cent.

Sufficient data have not yet accumulated to measure seasonal changes in consumption. It is apparent from the figures that price considerations are a major cause in determining changes in consumption, largely due to the possibility of substituting butter for margarine at the lower price levels. Thus, in both years the movement into consumption channels was greater in the second half of the year than in the first six months, and in both periods prices towards the end of the year were lower. The supply of home-produced butter does not appear to exercise a major effect, probably due to the small proportion which it bears to total supplies, but in both years consumption of imported butter was rather below the annual average in the late spring and early summer, when home production would be at its height.

Table II shows the apparent consumption of imported butter in Great Britain in four-weekly periods in 1931 and 1930, the figures being subject to the reservations already outlined.

TABLE II.—*Apparent Consumption of Imported Butter in Great Britain in 1931.*

Period.	Recorded Imports.	Movement into (+) or out of (–) cold storage. (a)	Apparent Consumption 1931.	Apparent Consumption 1930.
Four weeks ended	cwts.	cwts.	cwts.	cwts.
24th January .. ..	634,031	+ 26,511	607,520	506,119
21st February .. ..	659,271	– 366	658,637	560,053
21st March .. ..	519,346	– 5,206	524,552	410,168
18th April .. ..	586,827	+ 4,040	582,787	454,577
16th May .. ..	626,648	+ 98,316	528,332	502,309
13th June .. ..	673,836	+ 71,261	602,575	411,340
11th July .. ..	633,452	+ 93,205	540,247	581,470
8th August .. ..	702,748	+ 134,528	568,220	605,450
5th September .. ..	575,445	– 69,877	645,322	443,036
3rd October .. ..	527,267	– 70,162	597,429	539,978
31st October .. ..	536,585	– 102,793	639,378	534,556
23th November .. ..	503,984	– 58,182	562,166	622,113
Period to 23rd December	596,485	– 25,007	621,492	475,911

(a) Corrected to allow for quantities not covered by the Board's fortnightly returns.

### THE CHEESE MARKET IN 1931.

#### SUPPLIES.

Home production of cheese in 1924–25 was estimated to account for rather less than one-quarter of the total consumption. In that year the estimated quantity manufactured on farms and in factories in Great Britain was 857,000 cwts.; production of cheese in Northern Ireland was very small. No information is available for later years, but factory production, which in 1924 accounted for about one-quarter of the total make in Great Britain, showed a threefold increase in 1930, according to preliminary figures relating to the Board of Trade Census of Production, but this increase was probably due largely to the development of the processed-cheese industry. It is generally agreed that the quantity of cheese manufactured in the country as a whole in 1931 was smaller than in other recent years.

Imports of cheese, unlike those of butter, have shown no marked upward tendency in the post-war period, and have, indeed, fluctuated within comparatively narrow limits. The quantity imported in 1931 amounted to 2,884,815 cwts., which, although only 7 per cent. below the record 1930 figure, was the smallest since 1923.

*Sources of Supply.*—New Zealand and Canada between them supply the greater part of the cheese imported into the United Kingdom. Supplies from New Zealand in the five years 1909–13 averaged slightly under one-fifth of total imports, while imports from Canada averaged over three-fifths. In the post-war period New Zealand has occupied the principal role and supplies from that source, apart from minor fluctuations, have shown a pronounced upward tendency, while imports from Canada have declined substantially from the peak attained in 1925. In 1931, however, supplies from New Zealand were 12 per cent. smaller than in 1930 and comprised 60 per cent. of total imports as against 63 per cent. in the earlier year, whereas the increased shipments registered from Canada towards the end of the season resulted in the 1931 figure of imports from that country exceeding the 1930 total by 4 per cent. and accounting for nearly 25 per cent. of total imports as compared with 22 per cent. in 1930. Supplies from Australia, which were practically negligible before the war, have fluctuated appreciably in recent years without showing a definite trend in either direction, but the figure recorded in 1931 was 42 per cent. greater than in 1930 and the largest since 1928. South Africa, which entered the field in 1930, is the only other Empire source of importance and was responsible for about 15,300 cwts. in 1931, or slightly less than in the previous year.

Empire supplies as a whole, although reduced in volume, represented fully 87 per cent. of total imports of cheese in 1931, or approximately the same proportion as in 1930.

The Netherlands is the chief foreign source of imported cheese, but imports have tended to decline since 1928, and in 1931 were 8 per cent. smaller than in 1930. Imports of Italian cheese increased rapidly until 1925 and continued at a slightly lower level in the following five years, but a decrease of about 9 per cent. occurred in 1931, compared with a year earlier. Compared with the pre-war period, imports from the Netherlands have suffered a material decline, whereas Italian supplies have been on a larger scale. These two countries between them have accounted for 10 per cent. of total imports of cheese in each of the past six years. Other foreign countries are of less importance as sources of imported cheese, the chief being Switzerland, which was responsible for reduced supplies in 1931. Imports from France were less than half as heavy as in 1930, while Denmark also shipped rather smaller quantities. Imports from the United States at one time were of considerable importance, but have diminished to insignificant proportions.

Table I gives details of the imports of cheese into the United Kingdom in 1913 and from 1927 to 1931.

TABLE I.—*Imports of Cheese into the United Kingdom.*

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000. cwts.	000. cwts.	000. cwts.	000. cwts.	000. cwts.	000. cwts.
New Zealand .. .. .	547	1,612	1,554	1,801	1,961	1,732
Canada .. .. .	1,294	844	920	723	678	707
Australia .. .. .	8	36	74	50	48	68
Union of South Africa ..	—	—	—	(b)	(c)16	(c)15
Irish Free State .. .. .	(a)	2	2	2	2	2
Other Empire Countries	—	1	—	—	—	—
Netherlands .. .. .	292	228	228	196	183	168
Italy .. .. .	102	141	141	132	145	132
Switzerland .. .. .	12	29	34	40	38	32
France .. .. .	15	20	28	26	27	12
Denmark .. .. .	(d)	9	9	6	7	5
Finland .. .. .	(d)	2	2	2	1	3
Belgium .. .. .	2	4	2	4	1	2
Germany .. .. .	(d)	1	2	3	1	1
Norway .. .. .	(d)	—	—	—	—	1
Russia .. .. .	(d)	—	1	1	—	—
United States of America	22	17	5	7	4	4
Other Foreign Countries..	3	3	3	1(e)	—	1
Total Empire Countries ..	1,849	2,495	2,550	2,576	2,705	2,524
Total Foreign Countries ..	448	454	455	418	407	361
Total All Countries ..	2,297	2,949	3,005	2,994	3,112	2,885

(a) Not separately distinguished before April, 1923.

(b) Included in Other Empire Countries.

(c) Including South West Africa Territory.

(d) Included in Other Foreign Countries.

(e) Including certain quantities of "soft" cheese for which no specific country of consignment is given in the Annual Statement of Trade of the United Kingdom.

*Exports and Re-exports.*—Exports of home-produced cheese were practically negligible up to 1924. A considerable increase then occurred, reaching a peak of 57,000 cwts. in 1929. A decline to under 50,000 cwts. was experienced in 1930 and to 36,000 cwts. in 1931. These exports consisted largely of hard cheese sent to Germany, but



the increased volume of exports after 1924 may be partly attributable to exports of processed cheese, which is manufactured largely from imported bulk types.

Exports of imported cheese have fluctuated at different times, but have tended to decline in recent years, following reduced quantities taken by the Irish Free State, the principal market. Re-exports in 1931 totalled 29,000 cwts., as compared with 30,000 cwts. in 1930—just over 1 per cent. of imports.

*Seasonal Variation.*—When Canada supplied the bulk of cheese imports supplies tended to be greatest from July to November, but, with the increase in New Zealand shipments and the almost complementary nature of New Zealand and Canadian arrivals, total monthly imports in recent years have shown no marked seasonal variation.

The reduction in supplies during 1931, compared with a year earlier, occurred principally in the first and last months and in the four months June to September. During these periods New Zealand cheese was in particularly short supply and this was the main cause of the difference. Imports reached a maximum in February, which had been the month of smallest importation in 1930; in that year the peak occurred in December. Supplies in 1931 were at their lowest in June, when imports were the smallest in any month for several years.

Table II shows the monthly imports of cheese into the United Kingdom in 1913 and in the seven years 1925 to 1931.

TABLE II.—*Monthly Imports of Cheese into the United Kingdom.*

Month.	1913.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	000	000	000	000	000	000	000	000.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. .. .	137	271	348	278	224	345	338	233
February .. .. .	147	242	170	201	272	316	201	281
March .. .. .	150	245	238	296	319	228	266	274
April .. .. .	136	265	231	183	193	242	273	243
May .. .. .	156	222	217	220	281	238	226	279
June .. .. .	175	254	232	275	240	219	207	146
July .. .. .	281	331	388	237	223	233	267	238
August .. .. .	242	299	303	290	329	270	289	205
September .. .. .	265	227	205	269	193	194	234	196
October .. .. .	227	265	237	222	246	234	220	278
November .. .. .	241	162	239	278	293	251	246	256
December .. .. .	140	313	206	200	192	224	345	256
Total .. .. .	2,297	3,096	3,014	2,949	3,005	2,994	3,112	2,885

Table III shows the monthly imports of cheese from the principal sources of supply in 1931, and illustrates the extent to which New Zealand and Canadian supplies are complementary.

TABLE III.—*Monthly Imports of Cheese from Chief Countries of Consignment in 1931.*

Month.	New Zealand.	Australia.	Canada.	Italy and Netherlands.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January ..	190	14	1	23	5	233
February ..	240	8	2	25	6	281
March ..	236	4	1	26	7	274
April ..	199	7	3	26	8	243
May ..	235	2	8	26	8	279
June ..	84	8	22	25	7	146
July ..	138	5	67	21	7	238
August ..	73	3	103	21	5	205
September..	60	—	106	22	8	196
October ..	60	4	185	23	6	278
November ..	65	1	156	27	7	256
December ..	152	12	53	35	4	256
Total ..	1,732	68	707	300	78	2,885

#### PRICES.

In spite of a comparatively strong statistical position occasioned by reduced imports, cheese prices suffered a drastic general decline in 1931. In the case of butter the decline in values compared with a year earlier was greater in 1930 than in 1931, but in cheese the reverse occurred, prices for Dominion produce over the whole year being from 22 to 25 per cent. lower than in 1930, as compared with a reduction of only 12 to 15 per cent. between 1929 and 1930.

The year opened with finest New Zealand cheese at around 62s. per cwt., or 26s. less than at the beginning of 1930. Stocks were estimated to be appreciably greater than a year earlier and values declined steadily until early in February. A short recovery ensued, but, with an extremely quiet demand continuing, values tended gradually downwards from the end of February until a low point of 47s. per cwt. was reached early in May, prices then being the lowest

for many years. At this stage an improvement in demand resulted and, aided by short available supplies, an upward price movement commenced. New season's Canadian appeared on the market a month later than in 1930 and from July until September moved on a similar level to New Zealand. A weaker tendency developed at the end of August, but continued light supplies, accentuated by the increase in Canadian c.i.f. quotations following the United Kingdom's departure from the gold standard, caused a rapid increase in prices throughout September and early October, at which time the highest point of 71s. per cwt. was reached and prices touched the previous year's level. Thereafter the tendency was gradually downwards, prices in early December slightly exceeding the 1930 figure; but the remainder of the month witnessed an acceleration in the rate of decline.

Taking the year as a whole, New Zealand finest white cheese averaged about 24 per cent. less than in 1930. In the case of Canadian, where quotations tend to be more stabilised during most of the year, the fall was almost equally pronounced and finest white on the average ruled about 22 per cent. under the 1930 figure. During the first half of the year the difference in price in favour of Canadian cheese, compared with New Zealand, was more pronounced than in earlier years, but, as already stated, in the first few months of the Canadian season starting in July, the prices of the two descriptions were practically on a par. In 1930 values for Canadian cheese had consistently ruled above those for New Zealand.

As between white and coloured New Zealand cheese the average price difference for the year was comparatively small, but considerable margins existed at different periods. In January a slight premium obtained for white, but from February until about October coloured cheese was consistently dearer than white, the margin amounting to as much as 4s. in the spring. In the two final months of the year white cheese, in relatively light supply, again commanded a premium. For the year as a whole finest coloured averaged 60s. 3d. as against 59s. 1d. for white, or almost the same difference as in 1930. Canadian finest coloured averaged 71s. 4d., or about 4d. more than white, whereas in the previous year the margin was rather in favour of the latter.

Table IV gives average monthly prices for New Zealand and Canadian finest white and coloured cheese at London in 1931, as compared with 1930. The figures are taken from the weekly quotations of the London Provision Exchange and represent the average of top prices of a series.

TABLE IV.—*Cheese Prices at London.*

Month.	New Zealand Finest White.		Canadian Finest White.		New Zealand Finest Coloured.		Canadian Finest Coloured.	
	1931.	1930.	1931.	1930.	1931.	1930.	1931.	1930.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January ..	58 0	88 9	77 6	98 9	57 6	86 9	75 6	98 0
February ..	56 9	88 9	77 6	100 0	57 6	87 3	77 6	98 0
March ..	55 9	82 3	77 0	99 6	58 0	83 9	77 6	98 0
April ..	51 0	76 6	75 0	100 0	54 6	79 0	76 6	98 0
May ..	50 6	81 3	74 0	103 6	53 3	86 6	74 6	101 9
June ..	54 9	77 9	74 0	{ 104 0* 83 3† }	57 6	84 0	74 0	{ 104 0* 83 3† }
July ..	60 0	77 3	{ 72 9* 61 0† }	83 0	62 6	82 9	{ 73 6* 62 6† }	83 9
August ..	62 6	76 6	{ 71 6* 62 9† }	82 3	64 0	81 0	{ 71 6* 64 0† }	83 6
September ..	62 0	73 9	63 0	79 0	63 6	75 0	63 9	80 0
October ..	69 0	74 0	70 0	79 3	69 6	72 0	70 0	78 0
November ..	67 3	72 0	70 0	78 6	66 0	68 3	71 0	78 0
December ..	61 3	62 3	70 0	78 0	59 3	60 9	69 6	76 9
Average for Year.	59 1	77 7	71 0‡	90 6‡	60 3	78 11	71 4‡	89 10‡

\* Old.

† New.

‡ The yearly average for Canadian is calculated on prices of "old" cheese for the period January to June, and on "new" cheese from July to December.

The decline in price of Dutch cheese in 1931 was not so marked as in the case of New Zealand and Canadian. Until September prices ruled considerably under those of a year earlier, but with the depreciation in sterling from September onwards prices were appreciably increased and in the last quarter of the year exceeded the corresponding 1930 quotations. For the year as a whole full cream Gouda and 40 per cent. Edam were less than in the previous year by 11 per cent. and 10 per cent. respectively.

Average top prices of these descriptions in 1930 and 1931, as quoted on the London Provision Exchange, are given in Table V.

TABLE V.—Average Price of Certain Dutch Cheese at London.

Month.	Edam. Factory 40 per cent.		Gouda. Full Cream.	
	1931.	1930.	1931.	1930.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January .. .. .	67 9	85 3	72 6	98 0
February .. .. .	69 3	77 0	76 0	95 0
March .. .. .	70 6	77 0	77 0	85 9
April .. .. .	61 6	71 3	68 9	74 9
May .. .. .	55 3	64 6	63 0	73 6
June .. .. .	53 6	63 6	61 6	73 3
July .. .. .	64 6	72 9	69 3	78 6
August .. .. .	59 0	70 3	67 0	81 0
September .. .. .	57 9	68 0	66 6	78 6
October .. .. .	68 3	65 3	81 0	77 0
November .. .. .	67 0	66 3	78 3	76 0
December .. .. .	70 0	68 3	79 6	72 9
Average for year ..	63 9	70 9	71 9	80 4

*Home-produced Cheese.*—No information is available regarding the output of home-produced Cheddar cheese during 1931, and, in the absence of representative quotations, no precise price-comparisons can be made with the previous year. From the wholesale prices supplied weekly by the Ministry of Agriculture and from the quotations on the London Provision Exchange it is apparent that the figures for 1931 were well below those of a year earlier, the difference being from 10s. to 15s. in the first half of the year. New cheese did not appear on the market until several weeks later than in 1930 and the price margin was then of a higher order, but was gradually reduced until, at the end of 1931, quotations were practically on a par with those of a year previously.

Scotch Farm Cheddar showed a similar trend, 1st quality at Glasgow in the first six months being quoted nominally at about 96s. as against 114s. in the same period of 1930. Here again the difference was much more marked when the new season's cheese appeared, but narrowed appreciably towards the end of the year.

At this stage white Cheddar was practically cleared and commanded a premium over coloured, which was affected by the supplies of Dominion produce.

The situation with regard to Cheshire cheese was rather different. The quantities on offer at the various fairs which are reported upon in "Weekly Dairy Produce Notes"\* were, on the whole, less than in 1930 and the reduction was more marked towards the end of the year. No doubt the relatively unremunerative nature of cheese-making during the summer caused a reduction in the output and this fact, combined with the shortage of milk later in the season, caused values, which had previously been rather under those of a year earlier, to show a rapid rise from October onwards, and 1930 levels were substantially exceeded during the closing months of the year.

Supplies of Caerphilly cheese at Highbridge in 1931 totalled 1,365 tons, as compared with 1,137 tons in 1930. First quality averaged 75s. 4d. in 1931 and 82s. 3d. in 1930.

#### IMPORTS OF CONDENSED MILK AND MILK POWDER.

Imports of condensed milk, in the aggregate, have shown an increasing tendency in recent years. A decline occurred in 1930, but total imports in 1931 were 8 per cent. greater than in 1930 and, apart from the abnormal importation just after the war, were the largest ever recorded. All descriptions shared in the increase over the previous year, but while imports of sweetened skimmed condensed milk and unsweetened condensed milk have increased considerably, in comparison both with recent years and the pre-war period, the importation of sweetened whole condensed milk has tended to decline.

The rapid increase in supplies of imported milk powder, the bulk of which is unsweetened, has been a feature of recent years and gross imports in 1931 were 36 per cent. greater than in 1930.

The factory output of condensed milk in Great Britain in 1930, excluding production in a number of small factories from which returns were not received, amounted to 874,000 cwts., an increase of 14 per cent. over the comparable 1924 figure. Details of the manufacture of the different classes are not yet available for 1930, but in 1924 it was estimated that about two-thirds consisted of sweetened whole condensed milk, one-eighth of sweetened skimmed

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\* Chester, Nantwich, Whitchurch.

and about one-fifth of unsweetened condensed milk. Exports of home-produced condensed milk in 1930 were equal to nearly one-quarter of the total production; excluding these, home production accounted for about one-fifth of the total quantity available for consumption.

The production of milk powder, sweetened and unsweetened, by factories in Great Britain in 1930 was estimated at 134,000 cwts., an increase of 13 per cent over the comparable 1924 figure. Home production in 1930 accounted for about one-third of the total quantity available for consumption.

Table I summarises the imports of the different types of preserved milk in 1913 and the six years 1926 to 1931.

TABLE I.—*Imports of Condensed Milk and Milk Powder into the United Kingdom.*

Year.	Sweetened Whole.	Sweetened Skimmed.	Un-sweetened Whole.	Milk Powder.		Preserved Milk, Other Kinds (Un-sweetened).
				Unsweetened.	Sweetened.	
1913..	481,435	720,772	50,008	46,572	7	15,870
1926..	257,133	1,773,431	361,758	135,168	1	29,399
1927..	253,272	1,854,759	411,485	137,794	32	26,709
1928..	297,015	1,951,025	425,406	199,706	63	34,073
1929..	258,421	1,986,893	405,387	263,048 <sup>(a)</sup>	16,475 <sup>(a)</sup>	4,912 <sup>(a)</sup>
1930..	226,666	1,972,432	402,967	250,440 <sup>(a)</sup>	14,364 <sup>(a)</sup>	2,360 <sup>(a)</sup>
1931..	229,748	2,087,875	483,073	352,652 <sup>(a)</sup>	8,106 <sup>(a)</sup>	5,268 <sup>(a)</sup>

<sup>(a)</sup> As a result of changes in methods of classification the figures for milk powder and preserved milk, other kinds, for 1929 onwards are not strictly comparable with those for previous years.

There is a fairly substantial export trade in condensed milk manufactured in the United Kingdom, principally to tropical countries. The bulk consists of the sweetened whole description, but exports have fallen off markedly in the past three years. Total exports of sweetened condensed milk from the United Kingdom amounted to 81,183 cwts. in 1931, as compared with 152,963 cwts. in 1930 and 208,805 cwts. in 1929. Exports of unsweetened condensed milk amounted to 36,790 cwts. in 1931, as against 45,288 cwts. and 37,971 cwts. in 1930 and 1929 respectively.

*Sources of Supply.*—Imports of *sweetened whole condensed milk* declined during 1929 and 1930, but recovered slightly in 1931. The Netherlands is the principal source, supplying 64 per cent. of total imports in the past year, although the quantity entered has fallen off since 1928. A marked decline in imports from Switzerland in recent years is a major cause of the reduction in total imports of this description, but supplies in 1931 were 63 per cent. greater than in 1930. Danish supplies have tended to decline in the past few years and a further decrease occurred in 1931. Imports from Canada have shown a downward trend for several years, while the small quantities from the Irish Free State have increased. Empire supplies in 1931, however, were reduced by one-half, mainly on account of the absence of imports from New Zealand, and accounted for only 5 per cent. of total imports, as compared with 10 per cent. in 1930.

Table II gives details of the gross imports of *sweetened whole condensed milk* in each of the five years 1927 to 1931. Re-exports are practically negligible.

TABLE II.—*Imports of Sweetened Whole Condensed Milk into the United Kingdom.*

Country whence consigned.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.
Canada .. .. .	13,951	12,142	9,930	7,971	5,165
Irish Free State .. .. .	238	1,855	2,408	5,599	5,890
New Zealand .. .. .	—	1,853	8,115	9,046	83
Other Empire Countries .. .. .	—	138	14	364	97
Netherlands .. .. .	155,807	171,514	161,829	147,967	146,785
Denmark .. .. .	31,996	29,098	30,087	28,583	27,100
Switzerland .. .. .	49,238	77,736	43,492	25,601	41,689
Belgium .. .. .	874	1,941	1,210	1,108	2,532
Other Foreign Countries .. .. .	1,168	738	1,336	427	407
Total Empire Countries .. .. .	14,189	15,988	20,467	22,980	11,235
Total Foreign Countries .. .. .	239,083	281,027	237,954	203,686	218,513
Total All Countries .. .. .	253,272	297,015	258,421	226,666	229,748

*Sweetened skimmed condensed milk* represents the bulk of condensed milk imported into the United Kingdom, comprising three-quarters of the total by weight in 1931. Apart from a slight decline in 1930,



imports have increased regularly, the total of over 2 million cwts. in 1931 being about 6 per cent. greater than in 1930 and nearly three times as heavy as in 1913. Regularly expanding imports from the Netherlands have been principally responsible for the increase, and 88 per cent. of the total imports in the past year were consigned from that country. Denmark, the second largest supplier, has shipped reduced quantities in recent years and a further reduction of 21 per cent. occurred in 1931. Supplies from the Irish Free State, the only Empire source of importance, were reduced by 45 per cent. in 1931, and Empire supplies accounted for 2 per cent. of the total, as compared with about 4 per cent. a year earlier.

Imports of sweetened skimmed condensed milk in the five years 1927 to 1931 are given in Table III. Re-exports are insignificant.

TABLE III.—*Imports of Sweetened Skimmed Condensed Milk into the United Kingdom.*

Country whence consigned.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.
Irish Free State .. ..	53,488	82,724	71,204	70,517	38,669
Other Empire Countries ..	1,025	396	172	149	205
Netherlands .. .. .	1,445,649	1,569,553	1,602,131	1,628,797	1,830,106
Denmark .. .. .	343,615	292,738	307,202	261,432	205,519
Italy .. .. .	7,620	3,783	2,322	10,059	12,187
Other Foreign Countries ..	3,362	1,831	3,862	1,478	1,189
Total Empire Countries ..	54,513	83,120	71,376	70,666	38,874
Total Foreign Countries ..	1,800,246	1,867,905	1,915,517	1,901,766	2,049,001
Total All Countries .. ..	1,854,759	1,951,025	1,986,893	1,972,432	2,087,875

Imports of *unsweetened condensed milk* in 1931 were 20 per cent. greater than in 1930 and, although they did not attain to the very large supplies of the immediate post-war period, were the largest since 1921. This description shows by far the greatest relative increase over the figures for pre-war years. Most of the principal supplying countries were responsible for heavier quantities in 1931. In the two preceding years the Netherlands had displaced the United States as chief source, but with an increase of 54 per cent. in 1931 the latter country again assumed first place. Imports from the Netherlands were slightly increased and supplies from Belgium and Denmark were larger by 23 per cent. and 14 per cent. respectively. Supplies

from Germany were only one-third as heavy as in 1930. Canada and the Irish Free State are practically the only Empire sources and, with substantial increases recorded from both countries, the proportion from the Empire rose from under 5 per cent. in 1930 to 7 per cent. in 1931.

There is a small re-export trade in unsweetened condensed milk, the total of about 7,000 cwts. shipped in 1931 being 3,000 cwts. more than in 1930. Table IV gives details of the gross and net imports in the five years, 1927 to 1931.

TABLE IV.—*Imports of Unsweetened Condensed Milk into the United Kingdom.*

Country whence consigned.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.
Canada .. .. .	73,756	42,928	15,218	13,709	24,489
Irish Free State .. .. .	614	570	3,535	5,067	9,927
Other Empire Countries .. .. .	—	4	1	4	45
Netherlands .. .. .	64,895	94,177	158,314	151,649	154,856
Belgium .. .. .	12,466	17,034	24,087	58,012	71,340
Denmark .. .. .	9,823	13,588	29,931	37,692	43,128
Germany .. .. .	473	1,309	13,578	27,070	8,646
Switzerland .. .. .	4,287	2,235	1,960	1,929	4,674
United States of America .. .. .	244,326	249,170	158,230	107,127	164,942
Other Foreign Countries .. .. .	845	4,391	533	708	1,026
Total Empire Countries .. .. .	74,370	43,502	18,754	18,780	34,461
Total Foreign Countries .. .. .	337,115	381,904	386,633	384,187	448,612
Total All Countries .. .. .	411,485	425,406	405,387	402,967	483,073
<i>Re-exports</i> .. .. .	<i>4,430</i>	<i>3,384</i>	<i>4,515</i>	<i>3,976</i>	<i>6,994</i>
Net Imports .. .. .	407,055	422,022	400,872	398,991	476,079

Imports of *milk powder (unsweetened)* have increased rapidly in the past few years. A slight decline occurred in 1930, but with a gross total of over 350,000 cwts. the 1931 figure was the largest ever recorded and 41 per cent. greater than in 1930. With an increase of 17 per cent. New Zealand regained its position as chief source of supply, accounting for 29 per cent. of the total. Supplies from the Netherlands have grown continuously and showed a further slight

increase in 1931, but a much greater relative advance occurred in imports from the United States, which totalled 82,000 cwts., as against under 11,000 cwts. in 1930. Imports from Canada also increased appreciably, but Empire supplies as a whole, although greater in actual volume, comprised only 43 per cent. of the total as compared with 48 per cent. in 1930.

Exports of imported milk powder (unsweetened) have fluctuated considerably, but the trend has been downwards since 1928 and total re-exports in 1931, amounting to 13,000 cwts., were 4,300 cwts. less than in 1930; net imports, as a consequence, showed an increase of 46 per cent.

Table V shows the gross and net imports of milk powder (unsweetened) in the five years 1927 to 1931.

TABLE V.—*Imports of Milk Powder (a) (Unsweetened) into the United Kingdom.*

Country whence consigned.	1927.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.	cwts.
New Zealand .. .. .	56,901	80,902	99,650	87,415	102,424
Canada .. .. .	20,783	29,271	34,412	25,988	42,025
Australia .. .. .	100	1,390	12,433	5,696	6,800
Irish Free State .. .. .	1,851	1,790	2,208	1,888	807
Netherlands .. .. .	49,166	69,224	90,485	96,911	100,169
France .. .. .	2,429	11,273	8,735	8,127	7,369
Switzerland .. .. .	1,950	872	5,715	7,740	4,595
Denmark .. .. .	1,045	3,158	4,503	3,506	3,119
Belgium .. .. .	(b)	708	1,894	1,607	753
Italy .. .. .	(b)	—	2	1	1,696
United States of America .. .. .	2,667	939	2,188	10,967	82,039
Other Foreign Countries .. .. .	902	179	823	594	856
Total Empire Countries .. .. .	79,635	113,353	148,703	120,987	152,056
Total Foreign Countries .. .. .	58,159	86,353	114,345	129,453	200,596
Total All Countries .. .. .	137,794	199,706	263,048	250,440	352,652
Re-exports .. .. .	6,025	20,139	17,389	17,331	13,057
Net Imports .. .. .	131,769	179,567	245,659	233,109	339,595

(a) Owing to changes in methods of classification the figures from 1929 onwards are not strictly comparable with those for earlier years.

(b) Included in Other Foreign Countries.

Seasonal variations in supplies of imported condensed milk are now of minor importance, although imports tend to be heavier in spring and summer, when Continental milk production is at its maximum. In January and February of 1931, and again in December, imports were on a smaller scale than a year previously, but during the remaining months the previous year's level was generally exceeded. In the case of milk powder the slight seasonal decline in supplies which normally occurs in summer and autumn, when New Zealand arrivals are reduced, was partially offset in 1931 by imports from other sources.

Table VI shows the monthly imports of the principal classes of condensed milk and milk powder in 1930 and 1931.

TABLE VI.—*Monthly Imports of Condensed Milk and Milk Powder into the United Kingdom during 1930 and 1931.*

Month.	Sweetened, whole.		Sweetened, skimmed.		Unsweetened.		Milk Powder (unsweetened).	
	1931.	1930.	1931.	1930.	1931.	1930.	1931.	1930.
	000	000	000	000	000	000	000	000
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts. <sup>1</sup>
January ..	14.8	18.1	153.5	165.7	37.0	40.6	19.9	15.9
February ..	14.2	14.9	140.6	148.8	30.4	29.9	23.2	18.0
March ..	18.3	16.6	203.6	165.0	29.4	20.7	33.2	25.6
April ..	19.5	16.8	193.5	171.9	43.2	30.8	56.0	33.8
May ..	18.7	25.4	180.5	179.0	37.7	38.8	37.8	25.6
June..	27.3	26.9	194.1	168.2	37.0	33.3	26.0	22.6
July ..	23.4	19.7	170.2	170.9	49.9	41.7	19.8	13.6
August ..	19.7	20.7	173.6	153.8	48.7	41.3	16.7	13.2
September ..	26.2	21.1	173.6	166.0	41.4	32.1	21.8	15.9
October ..	17.4	16.0	171.6	153.5	45.9	36.1	28.5	24.6
November ..	15.5	14.4	171.3	159.0	45.9	29.0	32.2	15.4
December ..	14.7	16.6	161.8	172.3	36.6	28.4	31.6	26.2
Total ..	229.7	227.2	2,087.9	1,974.1	483.1	402.7	352.7	250.4

#### THE EGG MARKET IN 1931. SUPPLIES.

Total imports of eggs in shell into the United Kingdom during 1931 amounted to 25,920,308 great hundreds, a decline of about 621,000 great hundreds or over 2 per cent. compared with the record 1930 figure. The inclusion of shipments from the Irish Free State

in the imports from 1924 onwards invalidates comparison with pre-war figures, but if supplies from the Irish Free State be omitted, imports were below the pre-war level until 1926. Since then, however, imports have shown an irregularly upward tendency and the annual figures, exclusive of imports from the Irish Free State, have been about at the pre-war level.

Home production has been estimated to account, on an average, for half the total consumption of eggs during the five years 1925 to 1929, when the increase in home supplies was at the rate of approximately 4 per cent. per annum. It is probable that the rate of increase was at least maintained in 1930 and 1931. By applying to the annual returns of fowls and ducks in England and Wales, Scotland and Northern Ireland, in 1931, the average production figure ascertained at the 1925 Census of Production, and excluding eggs for hatching, it may be calculated that production of eggs in the United Kingdom in 1931 was approximately 29 million great hundreds. This figure, however, is probably an underestimate, since the average output of eggs per hen, which had increased considerably before the 1925 Census, is likely to have shown a further improvement since; moreover, the considerable increase in young birds, revealed by the 1931 returns, would suggest an increased output of eggs towards the end of the year. Including net imports, and ignoring possible changes in storage stocks, the *per capita* consumption of eggs in the past year was apparently in the region of 140.

The output of eggs packed under the National Mark in England and Wales in 1931 is estimated at 234 millions as compared with 159 millions in 1930, an increase of 47 per cent. During the first four months of 1932 there was a further increase of 45 per cent. over the corresponding period of 1931.

*Sources of Supply.*—While total imports of eggs have shown comparatively little variation, notable changes have occurred in supplies from individual sources, in comparison both with the pre-war period and more recent times. Eggs are imported from a very large number of countries, but, broadly speaking, the tendency has been for supplies from those countries packing a large egg to increase.

Marked increases in shipments in recent years have consolidated Denmark's position as the chief source of eggs imported into the United Kingdom. Imports from that country in 1931 were 12 per cent. greater than in 1930 and exceeded the previous high level attained in 1926; they comprised 29 per cent. of total imports as

compared with 25 per cent. in the previous year. The Irish Free State remained the second largest supplier, although the quantity from this source was the smallest since 1926, declining by about 4 per cent. compared with 1930 and comprising 18 per cent. of total imports in each year. The steady growth in imports from the Netherlands in recent years was continued during 1931, but the increase, amounting to 4 per cent. over 1930, was less pronounced than in earlier years. Poland again occupied fourth place, but shipments until near the end of the year were considerably less than a year earlier and the total decrease compared with 1930 amounted to 925,000 great hundreds, or 26 per cent., although the 1929 figure was exceeded. Imports of Belgian eggs were insignificant before the war, but increased rapidly to a peak in 1929, since when they have declined, the 1931 figure being 11 per cent. less than that for 1930. Imports from China, a development of post-war years, amounted to about 1,500,000 great hundreds, or somewhat below the level of the two preceding years and 12 per cent. less than in 1930. Among other large foreign supplying countries imports from Germany were well above the 1930 figure, but it is probable that a proportion of the supplies registered from this source are of Polish and Central European origin. Supplies from Sweden, which declined in 1930, fell by a further 31 per cent. in 1931 to about the average for the 1909-13 period. Imports from France, at one time an important source of supply, have declined rapidly since 1928 and in 1931 were so reduced as to be of only minor significance. Russia sent fully three times as much as in 1930, but much less than in other recent years, and very considerably less than before the war, when Russian supplies accounted for over 50 per cent. of all the eggs imported into the United Kingdom. Baltic countries, in the aggregate, supplied larger quantities than in the previous year, the increase being particularly marked in the case of Lithuania.

Notable increases occurred in shipments from Australia and South Africa, which have steadily advanced over a decade to occupy seventh and eighth positions in the list of supplying countries in 1931. The increase was most marked in the case of Australia, where it amounted to 65 per cent., low prices, accentuated by exchange difficulties, reducing shipments from South Africa in the last few weeks of the year. In spite of the reduction in imports from the Irish Free State, the volume of Empire supplies as a whole was the largest ever recorded and accounted for 24 per cent. of total imports as compared with 22 per cent. in 1930.

TABLE I.—Imports of Eggs (in shell) into the United Kingdom.

Countries whence consigned	1913.	1927.	1928.	1929.	1930.	1931.
	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.
Irish Free State .. .. .	(a)	5,051	5,177	5,015	4,781	4,575
Australia .. .. .	(b)	122	267	375	555	914
Union of South Africa (in- cluding S.W. Africa Ter- ritory).	(b)	372	339	394	467	589
Canada .. .. .	2	42	83	79	15	47
New Zealand .. .. .	(b)	6	14	22	11	12
Other Empire Countries	2	—	—	1	7	—
Denmark .. .. .	4,265	5,680	5,330	5,573	6,728	7,548
Netherlands .. .. .	977	2,360	2,725	3,169	3,681	3,836
Poland .. .. .	(d)	3,388	2,562	2,385	3,613	2,687
Belgium .. .. .	73	2,141	2,908	2,962	2,334	2,073
Germany .. .. .	514	241	334	267	391	508
Sweden .. .. .	385	548	539	619	491	339
Russia .. .. .	11,453	1,586	1,767	608	85	262
Norway .. .. .	(c)	8	11	111	105	110
France .. .. .	702	429	1,659	868	659	97
Italy .. .. .	846	87	58	31	65	26
Latvia .. .. .	(e)	639	546	130	42	39
Lithuania .. .. .	(e)	11	56	29	32	75
Finland .. .. .	(e)	5	2	3	12	60
Estonia .. .. .	(e)	57	69	12	3	12
Austria .. .. .	} 884	9	—	—	—	1
Hungary .. .. .		6	2	2	—	4
Roumania .. .. .	226	7	—	3	1	—
China .. .. .	3	681	945	1,624	1,713	1,500
Egypt .. .. .	1,097	669	810	572	451	221
Morocco .. .. .	114	1	—	—	—	—
United States of America	6	93	92	18	192	96
Argentina .. .. .	(c)	81	99	60	77	205
Uruguay .. .. .	(c)	13	62	17	15	73
Other Foreign Countries	31	7	10	14	15	11
Total Empire Countries ..	4	5,593	5,880	5,886	5,836	6,137
Total Foreign Countries ..	21,576	18,747	20,586	19,078	20,705	19,783
Total All Countries ..	21,580	24,340	26,466	24,964	26,541	25,920

- (a) Not separately distinguished before 1st April, 1923.  
 (b) Included in Other Empire Countries.  
 (c) Included in Other Foreign Countries.  
 (d) Included in Russia, Germany and Austria-Hungary.  
 (e) Included in Russia.

Details of the imports of eggs during 1913, and the five years, 1927 to 1931, are shown in Table I above.

In addition to the imports shown in this table there is a fairly substantial and growing trade in eggs imported into Great Britain from Northern Ireland. These imports are not separately returned, but exports of eggs through Northern Ireland ports in 1931 exceeded 3½ million great hundreds, as compared with under 3·1 million in 1930, and 2·9 million great hundreds in 1929.

There is a small and fluctuating re-export trade in eggs from the United Kingdom, which have been taken principally by Argentina and Germany. These re-exports in 1931 were less than half the 1930 figure.

*Seasonal Variation.*—Table II shows the monthly imports in 1931 and in each of the five previous years 1926-30. The table also compares the monthly arrivals in 1931 expressed as a percentage of the average with the average for the five years, showing the present greater uniformity in imported supplies over the year.

TABLE II.—*Monthly Imports of Eggs into the United Kingdom.*

Month.	1926.	1927.	1928.	1929.	1930.	1931.	Monthly Average as a Percentage of the General Monthly Average.	
							1926-1930.	1931.
	000	000	000	000	000	000	Per cent.	Per cent.
	Gt. hds.	Gt. hds.	Gt. hds.	Gt. hds.	Gt. hds.	Gt. hds.		
January ..	1,494	1,543	1,739	2,223	2,366	2,079	90	96
February ..	1,312	1,351	1,863	1,139	1,989	1,708	74	79
March ..	2,141	2,112	2,252	1,599	2,216	2,028	100	94
April ..	2,360	2,498	2,323	2,367	2,288	2,231	114	103
May ..	1,911	2,240	2,668	2,480	2,518	2,426	114	112
June ..	2,033	2,618	2,874	1,776	2,275	2,350	112	109
July ..	1,953	2,046	2,156	2,229	2,219	2,323	102	108
August ..	1,732	1,749	2,199	2,276	2,186	2,194	98	102
September ..	1,806	1,984	1,744	1,932	1,927	2,126	91	98
October ..	1,936	2,464	2,206	2,285	2,376	2,165	109	100
November ..	1,671	1,939	2,424	2,354	1,936	2,264	100	105
December ..	1,776	1,796	2,018	2,304	2,245	2,026	98	94
Total ..	22,125	24,340	26,466	24,964	26,541	25,920	100	100



Imports of eggs tend to increase seasonally with Northern Hemisphere production until about May and thereafter to decline, although the variation, owing to shipments of Southern Hemisphere supplies, and of pickled and cold-stored European eggs during the winter months, is much less marked than in the case of home supplies and also less pronounced than a few years ago. On the other hand, home production has also undoubtedly tended to be more evenly spread throughout the year.

Table III shows the monthly imports in 1931 from the principal sources of supply. The groupings adopted are largely arbitrary, but to some extent they are in accordance with similarities in the class of egg.

TABLE III.—*Monthly Imports of Eggs into the United Kingdom during 1931.*

Month.	Irish Free State.	Denmark.	Netherlands, Belgium and France.	Australia, New Zealand and South Africa.	Poland, Egypt and China.	Other Countries.	Total.
	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.
January ..	220	573	457	125	561	143	2,079
February ..	350	375	488	4	375	116	1,708
March ..	546	490	552	—	349	91	2,028
April ..	769	670	452	—	283	57	2,231
May ..	694	646	583	—	394	109	2,426
June ..	607	646	582	—	299	216	2,350
July ..	478	772	610	—	262	201	2,323
August ..	303	799	697	—	322	173	2,194
September ..	217	695	598	42	422	152	2,126
October ..	191	795	348	332	277	222	2,165
November ..	109	579	356	506	469	245	2,264
December ..	91	508	382	507	395	143	2,026
Total ..	4,575	7,548	6,005	1,516	4,408	1,868	25,920

During the early months of 1931 imports were consistently lighter than a year earlier, chiefly as a result of reduced quantities from Poland, Belgium, France, China and Egypt. A relative increase was recorded in June, but total imports in the first six months of 1931

were 6 per cent. less than in the same period of 1930. European supplies thereafter showed an increase and in each month from June to September imports were on a heavier scale than a year earlier. A decline again occurred in October, partly attributable to exchange differences following the departure from the gold standard. A fairly substantial increase over the corresponding 1930 figure followed in November, but the 1930 figure had been exceptionally small. Imports in December were again less than in the same month of the previous year.

Total imports in the second half of 1931 were rather heavier than in the same period of 1930, although the last quarter's total, following the departure from gold, was smaller than in any year since 1927. As in each of the two preceding years, May was the month of heaviest importation, the smallest quantity being imported in February; in 1930 imported supplies were at a minimum in September.

#### COLD-STORED AND PRESERVED EGGS.

Tables II and III above do not accurately portray the periodicity in imported fresh egg supplies, as the United Kingdom trade returns do not differentiate between fresh eggs and those preserved by cold-storage or some method of pickling. The volume of eggs preserved or cold-stored in certain countries during the spring, for export in winter, is nevertheless of considerable importance. Few exporting countries make the distinction in their returns, but among those which do so are some of the principal countries of supply of preserved eggs. The bulk of these are shipped in the three months October to December, with considerably smaller quantities in January. In Table IV are shown the exports of fresh and preserved eggs (including cold-stored) to the United Kingdom in these four months of the 1931-32 season from the Netherlands, Denmark and the Irish Free State. Figures for the latter country relate to exports to all destinations, but the United Kingdom takes the bulk of the shipments.

Taking the figures for October to December only, it may be noted that during this period exports of preserved or cold-stored eggs from the Irish Free State accounted for about one-fifth of total egg exports, while exports of this type to the United Kingdom from the Netherlands and Denmark comprised 70 per cent. and 60 per cent. respectively of total egg exports to the United Kingdom. In the case of the Netherlands the greater proportion was cold-stored, but

the exports of preserved eggs from Denmark consist largely of eggs pickled in lime or other solution, although no distinction is made in the Danish returns. Other countries which send appreciable quantities of preserved, including cold-stored eggs, to the United Kingdom are Belgium, Poland and China; the small shipments of eggs from Canada and the United States are mainly cold-stored. In addition, appreciable quantities of eggs are preserved in this country, although no statistics of quantities are available.

TABLE IV.—*Exports of Fresh, Cold-stored and Preserved Eggs to the United Kingdom from certain Countries.*

	October, 1931.	November, 1931.	December, 1931.	January, 1932.	Total, 4 months.
<i>Netherlands.</i>	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Fresh .. ..	14.4	6.9	4.1	9.5	34.9
Cold-Stored .. ..	13.0	19.6	15.3	1.6	49.5
Preserved.. ..	3.0	3.0	4.1	2.0	12.1
Total .. ..	30.4	29.5	23.5	13.1	96.5
<i>Denmark.</i>	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.	000 Gt. hds.
Fresh .. ..	391.4	131.9	130.5	378.8	1,032.6
Cold-Stored .. ..	321.7	346.6	301.3	47.3	1,016.9
Preserved .. ..					
Total .. ..	713.1	478.5	431.8	426.1	2,049.5
<i>Irish Free State (a)</i>					
Fresh .. ..	161.9	61.0	68.4	130.6	421.9
Cold-Stored .. ..	19.8	30.1	25.7	7.2	82.8
Preserved .. ..					
Total .. ..	181.7	91.1	94.1	137.8	504.7

(a) Total exports.

An enquiry conducted by the Board towards the end of 1931 among the distributive trades in different parts of the country revealed wide differences, both as between one area and another, and among different shops in the same area, in the proportions of

fresh and preserved eggs sold during the winter months. An estimate, based on a moderate sample and subject to many reservations, places the proportion of fresh eggs, both home and imported, sold during the winter period, at about 40 per cent. of total sales, with cold-stored and preserved eggs (other than cold-stored) each accounting for approximately 30 per cent.

#### PRICES.

The general decline in the level of egg prices, which was apparent during 1930, was continued in 1931 and values, on the average, were 12 to 15 per cent. less than in 1930, or about the same proportionate drop as in the previous year. Over the two years, therefore, the fall in egg prices was rather less marked than the fall in butter and cheese.

There is a well-defined seasonal fluctuation in egg prices, which can generally be related to movements in home supplies. Home production usually increases rapidly until April or May, when prices for most descriptions, whether home or imported, touch their lowest point. Thereafter production declines throughout the summer and autumn, and prices show a corresponding increase, rising to a peak in October and November.

Egg prices in 1931 showed the usual seasonal variation. The year opened with prices only slightly less than a year earlier, but a rapid decline occurred during January. A recovery at the beginning of February was followed by a further seasonal decline, which was, however, much less pronounced than in the previous year, so that for one week at the beginning of March the 1930 figure was slightly exceeded. Whereas prices in 1930 were steady in March and April, in 1931 they declined throughout the earlier month to reach a low point about the middle of April, or a fortnight earlier than in the preceding year. At this period National Mark Specials were quoted about 11s. per 120 and were 1s. 6d. dearer than Danish 18 lb. Price changes in the following month were slight, but the tendency was gradually upwards with the level consistently under that of a year earlier. The peak in the case of National Mark and Continental eggs occurred about the second week in November, or fully three weeks later than in 1930. At their highest point National Mark Specials averaged 28s. per 120 and Danish 18 lb. 21s. 6d. At the beginning of November prices fully equalled the corresponding 1930 level, but the ensuing decline was more rapid than in 1930 and,

with increased home production following a spell of mild weather, prices at the end of 1931 were considerably less than a year earlier, particularly in the case of National Mark eggs.

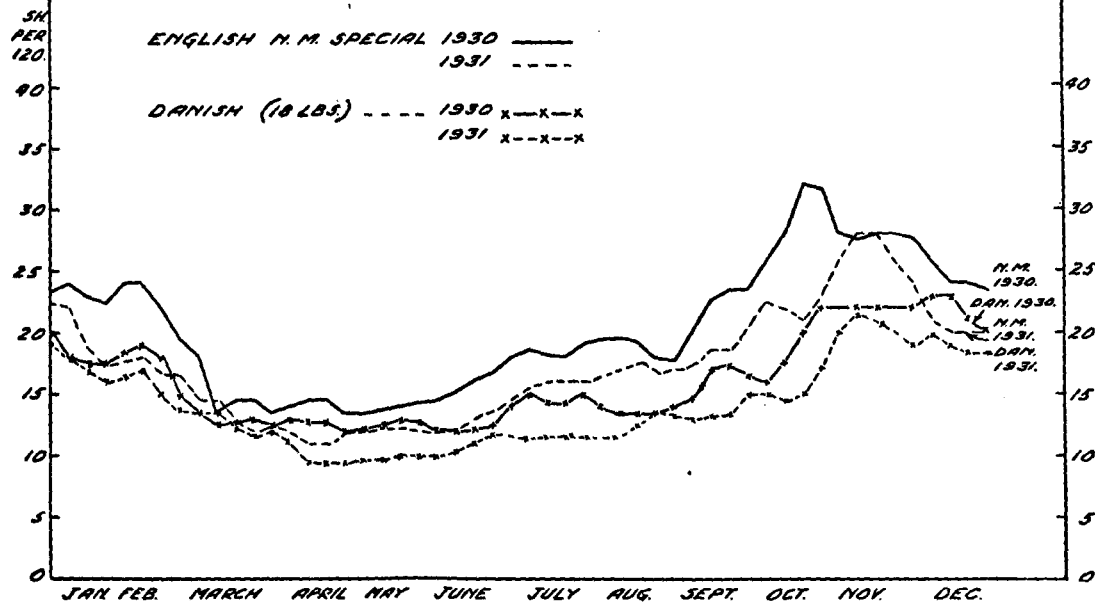
Prior to the introduction of the National Mark, the price of best quality home eggs seldom averaged more than the best imported and frequently ran slightly below the level of the latter. Since their introduction in the spring of 1929 National Mark eggs have been consistently higher in price than the highest grade imported descriptions, and this premium was maintained during 1931, although with increasing supplies the margin was rather less than in 1930. The actual price difference was least in March and April when supplies were greatest, and most marked during the period of relative scarcity in October and November.

Table V gives average monthly prices (unweighted) of National Mark Specials in 1930 and 1931, with corresponding figures for approximately comparable imported descriptions, namely, Danish 18 lb. and Dutch 18 lb. The prices are from the weekly quotations of the London Egg Exchange. Weekly quotations for National Mark Specials and Danish 18 lb. in 1930 and 1931 are shown graphically in fig. 4.

TABLE V.—Average Prices of Certain Eggs at London.

Month.	English N.M. Specials.		Danish 18 lb.		Dutch 18 lb.	
	1931.	1930.	1931.	1930.	1931.	1930.
	Per 120.	Per 120.	Per 120.	Per 120.	Per 120.	Per 120.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January .. .. .	20 2	23 3	17 6	18 3	17 6	19 2
February .. .. .	17 6	22 5	15 6	17 6	15 6	17 10
March .. .. .	13 4	14 7	12 7	12 11	12 11	13 10
April .. .. .	11 6	14 1	9 11	12 7	10 7	13 1
May .. .. .	12 2	13 11	9 11	12 7	10 11	13 6
June .. .. .	13 0	16 1	10 11	12 8	11 4	13 6
July .. .. .	16 11	18 4	11 5	14 7	12 3	15 0
August .. .. .	17 0	19 1	12 6	13 8	12 11	15 1
September .. .. .	18 9	21 5	13 3	15 10	15 0	17 7
October .. .. .	22 2	29 5	16 6	18 11	17 2	21 3
November .. .. .	26 5	27 11	20 4	22 0	22 10	24 6
December .. .. .	20 3	24 10	19 0	21 10	21 2	23 6
Average .. .. .	17 5	20 5	14 1	16 1	15 0	17 4

FIG 4. PRICES OF ENGLISH (NAT. MARK)  
AND DANISH EGGS AT LONDON.



The price-decline was not confined to the highest-grade eggs, but was also apparent in the medium and undergrade types, in spite of the reduction in imports of the latter. Table VI shows monthly average prices for certain other descriptions of eggs at London, also taken from the weekly quotations of the London Egg Exchange, except Irish Free State eggs, which are wholesale prices at Liverpool.

TABLE VI.—Average Monthly Prices of Eggs at London.

Month.	National Mark Standards.		Irish Free State Extra Selected. (a)		Danish 15½ lb.		Chinese 16-17 lb.		Polish 51-54 lb.	
	1931.	1930.	1931.	1930.	1931.	1930.	1931.	1930.	1931.	1930.
	Per 120	Per 120	Per 120	Per 120	Per 120	Per 120	Per 120	Per 120	Per 120	Per 120
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January	18 6	20 11	14 3	18 10	14 10	16 0	12 7	14 9	10 11	12 3
February	16 0	20 8	13 6	15 11	12 11	14 6	11 0	13 1	9 3	9 1
March ..	12 0	13 1	10 10	11 2	10 5	11 1	8 11	9 4	7 8	7 10
April ..	10 7	13 1	8 11	10 3	8 10	10 9	—	—	6 9	7 6
May ..	10 5	12 6	9 2	10 7	8 9	11 11	—	—	6 6	7 11
June ..	11 1	14 2	9 3	11 1	9 2	10 3	—	—	6 2	7 6
July ..	14 10	17 4	10 10	13 6	9 5	11 10	—	—	6 3	7 11
August ..	15 7	18 1	12 4	13 11	10 7	13 0	—	—	6 6	8 6
September	17 3	19 7	14 2	15 3	12 8	14 7	—	12 7	8 3	9 10
October ..	20 11	27 7	15 7	19 6	14 3	17 9	11 8	14 0	8 11	12 3
November	24 3	26 8	20 0	23 8	19 1	21 5	12 6	14 8	10 0	12 11
December	17 6	21 7	18 1	21 0	16 3	19 7	12 4	13 1	10 0	12 5
Average for Year.	15 9	18 9	13 1	15 5	12 3	14 5	—	—	8 1	9 8

(a) At Liverpool.

Farm eggs at country markets in England and Wales in 1931 were also on a lower level of prices than in 1930. The average price of first quality eggs at the markets quoted in the *Agricultural Market Report* was 1s. 5½d. per dozen, as compared with 1s. 9d. in 1930, or practically the same relative reduction as for imported supplies. Prices varied from 11½d. per dozen at the end of May to 2s. 5½d. in the two middle weeks of November; in 1930 the minimum price of 1s. 1½d. per dozen occurred at the beginning of May and the maximum of 2s. 8½d. at the beginning of November.

Table VII shows the average monthly prices of first quality English eggs at country provision markets in England and Wales in 1931. Similar figures are given for Scottish eggs at Glasgow, a consuming centre, and Aberdeen, a producing centre. It is not suggested that these figures are at all comparable, but it is of interest to note that the decline at the Scottish centres was slightly less marked than in England.

TABLE VII.—*Monthly Average Prices of First Quality English and Scottish Eggs.*

Month.	English Farm Eggs. (a)		Scottish Farm Eggs.			
			Glasgow.		Aberdeen.	
	1931.	1930.	1931.	1930.	1931.	1930.
	Per dozen.	Per dozen.	Per dozen.	Per dozen.	Per dozen.	Per dozen.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January .. .. .	1 9	1 11½	1 11½	2 6½	1 8½	2 1½
February .. .. .	1 5½	1 10¼	1 8½	2 2½	1 6½	1 10½
March .. .. .	1 2	1 3	1 4	1 3½	1 3	1 1½
April .. .. .	1 0	1 2	1 0½	1 1	0 11½	1 1½
May .. .. .	0 11½	1 1½	1 0½	1 2½	0 11½	1 2
June .. .. .	1 0½	1 3½	1 1½	1 3½	0 11	1 2½
July .. .. .	1 3½	1 7	1 3½	1 5½	1 1½	1 2½
August .. .. .	1 5½	1 8½	1 7	1 7½	1 4½	1 7½
September .. .. .	1 6½	1 9½	1 8½	1 10½	1 7	1 7½
October .. .. .	1 11	2 4½	2 1½	2 3½	1 9½	2 1
November .. .. .	2 4½	2 7	2 9½	2 11	2 4½	2 7
December .. .. .	1 8½	2 2½	2 4½	2 6	2 3½	2 3½
Average for Year.. ..	1 5½	1 9	1 8½	1 10½	1 6	1 8

(a) At Representative Country Provision Markets.

#### IMPORTS OF EGG PRODUCTS.

In addition to the imports of eggs in shell there is a very large import trade in eggs not in shell, mainly from China. A proportion, varying from about 7 per cent. to over 20 per cent., is annually



re-exported, but retained imports of these egg products in 1931 amounted to approximately 743,000 cwts., or the equivalent of about 8½ million great hundreds of eggs.

By far the most important group given separately in the Trade Returns is that comprising liquid or frozen eggs (whole, yolk or white). Imports showed little variation in post-war years up to 1925, but the average over the three following years increased by one-third. Further marked increases occurred in 1929 and 1930, but the 1931 figures of gross imports showed a fall of 6 per cent. compared with 1930, although larger than in any other recent year. Re-exports were also reduced, and the decline in retained imports was little more than 2 per cent.

China is the principal source of imports of this class of egg product, supplying an average of nearly 99 per cent. of the total in the past five years. Empire supplies are practically non-existent, although it is of interest to note that in the past Southern Hemisphere egg season Australia exported to the United Kingdom egg pulp equal to 127,708 great hundreds of eggs. The bulk of this quantity, arriving towards the end of the season, is not included in the import returns for 1931.

The following table shows the imports and re-exports of frozen eggs in each of the seven years, 1925 to 1931.

TABLE I.—*Imports of Liquid and Frozen Eggs (Whole, Yolk or White) into the United Kingdom.*

Country whence consigned.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
China .. .. .	554	664	628	639	741	817	764
Other Countries ..	12	7	12	13	7	6	10
Total .. .. .	566	671	640	652	748	823	774
<i>Re-exports</i> ..	121	126	40	90	108	82	52
Net Imports ..	445	545	600	562	640	741	722

Imports of albumen as such, also mainly from China, are relatively of much less importance, but increased slightly in 1931.

Imports of dried eggs (except albumen) are also comparatively small and a considerable proportion is re-exported. China is again the principal source.

Tables II and III show the imports of albumen and of dried eggs (except albumen) respectively, during each of the past seven years.

TABLE II.—*Imports of Albumen into the United Kingdom.*

Country whence consigned.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
China .. .. .	28.1	20.1	13.0	15.5	18.7	14.9	17.3
Other Countries.. ..	1.0	0.6	1.2	0.5	0.3	0.7	0.8
Total .. .. .	29.1	20.7	14.2	16.0	19.0	15.6	18.1
<i>Re-exports</i> .. ..	2.7	2.7	3.1	2.8	1.8	1.0	2.3
Net Imports .. ..	26.4	18.0	11.1	13.2	17.2	14.6	15.8

TABLE III.—*Imports of Dried Eggs (except Albumen) into the United Kingdom.*

Country whence consigned.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
China .. .. .	18.6	24.7	22.9	14.6	14.1	12.4	8.0
Other Countries .. ..	1.1	1.1	1.0	0.6	0.6	0.4	0.3
Total .. .. .	19.7	25.8	23.9	15.2	14.7	12.8	8.3
<i>Re-exports</i> .. ..	12.7	7.1	9.7	8.0	5.9	3.5	3.3
Net Imports .. ..	7.0	18.7	14.2	7.2	8.8	9.3	5.0

Imports of egg products, unlike those of eggs in shell, do not show any marked seasonal variation, although supplies tend to be heavier in the second half of the year. During the past five years about three-fifths of the imports, on the average, were received in the second six months, but this tendency was less marked in 1931, when supplies were more evenly spread throughout the year.

Aggregate monthly imports of all classes of egg products in each of the seven years 1925-1931 are given in Table IV.

TABLE IV.—*Monthly Imports of Egg Products.*

Month.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	20	68	45	36	38	61	36
February .. .. .	20	25	49	60	19	33	50
March .. .. .	5	57	75	52	54	39	45
April .. .. .	43	25	64	17	37	36	67
May .. .. .	45	23	30	51	47	21	83
June .. .. .	48	133	50	78	44	97	77
July .. .. .	111	67	60	61	46	100	93
August .. .. .	58	99	103	68	132	95	85
September .. .. .	97	96	72	23	132	80	41
October .. .. .	25	42	71	186	14	138	57
November .. .. .	102	23	32	25	160	70	89
December .. .. .	41	60	27	26	59	81	78
Total .. .. .	615	718	678	683	782	851	801

#### PRICES.

Average declared values of the imports of egg products from China show that, following a general decline of 11 to 12 per cent. for all classes in 1930, liquid and dried eggs dropped only slightly in 1931, but albumen declined by about 29 per cent. compared with 1930.

Average values of the different classes of egg products from China, as declared by the Customs, are given in Table V for the seven years, 1925 to 1931.

TABLE V.—Average Declared Value of Egg Products Imported from China into the United Kingdom.

Year.	Frozen or Liquid (whole, yolk or white)	Albumen.	Dried (except albumen).
	Per cwt. £	Per cwt. £	Per cwt. £
1925 .. ..	4.4	18.7	15.2
1926 .. ..	4.4	18.7	10.1
1927 .. ..	4.4	18.7	11.8
1928 .. ..	4.4	13.7	12.5
1929 .. ..	4.2	14.4	14.2
1930 .. ..	3.7	12.7	12.6
1931 .. ..	3.4	9.0	12.0

#### IMPORTS OF POULTRY.

Of the poultry consumed annually in the United Kingdom, the greater part is home-produced. The increase in poultry stocks in recent years, although perhaps directed more towards egg production, has naturally led to heavier supplies of poultry being available for food. Imports have also increased at a rapid rate and, at a broad estimate, the total consumption of poultry (fowls, ducks, geese and turkeys) in the United Kingdom in 1931 was about 5 lb. per head, representing nearly 60 million birds. Of this total, it is estimated that over 70 per cent. were produced in Great Britain and Northern Ireland, and less than 30 per cent. were imported.

Imports of poultry (dead) into the United Kingdom have shown considerable expansion in the past three years, and the 1931 total was the largest ever recorded, exceeding the figure for 1930, the previous record year, by nearly 97,000 cwts., or 17 per cent. No differentiation is made in the import returns between the different kinds of poultry imported, but there is little doubt that fowls constitute the greatest proportion, with turkeys occupying second place.

A major cause of the increase in total imports has been the re-entry of Russia, which was by far the principal source in pre-war years. Supplies were restricted for several years after the war, but expanded rapidly from 1928 onwards, until, in 1930, Russia supplanted the Irish Free State as the chief source of imported supplies by weight. Russian

supplies increased by a further 45 per cent. in 1931 as a result of increased shipments towards the end of the year, and represented 27 per cent. of total imports. Supplies from Hungary have likewise shown a considerable increase in recent years and the 1931 figure was 38 per cent. greater than in 1930, due chiefly to the increased shipments in December. Imports from the Irish Free State increased steadily to a peak in 1929, but have since tended downwards and in 1931 were 6 per cent. less than in the previous year. Supplies from the Netherlands, received mainly in the summer months when imports as a whole are light, have grown steadily in the past few years and increased by a further 13 per cent. in the year under review. Imports from France were slightly greater than in 1930, but smaller than in other recent years; imports from Austria and Italy were lighter than in the previous year. Latvia until 1929 was an important factor on the market, occasionally figuring as the chief foreign source of imported poultry, but supplies from that country were entirely absent in 1931. Slightly increased quantities were received from the United States, although these were well below the level both of 1913 and of the immediate post-war years; imports from Argentina were double the 1930 figure. Other features of interest were relatively large increases in imports from Germany and Poland.

Empire supplies are largely confined to those of Irish Free State origin, although moderate quantities were imported from Australia in the past year. Imports from all Empire countries in 1931 constituted 17 per cent. of total imports as against 20 per cent. in 1930.

There is a small re-export trade in dead poultry, but re-exports in 1931, totalling 13,237 cwts., were about 2,000 cwts. less than in 1930.

Table I gives details of the imports of poultry (dead) into the United Kingdom in 1913, and the five years 1927 to 1931.

Apart from the countries listed in the table, large quantities of poultry are imported from Northern Ireland to Great Britain. No particulars of these imports are available, but returns issued by the Ministry of Commerce for Northern Ireland indicate that during 1931, 128,284 cwts. of poultry were exported through Northern Ireland ports, as against 124,801 cwts. in 1930.

TABLE I.—Imports of Poultry (Dead) into the United Kingdom.

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Irish Free State .. ..	(a) 112·3	112·3	106·4	126·9	115·7	109·1
Union of South Africa ..	(b) 0·3	1·4	2·0	1·2	—	0·2
Canada .. .. .	0·3	0·5	1·6	1·0	0·6	0·5
Australia .. .. .	(b) 0·4	0·8	—	—	—	2·5
Other Empire Countries	—	—	—	0·1	—	—
Russia .. .. .	119·9	22·4	61·1	121·9	126·4	182·7
Hungary .. .. .	26·7	33·9	40·9	44·4	85·7	118·2
Austria .. .. .	26·7	50·6	31·4	34·8	53·5	48·7
Netherlands .. .. .	(c) 19·6	19·6	24·1	30·7	43·9	49·7
France .. .. .	31·2	76·2	70·7	65·1	37·2	38·5
Yugo-Slavia .. .. .	(c) 3·2	3·2	5·8	7·7	25·5	24·9
Italy .. .. .	19·7	29·3	21·7	20·0	14·7	13·5
Belgium .. .. .	1·9	22·3	21·0	16·2	10·1	10·2
Poland .. .. .	(c) —	—	—	—	0·3	6·8
Norway .. .. .	(c) —	1·1	1·1	2·1	2·6	3·6
Czecho-Slovakia .. .. .	(c) —	0·3	0·8	7·8	15·0	2·3
Latvia .. .. .	—	76·9	71·5	43·5	8·2	—
Bulgaria .. .. .	(c) —	—	—	—	0·4	1·1
Switzerland .. .. .	(c) —	9·4	4·4	2·5	—	—
Germany .. .. .	(c) —	1·2	1·5	1·0	4·7	16·7
Roumania .. .. .	(c) —	—	—	—	—	0·9
United States of America	54·2	34·3	19·0	9·7	13·3	14·1
Argentina .. .. .	(c) —	5·2	3·5	4·0	5·2	10·4
Uruguay .. .. .	(c) —	1·2	0·8	0·2	1·9	2·9
China .. .. .	20·0	3·2	0·1	12·9	4·0	7·2
Other Foreign Countries..	4·1	0·4	0·8	0·5	1·0	2·1
Total Empire Countries ..	0·7	115·0	110·0	129·2	116·3	112·3
Total Foreign Countries ..	277·7	390·7	380·2	425·0	453·6	554·5
Total All Countries ..	278·4	505·7	490·2	554·2	569·9	666·8
Re-exports .. .. .	9·9	12·4	21·4	20·6	15·2	13·2
Net Imports .. .. .	268·5	493·3	468·8	533·6	554·7	653·6

(a) Not separately distinguished before April, 1923.

(b) Included in Other Empire Countries.

(c) Included in Other Foreign Countries.

*Seasonal Variation.*—December is by far the month of largest import for dead poultry and 37 per cent. of the total imports in 1931 were entered during this month, as compared with 31 per cent. in 1930. Imports are always lightest in summer, although there has been some slight tendency towards a more even distribution throughout the year. Imported supplies in 1931 were smallest in July, or one month later than in 1930.

Monthly imports of dead poultry in 1913, 1924 and 1927 to 1931 are given in Table II.

TABLE II.—*Monthly Imports of Poultry (Dead) into the United Kingdom.*

Month.	1913.(a)	1924.	1927.	1928.	1929.	1930.	1931.
	000	000	000	000	000	000	000
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. ..	44	11	56	61	79	76	61
February .. ..	65	21	38	32	28	61	60
March .. ..	42	17	45	52	38	48	60
April .. ..	11	23	30	33	59	37	30
May .. ..	4	26	23	19	35	28	37
June .. ..	2	5	10	15	10	9	19
July .. ..	1	15	8	11	9	12	15
August .. ..	8	9	7	11	13	14	20
September .. ..	6	7	13	11	12	20	21
October .. ..	2	10	23	20	21	36	38
November .. ..	5	14	35	33	37	50	60
December .. ..	88	125	218	192	213	179	246
Total .. ..	278	283	506	490	554	570	667

(a) Excluding imports from the Irish Free State.

Monthly imports of dead poultry during 1931, by country or group of countries of despatch, are shown in Table III. European supplies are heaviest in December, and in winter months generally, although Dutch supplies are more evenly spread throughout the year. The United States does not figure on the December market.

TABLE III.—*Monthly Imports of Poultry (Dead) into the United Kingdom during 1931.*

Month.	Irish Free State.	Netherlands, Belgium, France.	Austria and Hungary.	Russia.	United States of America and Argentina.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January	10·1	8·1	24·2	3·3	0·8	14·5	61·0
February	6·2	4·0	11·6	31·7	2·0	4·2	59·7
March ..	5·4	3·7	5·9	35·0	2·2	7·8	60·0
April ..	3·6	3·5	0·9	9·7	3·2	9·3	30·2
May ..	2·2	3·4	0·5	24·1	4·1	3·2	37·5
June ..	2·9	4·4	—	9·6	1·2	0·6	18·7
July ..	3·1	7·6	0·6	0·5	1·9	1·2	14·9
August ..	3·5	9·2	1·6	0·5	3·8	1·4	20·0
September	4·6	8·6	3·0	1·4	2·2	1·4	21·2
October ..	7·4	7·2	13·8	4·5	1·8	3·2	37·9
November	11·1	5·1	27·7	8·9	1·3	5·9	60·0
December	49·0	33·6	77·1	53·5	—	32·5	245·7
Total ..	109·1	98·4	166·9	182·7	24·5	85·2	666·8

#### LIVE POULTRY.

In addition to dead poultry, considerable numbers of live poultry are also imported. These have shown a downward tendency, although the 1931 figure was 5 per cent. above that of 1930. The bulk of the supplies comes from the Irish Free State, which accounted for 92 per cent. of the total in 1931; increased numbers from this source were responsible for the heavier total imports. Imports from Continental countries, especially Belgium, France and Italy, were once of considerable importance but have fallen off rapidly in recent years, declining still further in 1931.

Imports of live poultry are not subject to the same seasonal variation as dead poultry. Supplies are normally light from April to June, thereafter increasing to a maximum in the three months September to November. December imports, although still fairly heavy, show a decline, which continues in the following months.



Table IV shows the imports into the United Kingdom of live poultry from the principal sources in the eight years, 1924 to 1931, and Table V monthly imports in each of the seven years 1925 to 1931.

TABLE IV.—*Imports of Live Poultry into the United Kingdom.*

Year.	Countries whence consigned.				
	Irish Free State.	Belgium.	Italy.	Other Countries.	Total.
	000's.	000's.	000's.	000's.	000's.
1924 .. ..	1,128	106	153	18	1,405
1925 .. ..	1,074	117	58	16	1,265
1926 .. ..	1,126	138	26	16	1,306
1927 .. ..	1,105	172	29	16	1,322
1928 .. ..	1,021	128	25	8	1,182
1929 .. ..	1,073	109	6	16	1,204
1930 .. ..	971	105	3	13	1,092
1931 .. ..	1,055	(a)	(a)	90	1,145

(a) Included in Other Countries.

TABLE V.—*Monthly Imports of Live Poultry.*

Month.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
	000's.	000's.	000's.	000's.	000's.	000's.	000's.
January ..	94	101	109	93	88	95	97
February ..	91	119	88	100	98	82	89
March .. ..	90	111	131	93	80	88	81
April .. ..	63	67	91	73	75	52	44
May .. .. .	58	35	62	50	44	53	38
June .. .. .	63	68	74	56	54	48	42
July .. .. .	107	92	95	90	80	70	81
August .. .	125	124	96	115	119	99	106
September ..	143	155	133	124	159	119	128
October .. .	164	168	153	133	165	152	150
November ..	144	142	162	139	123	128	179
December ..	123	124	128	116	119	106	110
Total .. .	1,265	1,306	1,322	1,182	1,204	1,092	1,145

PRICES.

There is a well-defined seasonal variation in fowl and duck prices. From a fairly low level in January, prices for fowls increase to a peak in April and May; thereafter there is a downward movement until November, but a slight rise in December. Duck prices move in a somewhat similar manner except that the peak occurs rather earlier, prices commencing to fall by May.

The usual seasonal movement occurred in 1931, prices on the average being rather lower than in 1930, although the decline was much less pronounced than in most other food commodities; in December, prices were fully up to the previous year's level. Table VI gives average monthly wholesale prices of certain descriptions of chicken and duck during 1930 and 1931, as quoted in the *Agricultural Market Report*.

TABLE VI.—*Monthly Average Prices of Certain Classes of Poultry.*

Month.	British Chicken (a) (1st quality).		Irish Free State Chicken (b) (1st quality).		British Ducklings (a) (1st quality).	
	1931.	1930.	1931.	1930.	1931.	1930.
	Per lb. s. d.	Per lb. s. d.	Per lb. s. d.	Per lb. s. d.	Per lb. s. d.	Per lb. s. d.
January .. .. .	1 7	1 7	1 1½	1 3	1 2	1 3
February .. .. .	1 8	1 8	1 2½	1 3	1 3	1 6
March .. .. .	1 10	1 9½	1 3½	1 3	1 5½	1 7
April .. .. .	2 0	2 0	1 4	1 4	1 8	1 10½
May .. .. .	2 0	2 0	1 4½	1 4	1 7½	1 6
June .. .. .	1 10	1 11½	1 3	1 4	1 3½	1 4½
July .. .. .	1 8	1 9	1 1½	1 3	1 3	1 2
August .. .. .	1 5½	1 6	1 0	1 1	0 11½	1 1½
September .. .. .	1 5	1 5	1 0	1 0	0 10½	1 0½
October .. .. .	1 4	1 4½	1 0	0 11½	0 9½	0 11
November .. .. .	1 4	1 4	1 0	0 11	0 9½	0 10½
December .. .. .	1 5	1 5	1 0½	0 11½	0 11	1 0
Average for Year ..	1 7½	1 8	1 1½	1 2	1 2	1 3

(a) At London.

(b) At Bristol.

TABLE VII.—*Smithfield Quotations for First Quality Poultry on Tuesdays during December.*

Date.	Chicken.					
	English Surrey.		Dutch White.		Belgian.	
	1931.	<i>Same Day 1930.</i>	1931.	<i>Same Day 1930.</i>	1931.	<i>Same Day 1930.</i>
	Per lb. s. d.	<i>Per lb. s. d.</i>	Per lb. s. d.	<i>Per lb. s. d.</i>	Per lb. s. d.	<i>Per lb. s. d.</i>
1st December .. ..	1 4	1 4	1 3	1 3	1 3	1 4
8th December .. ..	1 5	1 5	1 3	1 3	1 4	1 4
15th December .. ..	1 7	1 6	1 3	1 5	1 4	1 6
22nd December .. ..	1 7	1 6	1 4	1 5	1 5	1 7
29th December .. ..	1 6	1 6	1 3	1 5	1 5	1 7

Date.	Turkeys.						Geese.	
	English.		Irish.		Hungarian.		English.	
	1931.	<i>Same Day 1930.</i>	1931.	<i>Same Day 1930.</i>	1931.	<i>Same Day 1930.</i>	1931.	<i>Same Day 1930.</i>
	Per lb. s. d.	<i>Per lb. s. d.</i>	Per lb. s. d.	<i>Per lb. s. d.</i>	Per lb. s. d.	<i>Per lb. s. d.</i>	Per lb. s. d.	<i>Per lb. s. d.</i>
1st December .. ..	—	—	—	1 2	—	0 8½	0 9½	0 9
8th December .. ..	—	—	—	1 1	—	0 8½	0 9½	0 10
15th December .. ..	—	1 6	1 6	1 2	1 1	0 11	1 0	0 11
22nd December .. ..	2 0	1 9*	1 8	1 7*	1 3	1 2*	1 0	1 1
29th December .. ..	—	—	—	—	—	1 2	0 9½	1 2

\* Prices as on Monday, 22nd December, 1930.

Table VII shows the top prices for certain descriptions of poultry as quoted on the London Central Markets in each Tuesday during December 1931, in comparison with prices for the corresponding Tuesday in 1930. The figures are intended merely to serve as an indication of the trade when supplies are greatest. Turkeys were in relatively short supply and quotations exceeded those of a year earlier.

### THE BACON MARKET IN 1931.

#### SUPPLIES.

Coincident with the expansion of the dairy industry, pig-breeding in certain European countries has shown a marked development in recent years, having in many cases as its main objective the shipping of the final product to the United Kingdom market in the form of bacon. In addition to the continuation of this more regular upward movement, the year 1931 appears to have witnessed the peak of the present "pig-cycle" in certain of the main European producing countries. Supplies of bacon, as a consequence, were on an unprecedented scale, the total quantity imported into the United Kingdom during the twelve months amounting to 11,137,829 cwts., an increase of about 1,950,000 cwts., or 21 per cent., compared with 1930, which was itself a record year. Compared with the average for the five years 1925 to 1929, imports showed an increase of 37 per cent. and were more than twice as heavy as the 1909-13 average.

Home production of bacon represents a comparatively small proportion of the total quantity consumed in the United Kingdom. Details of production are not available later than for 1924, when factory output of bacon and hams in the United Kingdom was returned at 2,231,000 cwts. Of this quantity nearly 300,000 cwts. were not separately distinguished, but some 1,559,000 cwts. (81 per cent.) of the remainder consisted of bacon. This figure, however, included 515,000 cwts. of bacon purchased in the green state and processed in factories in this country, the bulk being imported produce. There was thus a net factory output from home-produced pigs of something over one million cwts., to which should be added the quantity of pigs cured on farms and by retailers, etc., details of which are not available. Although no information is available regarding the trend of home production in later years, it is obvious that imports alone are sufficient to account for a consumption of bacon in 1931 greater than in any previous year.

*Sources of Supply.*—Increased shipments from European countries are mainly responsible for the increase in bacon imports.

Supplies from Denmark constitute by far the largest item on the United Kingdom bacon market. Imports from this source, although subject to minor cyclical movements, have shown a pronounced increase and during 1931 were 20 per cent. greater than in 1930, thereby establishing a further record and accounting for practically two-thirds of total bacon imports, or about the same proportion as in the previous year. The increase in imports of bacon from Poland during the past four years has been a notable feature of the supply position and, with the 1931 figure more than double the previous year's total, that country displaced the Netherlands as the next most important source of supply to Denmark. Imports from the Netherlands increased by 19 per cent. to approximately a million cwts., but did not quite attain to the high level established in 1928. Supplies of Swedish bacon, which in 1930 were 45 per cent. greater than in 1929, increased by only a further 5 per cent. in the year under review. Perhaps the most remarkable development in the past two years has been in imports of bacon from Lithuania, which increased from 5,000 cwts. in 1929 to over 362,000 cwts. in 1931 and resulted in Lithuania occupying fifth place in the list of supplying countries.

In the five years 1909 to 1913 the United States of America supplied nearly two-fifths of the total bacon imports of the United Kingdom and was the principal source in the immediate post-war period. Since then imports have fallen off continuously and in 1931, at 189,000 cwts., were only about two-fifths of the 1930 figure. Russia has ceased to figure as a main source of imported bacon, and imports from that country in 1931 were only half as heavy as a year earlier. Among other imported supplies from foreign countries in 1931 considerable increases occurred in shipments from Estonia, Finland, Germany and Argentina, but much smaller quantities were recorded from Latvia and Hungary.

Empire supplies have represented only a small part of total imports of bacon in recent years and the proportion has been declining steadily. Imports from the Irish Free State in 1931 were 10 per cent. less than in 1930 and the smallest since separate returns have been available; they were, in fact, less than the quantity of imported bacon re-exported from the United Kingdom to the Irish Free State. Imports from Canada were at one time of considerable importance, but have declined continuously from over 1½ million

cwts. in 1925 to under 50,000 cwts. in 1931. Total Empire supplies declined by nearly 20 per cent. in 1931 and comprised only 3 per cent. of total imports as against 5 per cent. in 1930 and 23 per cent. in 1925.

TABLE I.—Imports of Bacon into the United Kingdom.

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Irish Free State .. .. .	(a)	451	555	497	331	297
Canada .. .. .	244	503	307	199	99	50
Australia .. .. .	(d)	—	1	—	2	1
Other Empire Countries .. .. .	6	2	—	—	1	—
Denmark .. .. .	2,335	5,091	5,376	4,977	6,118	7,339
Poland .. .. .	(b)	116	118	305	483	1,077
Netherlands .. .. .	186	797	1,061	902	842	1,001
Sweden .. .. .	62	474	441	380	550	578
Lithuania .. .. .	(c)	2	2	5	73	363
Finland .. .. .	(c)	—	—	—	5	35
Estonia .. .. .	(c)	50	41	25	25	65
Russia .. .. .	212	114	197	209	50	29
Latvia .. .. .	(c)	164	145	67	47	31
Germany .. .. .	(e)	24	21	5	17	29
Hungary .. .. .	(e)	—	—	6	24	1
United States of America .. .. .	1,803	641	538	635	479	189
Argentina .. .. .	(e)	51	49	58	38	50
Other Foreign Countries .. .. .	11	2	1	8	7	3
Total Empire Countries .. .. .	250	956	863	696	433	348
Total Foreign Countries .. .. .	4,609	7,526	7,990	7,582	8,758	10,790
Total All Countries .. .. .	4,859	8,482	8,853	8,278	9,191	11,138
<i>Re-exports :—</i>						
<i>Irish Free State .. .. .</i>	(a)	334	297	307	307	333
<i>Other Empire Countries .. .. .</i>	38	25	26	28	27	} 62
<i>Foreign Countries .. .. .</i>	71	30	26	16	23	
Total Re-exports .. .. .	109	389	349	351	357	395
Net Imports .. .. .	4,750	8,093	8,504	7,927	8,834	10,743

- (a) Not separately distinguished before April, 1923.  
 (b) Included in Russia, Germany and Austria-Hungary.  
 (c) Included in Russia.  
 (d) Included in Other Empire Countries.  
 (e) Included in Other Foreign Countries.

Exports of imported bacon in 1931 amounted to 394,732 cwts., or 37,556 cwts. more than in 1930. The bulk of the re-exports are shipped to the Irish Free State, which took 84 per cent. of the total in 1931.

Table I opposite gives details of the gross and net imports of bacon into the United Kingdom in 1913, and the five years 1927 to 1931.

As with butter, the country whence bacon is consigned is nearly always also the country of origin. Here again, however, the principal discrepancy relates to Sweden. The quantity consigned from that country in 1931 amounted to 578,423 cwts., whereas, according to returns obtained by the Board of Trade, imports of bacon of Swedish origin comprised 593,239 cwts. Shipments of Danish origin amounted to 7,324,846 cwts., but the quantity consigned from Denmark totalled 7,339,095 cwts. and so probably included some bacon of Swedish origin. The only other cases where significant differences obtained referred to the United States of America and Canada, but the discrepancies were of no great magnitude.

*Seasonal Variation.*—Table II shows the monthly imports of bacon into the United Kingdom in 1913, and the five years 1927 to 1931.

TABLE II.—*Monthly Imports of Bacon into the United Kingdom.*

Month.	1913.	1927.	1928.	1929.	1930.	1931.
	000	000	000	000	000	000
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January .. ..	350	673	735	786	668	851
February .. ..	367	624	760	612	658	890
March .. ..	427	736	777	615	756	834
April .. ..	460	636	748	653	671	888
May .. ..	405	684	793	784	755	965
June .. ..	379	789	771	642	744	974
July .. ..	445	751	707	717	763	943
August .. ..	424	665	776	735	757	951
September .. ..	376	716	641	656	788	946
October .. ..	417	764	736	646	855	974
November .. ..	374	711	708	668	771	941
December .. ..	434	733	701	764	1,005	981
Total .. ..	4,858	8,482	8,853	8,278	9,191	11,138

Imports of bacon show no definite seasonality, the variation from month to month, over a period of years, being comparatively small. Increasing supplies towards the end of the year 1930 culminated in a record quantity of over one million hundredweights being imported in December. Throughout 1931 supplies were on a consistently greater scale than a year earlier, until December, when imports, although heavier than in any earlier month of the year, were 2 per cent. below the large December, 1930, figure. Imports in 1931 were lightest in March, or a month later than in 1930.

Table III shows the monthly imports of bacon from the principal sources during 1931. Nearly half of the Canadian supplies were imported in the last two months of the year.

TABLE III.—*Monthly Imports of Bacon into the United Kingdom during 1931.*

Month.	Irish Free State.	Canada.	Denmark.	Netherlands and Sweden.	Russia and Baltic Countries. (a)	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January ..	20	1	597	102	101	30	851
February ..	16	—	600	128	116	30	890
March ..	17	2	585	119	85	26	834
April ..	17	2	564	152	123	30	888
May ..	16	2	600	179	142	26	965
June ..	17	3	591	172	167	24	974
July ..	23	2	613	151	128	26	943
August ..	32	—	608	171	118	22	951
September ..	38	5	606	148	110	39	946
October ..	39	8	635	121	150	21	974
November ..	34	11	648	76	157	15	941
December ..	28	14	692	60	167	21	981
Total ..	297	49	7,339	1,579	1,564	310	11,138

(a) Poland, Estonia, Latvia, Lithuania.

#### PRICES.

The large volume of supplies in 1931 was accompanied by a drastic decline in prices, which in certain periods of the year were below the pre-war level. Average prices for imported bacon were from 33 per cent. to 36 per cent. lower than in 1930, following a decline of about 15 to 16 per cent. between 1929 and 1930. Danish



weekly killings have, in the past few years, exercised a major effect in determining the course of prices on the United Kingdom market. Owing to a number of factors, including the abnormal nature of supplies and the growing part played by other Continental countries, this relationship was hardly so pronounced in 1931, particularly during the summer months, but Continental killings as a whole remain one of the major factors in influencing prices.

Prices, which declined slightly towards the end of January, remained steady in February and thereafter tended to increase to a maximum which was maintained from the latter half of April until the beginning of May. A rapid decline then set in and in the middle of June prices were only about one-half what they were a year earlier. An upward movement commenced at the end of June and continued until the third week in August, when a further decline commenced. This was partly arrested by conditions consequent on the departure from the gold standard, but heavy killings in Denmark in the last three months of the year caused a revival of the downward movement, values about the middle of November touching their lowest point for many years. From then until the end of the year little change occurred.

Average monthly prices of certain descriptions of bacon in 1931 and 1930 are shown in Table IV (on page 74). The figures, except for British Wiltshire bacon, are taken from the weekly quotations of the London Provision Exchange and represent the highest average of a series. The range of quotations within each grade is comparatively small, except for Irish Lean Sizeable, where the range may be as great as 20s. Prices for British Wiltshire (green) bacon refer to wholesale prices on the Bristol market, and, being for a high quality product with a limited market, are not comparable with prices of imported descriptions.

#### PROSPECTS FOR FUTURE SUPPLIES OF BACON.

As already indicated, the pig population in most European countries in 1931 showed an advance on the 1930 figures. The resultant increase in bacon supplies to the United Kingdom in 1931 was carried into 1932, when imports in the first quarter were 18 per cent. above the large figure for the same period in 1931.

TABLE IV.—Average monthly Prices of Bacon at London.

Month.	British Wiltshire Green*.		Irish Free State Lean Sizeable.		Danish No. 1 Sizeable.	
	1931.	1930.	1931.	1930.	1931.	1930.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January .. .. .	114 9	142 9	102 6	130 0	66 6	111 0
February .. .. .	120 0	146 0	104 6	135 0	64 0	112 0
March .. .. .	109 6	148 0	101 6	138 0	68 6	112 0
April .. .. .	106 0	146 0	102 0	138 0	78 0	112 0
May .. .. .	106 3	132 0	98 6	115 6	68 0	100 0
June .. .. .	90 6	124 6	91 6	114 0	57 6	103 0
July .. .. .	86 9	117 0	90 0	101 6	65 6	93 6
August .. .. .	93 0	122 0	89 3	104 0	73 0	94 0
September .. .. .	87 6	113 3	80 6	97 3	63 0	83 0
October .. .. .	79 3	108 6	82 3	98 0	60 6	71 6
November .. .. .	75 6	110 0	75 6	102 0	51 0	75 0
December .. .. .	78 9	105 3	70 0	98 9	48 6	68 6
Average for year ..	95 9	126 3	90 9	114 3	63 9	94 6

Month.	Polish No. 1 Sizeable.		Dutch No. 1 Sizeable.		Swedish No. 1 Sizeable.	
	1931.	1930.	1931.	1930.	1931.	1930.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January .. .. .	55 0	96 0	62 0	105 6	62 6	107 3
February .. .. .	49 0	94 6	57 0	105 0	58 3	107 6
March .. .. .	55 6	97 0	61 0	106 0	64 3	108 0
April .. .. .	58 6	93 0	67 0	104 0	73 6	108 0
May .. .. .	46 0	84 6	56 6	93 0	58 0	96 6
June .. .. .	41 0	84 6	49 0	97 0	50 9	100 0
July .. .. .	53 6	75 0	59 0	87 0	59 6	90 6
August .. .. .	61 0	78 0	66 0	86 0	69 0	91 0
September .. .. .	51 6	71 0	56 6	77 0	58 9	79 0
October .. .. .	51 0	62 6	56 6	68 6	57 9	68 3
November .. .. .	42 0	64 0	47 0	69 0	48 3	71 9
December .. .. .	41 0	56 0	45 6	62 0	46 6	64 9
Average for year ..	50 6	79 9	57 0	88 3	59 0	91 0

\* Average wholesale price at Bristol.

In the countries comprising the United Kingdom the increase in the pig population in 1931 amounted to 19 per cent., shared by all classes, and the total figure was the highest since 1928. The movement of fat and store pigs to markets was greater than a year previously, the increase being continued in 1932; but no figures are available regarding the proportions intended for bacon and pork, and the relative profitableness of the two trades must remain an important factor in deciding home supplies of bacon in the current year. The number of pigs in the Irish Free State in 1931 was 17 per cent. greater than in 1930, but there has been a tendency for an increasing proportion of the output to be marketed as pork, and imports of bacon from the Irish Free State during 1931 and the first few months of 1932 were on a reduced scale. Recent legislative measures suggest that a greater proportion of the bacon produced in the Irish Free State in the immediate future will be absorbed in that country.

Denmark, which plays the most prominent part in the United Kingdom bacon market, has increased its pig population considerably during the past few years, and the July, 1931, figure was 12 per cent. greater than a year earlier. But there are signs that breeding has become relatively unprofitable and although the interim census in January, 1932, revealed a further increase in total numbers, the number of breeding sows was reduced compared with a year earlier. Supplies, therefore, are likely to continue at a high rate in the first half of 1932, but may decline towards the end of the year. In the Netherlands, pig numbers have continued to increase, but breeding has been reduced and the estimated number of brood sows on 1st March, 1932, was less than a year earlier. On this basis, a few months of heavy supply followed by a gradual decline might be looked for, but differences in exchange accelerated the reduction in shipments of bacon in the last quarter of 1931 and the first few months of 1932. A September, 1931, estimate of the Swedish pig population showed an increase of 2 per cent. compared with a year earlier, but here again the number of sows was reduced. The provisional figure of the number of pigs in Poland on 30th June, 1931, showed an increase of 21 per cent. compared with a year earlier; details of the different age-groups are not available. The large increase in bacon shipments from that country has been mainly at the expense of exports of live pigs and other pork products to other countries. In the case of Germany, the peak appears to have been reached about September, 1931; the 1st March, 1932, estimate showed smaller figures than a year earlier, and the number

of sows was reduced. It is believed that marketings will tend to diminish in the latter half of this year. While Germany does not figure as a large exporter of bacon its place as a consumer and as an importer of other pork products makes the position in that country indirectly of considerable importance. Among other European countries figuring on the United Kingdom bacon market the available data generally indicate an increase in pig numbers during 1931, except in the case of Russia, for which no recent data are available, but where the 1930 figure showed a large decline on account of excessive domestic slaughtering.

The beginning of 1931 marked the bottom of the present cycle in pig numbers in the United States and inspected slaughterings in 1931 were slightly in excess of the 1930 figure. The January, 1932, estimate placed total numbers at 9 per cent. greater than a year earlier and it was indicated that the number of sows farrowed in the spring of 1932 would be 2 per cent. more than in the spring of 1931. Continued heavy supplies from Europe and low prices, accentuated by unfavourable exchange differences, are likely to prevent any rapid expansion of bacon imports from the United States in the immediate future. Pig numbers in Canada in 1931 were estimated to be 18 per cent. above the low 1930 level. Since the summer of 1931 slaughterings have been on a higher level than a year earlier and low prices have resulted in a renewal of the export trade in bacon to the United Kingdom, which amounted to 43,500 cwts. in the first three months of 1932, or nearly as much as in the whole of 1931. It is possible that the increase will be maintained. The year 1931 saw a marked development in exports of pig carcasses from Australia, but the bulk was intended for the pork market. New Zealand shipments were maintained, but the proportion of baconers was reduced. In both these countries and in Argentina there is the likelihood of an expansion in pig breeding, but supplies of bacon in the near future are not expected to be sufficiently large to affect the market. Rapid development is likely to wait upon a recovery in British prices from the present low level.

Difficult economic conditions, exchange differences, restrictions of imports, as well as the incomplete nature of the available statistics, all tend to make any attempt to forecast the probable trend of bacon supplies in the present year of no more than a tentative nature. Summarising the data in the preceding paragraphs, however, pig numbers in the main European producing countries in 1931 attained

a high figure, forcing prices down to an exceedingly low level, where breeding in many instances became so unprofitable and unpromising as to check development. The distribution of numbers at present points to a continuance of heavy supplies in the first half of 1932, but the reduction in breeding sows in some countries is likely to lead to a material decline in supplies of bacon in the latter months of the year.

#### IMPORTS OF HAMS.

No information is available regarding the proportion of the home output of pigmeat marketed annually as hams. The factory production of hams in the United Kingdom in 1924 was returned as 372,000 cwts., in addition to which there were some 298,000 cwts. of bacon and hams not separately distinguished, but probably mainly bacon. Of these totals, however, 59,000 and 122,000 cwts. respectively comprised smoked hams, or hams and bacon, and these may be assumed, according to the report of the Census of Production of 1924, to have consisted almost entirely of produce imported green, and smoked in the United Kingdom. Total imports of hams into the United Kingdom in 1931 amounted to 831,149 cwts., or less than in 1930 and 1929 by 17 per cent. and 19 per cent., respectively. Imports in the five years 1927 to 1931 were on a much lower level than in the preceding five years, the actual quantity imported in 1931 being the smallest recorded since 1920 and below the average for the 1909-13 period.

The United States of America is by far the largest source of imported hams on the United Kingdom market. Imports of hams from this source have tended to decline and the quantity recorded in 1931 was 27 per cent. less than in 1930, and comprised 72 per cent. of total imports, as against 82 per cent. in the preceding year. The expanding bacon industry in Poland has been accompanied by an equally rapid development of the export of hams, the quantity imported into the United Kingdom in 1931 being nearly 2½ times the 1930 figure and enabling Poland to displace Canada as the second largest source of supply. Imports from Canada have been declining steadily for a period of years and during 1931 a further decrease of 14 per cent. occurred, and the decrease would have been much more marked but for the relative increase shown in the last two months of the year. Imports from Argentina were rather greater than in 1930 and the quantity registered from the Irish Free State increased by 13 per cent. The expansion of the export trade in hams from

Australia in 1930 was not maintained during the past year. Germany and Brazil were responsible for increased quantities in 1931. Supplies from other sources are relatively unimportant.

Empire supplies, confined largely to the produce of Canada and the Irish Free State, declined in volume during 1931, but comprised 11 per cent. of total imports, against 10 per cent. in 1930.

Exports of imported hams from the United Kingdom are comparatively small and have been declining, the total of 15,833 cwts. in 1931 being 17 per cent. less than in 1930.

Table I gives details of the gross and net imports of hams in the years 1913 and 1927 to 1931.

TABLE I.—Imports of Hams into the United Kingdom.

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Canada .. .. .	90.1	133.7	115.3	98.2	84.0	72.5
Irish Free State .. ..	(a)	12.3	17.4	15.4	15.3	17.2
Australia .. .. .	(b)	0.1	0.7	—	4.9	0.6
Other Empire Countries ..	0.1	0.5	—	0.1	0.1	0.1
Poland .. .. .	(c)	7.2	15.9	28.4	42.8	102.2
Denmark .. .. .	1.2	2.6	1.9	1.3	2.9	2.6
Belgium .. .. .	(c)	2.9	0.3	0.5	1.0	0.1
Netherlands .. .. .	(c)	0.9	0.3	0.8	1.4	0.8
Germany .. .. .	(c)	0.1	0.2	0.3	0.5	2.2
United States of America	760.6	716.1	759.8	841.7	820.4	600.6
Argentina .. .. .	(c)	9.8	27.6	39.8	25.5	28.6
Brazil .. .. .	(c)	0.5	—	0.3	2.5	3.0
Other Foreign Countries..	3.0	2.0	2.6	2.0	1.7	0.6
Total Empire Countries ..	90.2	146.6	133.4	113.7	104.3	90.4
Total Foreign Countries ..	764.8	742.1	808.6	915.1	898.7	740.7
Total All Countries ..	855.0	888.7	942.0	1,028.8	1,003.0	831.1
Re-exports .. .. .	29.9	24.8	23.8	23.4	19.1	15.8
Net Imports .. .. .	825.1	863.9	918.2	1,005.4	983.9	815.3

(a) Not separately distinguished before April, 1923.

(b) Included in Other Empire Countries.

(c) Included in Other Foreign Countries.

Imports of hams tend to be heaviest during the summer months, coinciding with the period when demand is greatest. Prior to 1927 shipments from the United States were more evenly spread over a longer period, but in that year the sale of boracised hams was forbidden and monthly imports since then have tended to follow more closely the course of demand.

Throughout 1931 the volume of imports was below the previous year's level except in October and November; in the former month a slight increase in imports from the United States combined with increased European supplies to advance the total beyond that of October, 1930, while the increase registered in November was due chiefly to heavier supplies from Canada and continued large imports from Poland. As a result, imports in the second half of the year were only 14 per cent. below the corresponding 1930 figure, as against a decrease of 20 per cent. in the first six months. The volume of imports, as in 1930, attained a peak in July, and was smallest in March, whereas in 1930, November was the month of lightest importation.

Monthly imports of hams in 1913, 1924, and 1927 to 1931 are given in Table II.

TABLE II.—*Monthly Imports of Hams into the United Kingdom.*

Month.	1913.	1924.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January ..	68	101	79	62	78	70	63
February ..	70	187	58	81	74	71	58
March ..	59	152	62	83	61	77	48
April ..	85	126	58	71	80	85	68
May ..	66	158	82	83	126	110	82
June ..	64	143	105	96	94	98	87
July ..	90	171	102	102	108	128	100
August ..	84	156	74	121	108	107	66
September ..	74	115	79	67	72	64	50
October ..	64	82	70	50	72	52	65
November ..	68	150	52	60	73	51	67
December ..	63	95	68	66	83	90	77
Total ..	855	1,636	889	942	1,029	1,003	831

Monthly imports of hams in 1931 from the chief sources of supply are given in Table III.

TABLE III.—*Monthly Imports of Hams into the United Kingdom during 1931.*

Month.	Irish Free State.	Canada.	United States of America.	Poland.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. ..	1·4	5·7	46·1	8·3	1·9	63·4
February .. ..	1·0	3·7	44·6	6·8	2·0	58·1
March .. ..	1·0	4·0	35·4	3·9	3·3	47·6
April .. ..	1·4	5·1	52·0	8·4	0·9	67·8
May .. ..	1·1	4·6	64·1	10·5	1·9	82·2
June .. ..	0·9	4·6	67·9	11·3	2·6	87·3
July .. ..	1·2	4·6	80·5	9·1	4·3	99·7
August .. ..	1·4	3·7	49·9	7·9	3·4	66·3
September .. ..	1·4	2·8	37·5	5·2	3·2	50·1
October .. ..	1·7	7·2	40·7	10·1	4·7	64·4
November .. ..	2·7	13·5	36·1	9·9	5·2	67·4
December .. ..	2·0	13·0	45·8	10·8	5·2	76·8
Total .. ..	17·2	72·5	600·6	102·2	38·6	831·1

#### PRICES.

Those factors which affect the price of bacon operate also in the case of hams, and a significant price-change in the one commodity is likely to be at least partially reflected in the other. Thus, in spite of the smaller imports of hams in 1931, values, on the average, were fully 20 per cent. lower than in 1930. Home-produced hams declined until August, and the seasonal increase which ensued was much less marked than a year earlier. American hams reached their lowest point in June and increased until October, but experienced a sharp reduction in the two following months.

Table IV shows the average monthly top prices during 1931 and 1930 of York and Cumberland 14/16s. and American short cut 12/14s. as quoted on the London Provision Exchange. It should be noted that these two descriptions are not comparable in any way; neither is it suggested that the figures represent a price at which the bulk of sales took place. At the same time the figures give some idea of the seasonal change in prices in the past two years and indicate the extent of the decline which occurred as between 1930 and 1931.



TABLE IV.—Average Price of Hams at London.

Month.	York and Cumberland 14/16s.		United States (a) 12/14s.	
	1931.	1930.	1931.	1930.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January .. .. .	194 0	200 0	87 9	102 6
February .. .. .	180 0	200 0	75 3	105 0
March .. .. .	170 3	200 0	73 6	97 6
April .. .. .	170 0	200 0	75 6	99 0
May .. .. .	160 0	194 0	75 6	93 6
June .. .. .	145 0	190 0	73 3	101 3
July .. .. .	140 0	190 0	80 6	112 0
August .. .. .	140 0	190 0	81 6	97 6
September .. .. .	143 0	197 6	83 6	91 6
October .. .. .	150 0	210 0	88 9	91 6
November .. .. .	150 0	217 6	69 6	97 6
December .. .. .	150 0	213 3	69 0	93 9
Average for year .. .. .	157 9	200 3	77 9	98 6

(a) Short Cut, Green.

#### IMPORTS OF FRESH PORK.

No information is available regarding the quantity of pigmeat marketed as fresh pork in the United Kingdom. It has been estimated† that about one-half of the production of pigmeat in England and Wales‡ is consumed as fresh pork, a proportion which has probably increased since the increase in imports of bacon from Europe, following the embargo on Continental fresh meat. According to the Ministry of Agriculture the total production of pigmeat in Great Britain in the twelve months ended 31st May, 1931, amounted to 241,900 tons, as compared with 256,000 tons in the preceding year. These figures are based on the average number of sows at the June census, and as the number of sows in Great Britain as a whole

† Report on the Pork and Bacon Trades in England and Wales. Ministry of Agriculture and Fisheries, Economic Series No. 17.

‡ Production of fresh pork in Scotland and in Northern Ireland is comparatively unimportant.

on 1st June, 1931, was 26 per cent. greater than a year earlier, it is probable that the actual production of pigmeat, especially pork, in the calendar year 1931 was greater than in 1930. This is partly borne out by the trend of supplies of British pork (England and Wales and Scotland) at the London Central Markets, which in 1931 amounted to 438,540 cwts. as against 408,700 cwts. in 1930, the increase occurring principally in the second half of the year. It is apparent that home-produced pork accounts for the bulk of the total quantity consumed.

Imports of fresh pork into the United Kingdom reached their maximum of over one million cwts. in 1925. Until that point the Netherlands was by far the principal source of supply, the Irish Free State occupying second place, with smaller quantities from certain European countries, such as Belgium, Poland and Denmark. The embargo on fresh meat from the Continent in the following year caused a sharp reduction in fresh pork supplies, which from 1927 onwards were practically all of Irish Free State origin. These attained a peak of 387,700 cwts. in 1928, but declined substantially in the two following years, following the general reduction in pig breeding in that country. The upward trend of pig numbers in the Irish Free State in 1930 and 1931 resulted in imports of fresh pork into the United Kingdom in 1931, all from the Irish Free State, exceeding the 1930 figure by 32 per cent. and being the largest since 1928. These figures bring out what has been indicated elsewhere, namely, that the recent increase in Irish pig production has been directed more to fresh pork than to bacon production. At the same time, the greater part of the imports from the Irish Free State represents trade across the land boundary, mainly for the manufacture of bacon in Northern Ireland. During the five years 1927 to 1931 land boundary trade accounted on the average for 60 per cent. of total imports from the Irish Free State into the United Kingdom.

Imports of fresh pork are greatest from October to March and lightest during the summer months. Details of monthly imports indicate that supplies began to exceed those of twelve months earlier towards the end of 1930 and continued above the previous year's level throughout 1931. Imports were heaviest in November or one month earlier than in 1930, while June was the month of smallest supply in both years.

Table I shows the imports of fresh pork into the United Kingdom from the chief sources in the eight years 1924 to 1931.

TABLE I.—Imports of Fresh Pork into the United Kingdom.

Year.	Irish Free State.	Netherlands.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.
1924 .. .. .	248	535	25	808
1925 .. .. .	180	820	12	1,012
1926 .. .. .	203	381	54	638
1927 .. .. .	317	—	—	317
1928 .. .. .	388	—	—	388
1929 .. .. .	296	—	—	296
1930 .. .. .	289	—	—	289
1931 .. .. .	383	—	—	383

Table II shows the monthly imports of fresh pork during each of the past five years, practically all of the imports being from the Irish Free State.

TABLE II.—Monthly Imports of Fresh Pork.

Month.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	23	36	31	23	35
February .. .. .	21	36	39	23	34
March .. .. .	26	36	32	22	31
April .. .. .	21	31	20	22	25
May .. .. .	16	25	16	19	20
June .. .. .	21	23	16	10	14
July .. .. .	15	16	10	14	17
August .. .. .	13	14	12	11	14
September .. .. .	25	32	25	27	34
October .. .. .	36	42	29	37	45
November .. .. .	47	52	28	39	59
December .. .. .	53	45	38	42	55
Total .. .. .	317	388	296	289	383

IMPORTS OF FROZEN AND SALTED PORK.

(i) FROZEN PORK.

The importation of frozen pork into the United Kingdom on a fairly large scale is a development of post-war years. From 1909 to 1913 imports averaged approximately 30,000 cwts. annually, but

a considerable expansion occurred during the war and in the years immediately succeeding, imports rising to a peak of nearly 462,000 cwts. in 1920. The movement in following years was erratic, but an increase has occurred in each year since 1927 and the total of 365,460 cwts. imported in 1931 was 4 per cent. greater than in 1930 and the largest since 1923.

Table I gives details of the imports of frozen pork into the United Kingdom in 1913 and the five years from 1927 to 1931.

TABLE I.—Imports of Frozen Pork into the United Kingdom.

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
New Zealand .. ..	(a)	86	122	170	137	121
Australia .. .. .	(a)	2	1	—	23	86
Canada .. .. .	(a)	12	6	2	3	10
Union of South Africa ..	(a)	1	—	—	—	—
Other Empire Countries	3	—	—	—	1	—
United States of America	12	39	58	47	109	62
Argentina .. .. .	(b)	45	58	69	74	81
Brazil .. .. .	(b)	1	2	1	2	3
Uruguay .. .. .	(b)	(b)	(b)	(b)	(b)	2
China .. .. .	1	1	—	6	1	—
Other Foreign Countries	—	—	—	2	2	—
Total Empire Countries ..	3	101	129	172	164	217
Total Foreign Countries	13	86	118	125	188	148
Total All Countries ..	16	187	247	297	352	365
<i>Re-exports</i> .. .. .	—	2	1	2	1	2
Net Imports .. .. .	16	185	246	295	351	363

(a) Included in Other Empire Countries.

(b) Included in Other Foreign Countries.

Since 1927 New Zealand has been the chief source of supply of frozen pork on the United Kingdom market, but supplies from that country have declined since the peak year of 1929, and the quantity registered in 1931 was 11 per cent. less than in 1930. One of the most striking features of the supply position is the increase in shipments

from Australia, which were practically negligible prior to 1930. The quantity imported from Australia in 1931 was nearly four times as great as in 1930. Imports from Canada, although small in volume, showed a relatively large increase from the small figures of the two preceding years.

Empire supplies, as a whole, accounted for 59 per cent. of total imports of frozen pork in 1931, as compared with 47 per cent. in 1930.

Imports from the United States increased substantially in 1930, but the 1931 figure was 43 per cent. below that of the preceding year. Imports from Argentina, however, increased by nearly 10 per cent. Supplies from other sources are relatively unimportant, but it may be noted that the small quantities from Brazil have tended to increase without, however, attaining to the level of the immediate post-war years, while imports from China were entirely absent in 1931.

Imports of frozen pork are at their maximum during the winter and lightest in spring and summer, but since New Zealand has assumed the position of chief source, supplies have been more evenly spread throughout the year. During 1931 imports were on a larger scale than a year earlier, except in the spring and early summer, when the supplies from the United States were particularly reduced, and again in December. The volume of imports was greatest in December and lightest in April. Monthly imports of frozen pork in 1924 and in each of the years 1927 to 1931 are given in Table II.

TABLE II.—*Monthly Imports of Frozen Pork into the United Kingdom.*

Month.	1924.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	38	26	20	21	36	39
February .. .. .	41	12	23	26	27	42
March .. .. .	14	17	33	20	28	27
April .. .. .	3	25	29	26	25	19
May .. .. .	4	20	21	26	28	28
June .. .. .	7	5	8	22	27	19
July .. .. .	3	17	13	29	22	34
August .. .. .	11	6	22	37	13	22
September .. .. .	11	13	15	21	23	30
October .. .. .	10	14	26	17	28	25
November .. .. .	16	15	19	24	25	36
December .. .. .	43	17	18	28	70	44
Total .. .. .	201	187	247	297	352	365

Imports month by month from the principal sources in 1931 are given in Table III, which indicates that the heavier total supplies at the beginning and end of the year were due mainly to larger imports from the United States at that time.

TABLE III.—*Monthly Imports of Frozen Pork into the United Kingdom during 1931.*

Month.	New Zealand.	Australia.	United States of America and Argentina.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. ..	9.0	9.0	17.9	2.9	38.8
February .. ..	14.1	12.2	14.0	1.8	42.1
March .. .. .	14.6	4.5	7.5	0.6	27.2
April .. .. .	9.2	4.0	5.4	0.4	19.0
May .. .. .	16.7	3.8	6.9	0.5	27.9
June .. .. .	3.9	7.2	7.7	0.8	19.6
July .. .. .	13.3	12.7	7.8	0.4	34.2
August .. .. .	6.0	8.1	7.8	0.1	22.0
September .. ..	11.9	5.5	12.7	0.4	30.5
October .. .. .	6.0	4.1	13.2	1.4	24.7
November .. .. .	9.5	4.1	19.6	2.6	35.8
December .. ..	7.6	10.6	22.9	2.6	43.7
Total .. .. .	121.8	85.8	143.4	14.5	365.5

(ii) SALTED PORK.

In the five years 1909-13 imports of salted pork averaged 235,000 cwts., but the trade in post-war years has been on a much smaller scale. Between 1928 and 1930 gross imports doubled in volume, but the total quantity imported in 1931, amounting to 66,900 cwts., was 21 per cent. smaller than in 1930, although larger than in any other recent year since 1923.

Denmark is the principal source for imported salted pork, supplies from that country in 1931 being 24 per cent. less than in 1930 and accounting for 70 per cent. of the total quantity imported. Imports

from the United States, the second largest source, were 13 per cent. less than in 1930. Supplies from Empire countries are of minor importance.

There is a fairly appreciable re-export trade in salted pork, particularly to the Irish Free State, and this has developed considerably in the past five years. Re-exports in 1931 were 34 per cent. greater than in 1930 and were equal to nearly two-fifths of gross imports.

Details of the imports of salted pork in 1913 and 1927 to 1931 are given in Table I.

TABLE I.—*Imports of Salted Pork into the United Kingdom.*

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Canada .. .. .	(a)	1.4	0.9	0.7	0.1	(a)
Denmark .. .. .	187.5	33.0	29.4	45.3	61.8	47.2
United States of America	42.3	10.8	10.6	11.4	17.0	14.8
Argentina .. .. .	(a)	—	—	1.2	3.6	(a)
Other Countries .. .. .	10.8	1.8	1.4	3.2	2.4	4.9
Total .. .. .	240.6	47.0	42.3	61.8	84.9	66.9
<i>Re-exports</i> .. .. .	7.2	4.3	4.3	14.1	19.6	26.3
Net Imports .. .. .	233.4	42.7	38.0	47.7	65.3	40.6

(a) Included in Other Countries.

Imports of salted pork in the first two months of the year and in November were on a heavier scale than a year earlier, but in the remaining months were substantially under the 1930 level. Unlike fresh and frozen pork there is no pronounced seasonal fluctuation in supplies of salted pork. In the two preceding years imports were heaviest during the summer months, but in 1931 the highest point was touched in February, while supplies were at their lightest in December.

Monthly imports in recent years are shown in Table II.

TABLE II.—*Monthly Imports of Salted Pork into the United Kingdom.*

Month.	1924.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	2·4	4·8	2·3	2·1	2·6	5·7
February .. .. .	2·7	5·8	4·9	5·1	6·4	7·3
March .. .. .	2·3	4·2	6·7	5·1	6·8	5·3
April .. .. .	1·3	3·4	3·3	4·5	7·9	3·7
May .. .. .	7·2	4·1	4·0	7·5	8·5	7·0
June .. .. .	3·8	2·9	4·4	6·7	8·0	7·0
July .. .. .	4·2	8·8	3·5	5·7	9·1	6·2
August .. .. .	3·0	6·1	5·0	8·1	9·1	5·2
September .. .. .	3·6	2·8	1·1	6·9	8·4	5·7
October .. .. .	3·5	2·8	2·7	5·9	8·6	4·5
November .. .. .	1·8	0·7	2·6	3·7	4·3	5·4
December .. .. .	1·9	0·6	1·8	0·5	5·2	3·9
Total .. .. .	37·7	47·0	42·3	61·8	84·9	66·9

Table III gives details of the monthly imports of salted pork from the principal sources during 1931.

TABLE III.—*Monthly Imports of Salted Pork into the United Kingdom during 1931.*

Month.	Denmark.	United States of America.	Other Countries.	Total.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	3·8	1·7	0·2	5·7
February .. .. .	5·5	1·6	0·2	7·3
March .. .. .	4·3	0·7	0·3	5·3
April .. .. .	2·5	1·1	0·1	3·7
May .. .. .	5·7	1·0	0·3	7·0
June .. .. .	6·0	0·8	0·2	7·0
July .. .. .	4·7	1·2	0·3	6·2
August .. .. .	3·3	1·5	0·4	5·2
September .. .. .	3·1	1·4	1·2	5·7
October .. .. .	2·5	1·2	0·8	4·5
November .. .. .	3·3	1·4	0·7	5·4
December .. .. .	2·5	1·2	0·2	3·9
Total .. .. .	47·2	14·8	4·9	66·9



### IMPORTS OF LARD.

Imports of lard during the past ten years have varied within much narrower limits than those of other pig products. Imports increased from 1926 to a peak in 1929; a reduction occurred in 1930, but imported supplies in 1931 were 2 per cent. larger than in the previous year, although slightly below the record 1929 figure.

The production of lard in the United Kingdom during 1924, the latest year for which figures are available, amounted to 671,000 cwts.; but these figures relate only to the quantity returned under the Census of Production and the actual output of lard was undoubtedly higher than this total suggests.

The United States of America is the world's largest exporter of lard and the chief source of imports into the United Kingdom, accounting for 85 per cent. of total imports in the five years 1927 to 1931. In the first nine months of 1931 imports from this source were heavier than a year earlier, but the quantity imported in the last quarter of the year was 33 per cent. below the corresponding 1930 figure. For the year as a whole imports from the United States were 5 per cent. less than in 1930 and comprised 81 per cent. of the total from all sources. Canada is the second largest source of supply, and, following a marked reduction in 1930, imports from that country increased by 24 per cent. in 1931, and accounted for 8 per cent. of total imports. Supplies of lard from the Irish Free State have fallen off steadily since 1927 and a further slight decline occurred in 1931. Denmark and the Netherlands were responsible for considerably increased quantities compared with a year earlier and the increase in imports from other foreign countries was due chiefly to heavier supplies from Argentina.

Exports of imported lard in 1931, amounting to 8,460 cwts., were 1,500 cwts. less than in 1930. Exports of lard of United Kingdom manufacture totalled 5,760 cwts. in 1931, as compared with 6,600 cwts. in 1930.

Details of the imports of lard into the United Kingdom in 1913 and the five years 1927 to 1931 are given in Table I, while Table II shows total imports and imports from the United States month by month throughout 1929, 1930 and 1931. The decline in the last quarter was due to a marked reduction in supplies from the United States, imports from other sources showing an increase.

TABLE I.—Imports of Lard into the United Kingdom.

Country whence consigned.	1913.	1927.	1928.	1929.	1930.	1931.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
Canada .. .. .	83·1	250·7	233·8	242·3	168·3	209·0
Irish Free State .. .. .	(a)	49·2	45·7	39·2	33·4	32·9
Other Empire Countries..	1·4	0·2	1·9	3·4	11·1	30·0
Denmark .. .. .	17·5	69·9	59·0	34·7	45·2	83·4
Netherlands .. .. .	28·8	35·9	35·9	27·0	35·8	61·3
United States of America	1,869·0	1,966·9	2,056·3	2,258·1	2,172·5	2,065·3
Other Foreign Countries	5·5	24·2	14·2	16·3	38·7	67·0
Total Empire Countries ..	84·5	300·1	281·4	284·9	212·8	271·9
Total Foreign Countries ..	1,920·8	2,096·9	2,165·4	2,336·1	2,292·2	2,277·0
Total .. .. .	2,005·3	2,397·0	2,446·8	2,621·0	2,505·0	2,548·9
Re-exports .. .. .	304·8	8·6	14·0	7·7	10·0	8·5
Net Imports .. .. .	1,700·5	2,388·4	2,432·8	2,613·3	2,495·0	2,540·4

(a) Not separately recorded before 1st April, 1923.

TABLE II.—Monthly Imports of Lard into the United Kingdom.

Month.	1929.		1930.		1931.	
	From United States of America	Total Imports.	From United States of America	Total Imports.	From United States of America	Total Imports.
	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.	000 cwts.
January .. .. .	307·3	320·7	220·0	246·1	170·5	191·6
February .. .. .	232·6	265·6	198·6	224·9	247·5	290·8
March .. .. .	160·4	198·5	207·3	221·5	220·4	237·7
April .. .. .	168·7	192·9	150·6	162·7	199·1	225·7
May .. .. .	202·5	236·4	165·7	185·5	165·3	210·4
June .. .. .	149·2	183·0	141·0	188·2	186·8	246·3
July .. .. .	196·3	231·9	246·8	283·9	193·8	254·8
August .. .. .	157·2	189·3	152·9	182·4	169·8	223·2
September .. .. .	112·1	150·9	89·5	115·9	109·4	152·0
October .. .. .	176·5	195·0	178·0	204·4	115·0	154·7
November .. .. .	186·5	214·3	216·2	247·8	129·1	171·7
December .. .. .	208·8	242·5	205·9	241·7	158·6	190·0
Total .. .. .	2,258·1	2,621·0	2,172·5	2,505·0	2,065·3	2,548·9

Prices of lard fluctuated considerably in 1931, but moved consistently below the 1930 level. The difference was most pronounced during the autumn, but an increase in December, compared with a decline in the same month of 1930, brought prices very nearly to the level of a year earlier. For the year as a whole, the average price decline was some 16 to 18 per cent.

Table III shows average monthly prices of a few representative types of imported lard. The figures are from the weekly quotations of the London Provision Exchange and represent the average of top prices.

TABLE III.—Average Monthly Prices of Lard at London.

Month.	Irish.				Danish.		American.	
	Bladders.		28-lb. boxes.		28-lb. boxes.		56-lb. boxes.	
	1931.	1930.	1931.	1930.	1931.	1930.	1931.	1930.
	Per cwt.	Per cwt.	Per cwt.	Per cwt.	Per cwt.	Per cwt.	Per cwt.	Per cwt.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January ..	80 0	79 3	49 3	53 9	48 6	52 3	50 6	56 3
February ..	78 0	84 0	45 0	—	44 6	53 9	47 0	57 6
March ..	74 0	90 0	48 0	—	46 9	53 0	52 0	55 6
April ..	76 0	90 0	46 6	54 0	45 0	53 3	49 3	56 3
May ..	72 9	84 0	44 0	53 6	42 3	53 0	45 0	55 6
June ..	70 6	80 0	42 3	—	42 3	52 0	45 6	54 0
July ..	69 6	74 0	41 0	51 6	40 3	50 3	45 0	53 6
August ..	66 0	72 0	—	54 6	39 0	54 9	42 9	59 9
September ..	66 0	72 0	42 0	61 3	41 6	60 9	47 9	64 3
October ..	68 6	76 9	53 3	63 6	50 0	61 9	56 0	65 3
November ..	70 0	80 0	50 9	62 0	47 9	62 6	51 6	63 3
December ..	70 0	80 0	52 9	54 6	51 0	53 3	54 0	55 9

### SHIPMENTS OF BUTTER AND CHEESE FROM NEW ZEALAND AND AUSTRALIA.

#### (i) NEW ZEALAND.

The development of the dairy industry in New Zealand in recent years is reflected in the annual increase in the quantities of butter graded. Gradings of butter increased by a further 2 per cent. in

the 1930-31 season (August to July), a less pronounced advance than in other recent years. A further expansion, however, has occurred during the present (1931-32) season, the quantity graded from August, 1931, to April, 1932, being 7 per cent. greater than in the same period a year earlier.

Cheese production, as measured by gradings, has also increased, although the upward movement has been rather less marked and less regular than in the case of butter. The increase in 1930-31 over the previous season amounted to 2 per cent. Towards the end of the season gradings fell below those of a year earlier, a movement that was continued in the present season (1931-32); cheese gradings in the nine months August, 1931, to April, 1932, were 4 per cent. less than in the same period of the previous season.

Gradings of butter and cheese in New Zealand during the past seven seasons and in the first nine months of the present season are given in Table I. It may be mentioned that, of the butter graded in the 1930-31 season, 96 per cent. was salted and 4 per cent. unsalted, while two-thirds of the cheese were white and one-third coloured.

TABLE I.—*Gradings of Butter and Cheese in New Zealand.*

Season.	Butter.	Cheese.
	Tons.	Tons.
1924-25 .. .. .	70,126	69,993
1925-26 .. .. .	62,557	74,145
1926-27 .. .. .	71,695	76,312
1927-28 .. .. .	74,723	75,753
1928-29 .. .. .	81,656	86,605
1929-30 .. .. .	95,343	87,252
1930-31 .. .. .	97,031	89,229
1931-32 (August to April)	96,215	79,968

The bulk of the butter exported from New Zealand is shipped to the United Kingdom. In the three previous seasons increasing quantities had been sent to Canada, but an increase in Canadian tariff rates caused a drastic decline in shipments to that country; the quantity taken by the United Kingdom increased proportionately and comprised 97 per cent. of the total. Most of this was handled at London, but direct shipments to West Coast ports, comprising 11 per cent. of the total, showed a greater proportionate increase in the 1930-31 season.

Shipments of butter to the principal destinations during each of the past five seasons are given in Table II.

TABLE II.—*Shipments of Butter from New Zealand (August to July).*

Destination.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.
	Tons.	Tons.	Tons.	Tons.	Tons.
London .. .. .	55,074	55,350	60,009	64,815	80,480
U.K. West Coast Ports..	5,979	5,224	3,835	5,410	9,883
Vancouver .. .. .	1,721	3,863	4,558	4,861	1,413
Halifax .. .. .	936	2,601	7,693	15,668	75
Other .. .. .	5,958	4,519	1,729	1,633	1,373
Total .. .. .	69,668	71,557	77,824	92,387	93,224

Practically the whole of the exports of New Zealand cheese are shipped to the United Kingdom. London takes the bulk, but shipments to that port in the past season were slightly reduced as a result of larger quantities being sent to West Coast ports, which accounted for over 15 per cent. of the total.

Table III shows the shipments of cheese during the past five seasons.

TABLE III.—*Shipments of Cheese from New Zealand (August to July).*

Destination.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.
	Tons.	Tons.	Tons.	Tons.	Tons.
London .. .. .	67,859	63,997	69,595	75,711	72,471
U.K. West Coast Ports	8,450	9,706	12,232	9,855	13,324
Other .. .. .	529	703	663	254	67
Total .. .. .	76,838	74,406	82,490	85,820	85,862

In the remaining five months of 1931 exports of butter were 19 per cent. greater than in the same period of 1930, but shipments of cheese were slightly reduced. In each case, however, direct shipments to West Coast ports were well in advance of the previous year.

Details of the distribution of butter and cheese shipments in the five months August to December, 1931, are given in Table IV, with comparative figures for 1930.

TABLE IV.—*Shipments of Butter and Cheese from New Zealand (August to December).*

Destination.	Butter.		Cheese.	
	1st Aug., 1931 to 31st Dec., 1931.	1st Aug., 1930 to 31st Dec., 1930.	1st Aug., 1931 to 31st Dec., 1931.	1st Aug., 1930 to 31st Dec., 1930.
	Tons.	Tons.	Tons.	Tons.
London .. .. .	35,656	31,188	23,620	26,173
U.K. West Coast Ports ..	6,432	2,485	5,597	3,682
Canada .. .. .	13	1,354	—	—
Other .. .. .	409	640	30	34
Total .. .. .	42,510	35,667	29,247	29,889

(ii) AUSTRALIA.

Weather conditions, by their effect on pastures, play an important part in determining the course of dairy produce production in Australia, and exports are consequently subject to greater annual variation than in the case of New Zealand. Favourable conditions prevailed during the 1930-31 season (July to June) and, aided by exchange differences, exports of butter reached record levels, being 54 per cent. greater than in the 1929-30 season. Exports of cheese are of much less importance, but the 1930-31 figure was 2½ times the previous season's total, and the largest since 1924-25.

TABLE V.—*Exports of Butter and Cheese from Australia (July to June).*

Season.	Butter.	Cheese.
	Tons.	Tons.
1924-25 .. .. .	63,937	5,123
1925-26 .. .. .	43,405	3,335
1926-27 .. .. .	34,004	1,768
1927-28 .. .. .	44,306	3,298
1928-29 .. .. .	45,821	3,938
1929-30 .. .. .	48,091	1,659
1930-31 .. .. .	73,951	4,220

Table V above shows the trend of exports of butter and cheese from Australia during recent years.

The greater part of the exports of butter is shipped to the United Kingdom, which took practically 90 per cent. of the total in the 1930-31 season. Shipments to various Eastern ports account for the bulk of the remainder, but increased quantities were sent to Canada last season. Smaller quantities are exported direct to other destinations, including India and European countries. Details of the distribution of the exports in recent years are given in Table VI.

TABLE VI.—*Distribution of Shipments of Butter from Australia (July to June).*

Destination.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.
	Tons.	Tons.	Tons.	Tons.	Tons.
United Kingdom .. ..	28,217	38,138	39,237	41,079	66,169
Eastern Ports .. ..	4,299	4,783	4,927	5,521	5,106
Canada .. ..	12	214	173	515	1,226
Other .. ..	1,476	1,171	1,484	976	1,450
Total .. ..	34,004	44,306	45,821	48,091	73,951

The bulk of the cheese exported is consigned to the United Kingdom, which took 93 per cent. of the total in the 1930-31 season, the remainder being shipped to various Eastern ports and India.

Shipments of butter from all States to the United Kingdom increased during the 1930-31 season. As in each of the three previous seasons the greatest quantity was shipped from Queensland, with Victoria, which showed a relatively greater increase, occupying second place.

Most of the cheese exported from Australia is of Queensland origin, that State shipping 3,666 tons in the 1930-31 season, Victoria, with 248 tons, accounting for the remainder.

The large increase in production towards the end of the 1930-31 season was continued during the first part of the current (1931-32) season, and exports of butter in the first seven months (1st July, 1931 to 31st January, 1932) were 47 per cent. greater than in the corresponding period a year earlier. All States shared in the increase, particularly Victoria and New South Wales; even Western Australia was able to ship small quantities.

Table VII gives details of shipments of butter to the United Kingdom from each State of the Commonwealth during the past five seasons.

TABLE VII.—*Shipments of Australian Butter to United Kingdom from various States (July to June).*

State.	1926-27.	1927-28.	1928-29.	1929-30.	1930-31.
	Tons.	Tons.	Tons.	Tons.	Tons.
Queensland .. ..	9,496	19,436	19,301	20,185	30,035
Victoria .. .. .	11,347	10,164	13,496	12,473	21,746
New South Wales ..	6,065	7,436	5,002	6,775	11,196
Tasmania .. .. .	591	823	1,183	1,352	2,104
South Australia ..	718	279	255	294	1,088
Western Australia ..	—	—	—	—	—
Total to U.K. ..	28,217	38,138	39,237	41,079	66,169

Table VIII shows the shipments of butter from Australia to the United Kingdom and other countries in the first seven months of the 1931-32 season, with comparative totals for 1930-31.

TABLE VIII.—*Shipments of Australian Butter, First Seven Months, 1931-32.*

State.	July, 1931, to January, 1932.			Same Period, 1930-31.
	To United Kingdom.	To Other Countries.	Total.	Total.
	Tons.	Tons.	Tons.	Tons.
Queensland .. .. .	17,981	532	18,513	14,767
Victoria .. .. .	22,302	2,334	24,636	17,109
New South Wales ..	10,145	1,211	11,356	6,223
South Australia ..	2,490	—	2,490	835
Tasmania .. .. .	1,157	—	1,157	1,079
Western Australia ..	635	—	635	—
Total ..	54,710	4,077	58,787	40,013



## THE 1931-32 SEASON FOR AUSTRALIAN AND SOUTH AFRICAN EGGS.

### (i) AUSTRALIAN.

The exportation of eggs in shell from Australia is a comparatively recent development, but remarkable progress has been made, particularly in the 1931-32 season, when exports totalled nearly one million great hundreds, as against 589,500 great hundreds in the 1930-31 season, which was itself a record one. The different States contributed to the total in the following proportions:—New South Wales, 37·5 per cent. ; Victoria, 27 per cent. ; South Australia, 20 per cent. ; Queensland, 8 per cent. ; Western Australia, 7·5 per cent.

The bulk of the Australian eggs is shipped to the United Kingdom, and arrivals in this country during the past season amounted to 981,000 great hundreds, as compared with 578,600 great hundreds in the previous season, an increase of 70 per cent. The first shipment was received in the first week of September, or a fortnight earlier than in the previous season, and supplies continued for a period of twenty-two weeks, compared with eighteen weeks a year earlier. December was the month of heaviest arrivals, whereas in the previous year supplies were greatest in November. The bulk of the arrivals was handled at London, but several direct shipments were made to other ports, the distribution to the various ports being as follows:—London, 843,573 great hundreds ; Liverpool, 65,019 great hundreds ; Glasgow, 42,441 great hundreds, and Hull, 30,000 great hundreds. The figures for the last three ports do not include quantities railed or trans-shipped from London.

Taking the season as a whole, prices were about 12 per cent. lower than in the previous season. The decline was more pronounced early in the season, but the margin when prices were highest was comparatively small. Values reached a peak in the second half of November, or fully a fortnight later than in the previous season, and the decline thereafter was relatively more rapid. Thus, when supplies were heaviest, values had receded considerably from their highest point.

The following table shows total monthly arrivals of Australian eggs in the United Kingdom, according to the Board's figures, and average prices for two representative grades. It should be noted that these figures, which represent the average of top quotations on the London Egg Exchange, do not necessarily reflect a figure at

which the maximum volume of sales took place, but are merely given to afford an appropriate basis of comparison between the two seasons, and between different periods of the same season.

TABLE I.—*Supplies and Prices of Australian Eggs.*

Month.	1930-31.			1931-32.		
	Arrivals.	Prices.		Arrivals.	Prices.	
		16 lb. (mixed)	15 lb. (mixed)		16 lb. (mixed).	15 lb. (mixed.)
	Gt. hds.	Per 120. <i>s. d.</i>	Per 120. <i>s. d.</i>	Gt. hds.	Per 120. <i>s. d.</i>	Per 120. <i>s. d.</i>
September .. ..	9,912	—	—	14,019	—	—
October .. .. .	101,285	16 2	15 4	180,549	12 8	12 4
November .. ..	207,457	16 4	15 11	238,476	15 8	14 10 (a)
December .. ..	178,795	15 0	14 8	390,543	13 2	12 8
January .. .. .	81,159	14 0	13 3	157,416	12 5 (a)	12 1 (a)

(a) Three weeks' quotations.

(ii) SOUTH AFRICA.

Exports of eggs from South Africa during the 1931-32 season amounted to 563,802 great hundreds, a decline of 14,000 great hundreds from the previous season's record figure, but larger than in any other year. The different producing districts contributed to the exports in the following proportions:—Western Province, 32 per cent.; Transvaal, 25 per cent.; Natal, 15 per cent.; Port Elizabeth, 13 per cent.; East London, 8 per cent.; Orange Free State, 6 per cent.; and Rhodesia under 1 per cent. The greater part of the eggs produced in the Orange Free State, however, is marketed in the other provinces and included in the export figures of the latter.

Shipments of South African eggs to the United Kingdom in the past season amounted to 563,466 great hundreds, as compared with the record figure of 574,428 great hundreds in the 1930-31 season. The season started a week earlier than in 1930, and shipments up to the end of October, when supplies reached a maximum, were 20 per cent. larger than in the previous year. Supplies thereafter

declined at a fairly rapid rate, the effect of lower prices being accentuated by exchange differences. Shipments were spread over a period of nineteen weeks, or two less than in the preceding season.

The decline in prices over the season, compared with a year earlier, was rather less marked than for Australian eggs, due largely to the shorter season. At their highest point prices were only slightly lower than in the previous year, the difference being most pronounced at the beginning and towards the end of the season. The peak of weekly arrivals preceded the peak in prices by nearly one month.

The following table shows the monthly arrivals of South African eggs, and average prices of two representative grades. The reservations attaching to the preceding table apply with equal force to the following:—

TABLE II.—*Supplies and Prices of South African Eggs.*

Month.	1930-31.			1931-32.		
	Arrivals.	Prices.		Arrivals.	Prices.	
		16 lb.	15 lb.		16 lb.	15 lb.
	Gt. hds.	Per 120. s. d.	Per 120. s. d.	Gt. hds.	Per 120. s. d.	Per 120. s. d.
September .. ..	44,478	16 1½(a)	15 4½(a)	53,283	13 7½(a)	13 7(a)
October .. ..	149,205	16 3	15 0	179,424	13 1	12 8
November .. ..	187,554	16 7½	16 0	196,104	15 11	15 4
December .. ..	158,031	16 6	15 6	106,263	13 10½	13 5
January .. ..	31,587	13 8	13 1½	28,392	13 2 (c)	12 10(c)
February .. ..	3,573	12 3 (b)	12 0 (b)	—	—	—

(a) Two weeks' quotations. (b) One week's quotation. (c) Three weeks' quotations.

## GERMANY.

### IMPORTS OF BUTTER.

Next to the United Kingdom, Germany is the principal market for imported butter. Imports increased rapidly until 1929, and were fairly well maintained in 1930, but tariff restrictions and diminished purchasing power caused a considerable reduction in 1931, when total imports, amounting to 1,972,847 cwts., were less than in 1930 by 648,330 cwts., or 25 per cent.

Home production of butter in Germany is estimated to account for about three-quarters of the total quantity consumed. Milk production increased during 1931, but consumption of fresh milk was reduced and it was estimated that butter production increased by 3 to 4 per cent. On account of the substantial decline in imports, however, consumption is estimated to have declined by about 5 per cent.\* Consumption of butter in the United Kingdom increased by 14 per cent. in 1931 (*see* page 29).

The following table gives the imports of butter into Germany in the past eight years :—

TABLE I.—*Imports of Butter into Germany, 1924–31.*

Year.	Imports.	Year.	Imports.
	cwts.		cwts.
1924 .. .. .	1,052,705	1928 .. .. .	2,491,142
1925 .. .. .	1,901,833	1929 .. .. .	2,645,024
1926 .. .. .	1,924,969	1930 .. .. .	2,621,177
1927 .. .. .	2,130,433	1931 .. .. .	1,972,847

A further revision of tariff rates on butter and the introduction of a quota system in January, 1932, have served to reduce imports still further, the total quantity imported in the first three months of 1932 amounting to 403,700 cwts. or 9 per cent. less than in the same period of 1931.

Denmark is the chief source of butter imported into Germany, but supplies from that country in 1931 were 30 per cent. smaller than in 1930, and comprised 31 per cent. of total imports as against 33 per cent. in the earlier year. An even greater relative decline occurred in imports from the Netherlands, which were reduced by 42 per cent. Supplies from Latvia, the third most important contributor, declined by 19 per cent. compared with 1930. Imports from Russia, on the other hand, increased to two-and-a-half times, or practically the same proportionate increase as occurred in imports of Russian butter into the United Kingdom. Imports from Poland were practically unchanged, but other Baltic supplies, and imports from Finland, were all much smaller than in 1930.

\* Institut für Landwirtschaftliche Marktforschung.

Among the less important sources it may be noted that imports of Australian butter totalled nearly 30,000 cwts., as against under 400 cwts. in 1930. The small quantity from New Zealand was less than in the previous year.

Table II gives details of the imports of butter into Germany in the three years 1929, 1930 and 1931.

TABLE II.—*Imports of Butter into Germany.*

Country whence consigned.	1929.	1930.	1931.
	cwts.	cwts.	cwts.
Denmark .. .. .	866,256	865,382	603,067
Netherlands .. .. .	644,778	558,213	321,810
Latvia .. .. .	223,878	293,358	237,714
Russia .. .. .	124,354	61,719	150,370
Poland .. .. .	200,282	141,352	141,429
Sweden .. .. .	220,665	219,620	133,193
Estonia .. .. .	135,921	177,709	122,537
Lithuania .. .. .	79,598	112,341	84,120
Finland .. .. .	87,825	101,797	80,036
Australia .. .. .	3,268	386	29,634
New Zealand .. .. .	315	10,544	2,006
Other Countries .. .. .	57,884	78,756	66,931
Total .. .. .	2,645,024	2,621,177*	1,972,847

*Seasonal Variation.*—Imports into Germany tend to be greater in the second half of the year, unlike the United Kingdom imports, where the large proportion of Southern Hemisphere supplies makes imports heavier in the first half of the year. The increase in the second six months is due chiefly to heavier supplies from the less important sources, principally the Baltic countries, as Danish and Dutch supplies are decreasing at that time.

Throughout 1931 imports were on an appreciably smaller scale than in 1930, the reduction being particularly marked in July, when financial conditions were upset, and least pronounced in February and December. Imported supplies were lightest in March and heaviest in October.

Monthly imports of butter in each of the past three years are given in Table III.

TABLE III.—*Monthly Imports of Butter into Germany.*

Month.	1929.	1930.	1931.
	cwts.	cwts.	cwts.
January .. .. .	273,342	221,409	152,783
February .. .. .	197,329	157,441	152,701
March .. .. .	183,228	172,474	135,955
April .. .. .	164,282	189,870	142,872
May .. .. .	211,175	208,159	172,142
June .. .. .	204,667	210,425	159,535
July .. .. .	236,413	294,827	178,039
August .. .. .	262,370	236,514	168,055
September .. .. .	252,986	244,528	165,301
October .. .. .	245,606	261,754	192,278
November .. .. .	218,484	233,319	171,202
December .. .. .	195,142	190,457	181,984
Total .. .. .	2,645,024	2,621,177	1,972,847

PRICES.

Prices of butter in Germany are closely related to world prices and have declined with them during the past few years, but tariff restrictions on imported butter tended to modify the decline during 1931. The Berlin quotation for 1A butter (home-produced first quality butter) in 1931 averaged 125 R.M. per 50 kg., as compared with 139.5 R.M. in 1930.

IMPORTS OF CHEESE.

Imports of cheese into Germany reached a peak in 1925. The 1927 figure was only slightly smaller, and a reduction in 1928 was followed by a recovery in 1929, since when the tendency has been downwards. Total imports of cheese in 1931 amounted to 1,075,089 cwts. and were 12 per cent. less than in 1930. When imports were at their largest in June, the corresponding 1930 figure was exceeded, but in each other month a reduction was recorded.

The Netherlands is by far the most important source of imported cheese on the German market, supplying 62 per cent. of total imports in 1930 and 1931, although the actual quantity furnished in the latter year showed a reduction of 12 per cent. Imports from Switzerland were less than half as heavy as in 1930, and that country dropped from second to fifth place on the list of supplying countries. Imports

from Denmark were reduced by over 25 per cent. Supplies from Italy, on the other hand, were substantially greater in 1931 than in 1930, and imports from Finland and Czecho-Slovakia, consisting mainly of soft cheese, were also on a larger scale than a year earlier. The quantity registered as coming from the United Kingdom was 42 per cent. less than in 1930.

Table IV gives total imports of cheese into Germany since 1924, and in Table V imports in the three years 1929 to 1931 are analysed according to country of consignment.

TABLE IV.—*Imports of Cheese into Germany.*

Year.	Imports.	Year.	Imports.
	cwts.		cwts.
1924 .. ..	863,461	1928 .. ..	1,210,160
1925 .. ..	1,454,904	1929 .. ..	1,308,726
1926 .. ..	1,262,079	1930 .. ..	1,215,512
1927 .. ..	1,407,362	1931 .. ..	1,075,089

TABLE V.—*Imports of Cheese into Germany.*

Country whence consigned.	1929.	1930.	1931.
	cwts.	cwts.	cwts.
Netherlands .. ..	804,374	761,593	669,242
Denmark .. .. .	120,954	100,337	74,564
Italy .. .. .	26,268	38,784	54,918
Switzerland .. ..	133,859	108,825	52,234
Finland .. .. .	44,004	40,329	47,945
Czecho-Slovakia ..	11,395	29,386	52,962
United Kingdom ..	29,979	22,811	13,311
Other Countries ..	137,884	113,447	109,913
Total .. .. .	1,308,717	1,215,512	1,075,089

#### IMPORTS OF EGGS.

Next to the United Kingdom, Germany is the largest egg-importing country, and the difference between the two countries' imports is comparatively small. Imports have tended to decline

from the peak of 24½ million great hundreds recorded in 1928, and the quantity imported in 1931, amounting to 19,391,492 great hundreds, was 12 per cent. smaller than in 1930. The decline occurred in the first nine months, imports in the last quarter of the year being 9 per cent. greater than a year earlier, due in part to certain Continental countries increasing their supplies to Germany in this period at the expense of shipments to the United Kingdom.

The decline in imports has been more than offset by increased home production. Between 1925 and 1930 the fowl population increased by 37 per cent., although the 1931 figure was about 5 per cent. less than a year earlier. Production of eggs in Germany in 1931 was estimated at approximately 50 million great hundreds, or over 70 per cent. of the total consumption, which equals about 130 per head per annum.\* In the United Kingdom home production accounted for over 50 per cent. of consumption (*see* page 45).

Imports of eggs into Germany from 1924 to 1931 are given in Table VI.

TABLE VI.—*Imports of Eggs into Germany.*

Year.			Imports.	Year.			Imports.
			Gt. hds. 000				Gt. hds. 000
1924	..	..	10,447	1928	..	..	24,565
1925	..	..	20,305	1929	..	..	23,941
1926	..	..	19,687	1930	..	..	21,991
1927	..	..	22,512	1931	..	..	19,391

The Netherlands is by far the most important source of foreign eggs imported into Germany, the quantity registered in 1931 being very slightly less than in 1930, but accounting for 32 per cent. of total imports, as against 29 per cent. in the earlier year. Imports from Bulgaria showed a further increase, but supplies from Rumania were 24 per cent. smaller than in 1930; these countries do not figure among the chief United Kingdom suppliers. Imports from Russia, which displaced Rumania as third largest supplier, were 28 per cent. greater than in the previous year, but less than half as heavy as in 1929. Denmark was responsible for slightly increased

\* Institut für Landwirtschaftliche Marktforschung.



quantities, but Belgian supplies, which were reduced substantially in the previous year, declined by a further 42 per cent. in 1931, while imports from Poland were only one-third as heavy as in 1930. Imports from France into Germany, as into the United Kingdom, have fallen off in recent years and were practically absent in 1931. Supplies from other countries were, on the whole, appreciably smaller than in 1930.

The following table gives details of the imports of eggs into Germany during each of the past three years :—

TABLE VII.—*Imports of Eggs into Germany.*

Country whence consigned.	1929.	1930.	1931.
	Gt. hds.	Gt. hds.	Gt. hds.
Netherlands .. .. .	6,351,158	6,296,917	6,235,733
Bulgaria .. .. .	1,578,900	2,461,850	2,589,883
Russia .. .. .	3,995,142	1,464,675	1,878,483
Roumania .. .. .	1,454,959	2,338,875	1,785,818
Denmark .. .. .	1,463,575	1,046,325	1,163,383
Jugo-Slavia .. .. .	1,008,192	1,331,717	960,333
Belgium .. .. .	2,573,216	1,603,517	922,100
Italy .. .. .	986,900	814,941	847,533
Hungary .. .. .	429,633	969,341	753,367
Poland .. .. .	1,305,525	1,553,775	520,900
China .. .. .	343,200	609,950	495,100
Lithuania .. .. .	302,358	346,367	336,425
Estonia .. .. .	197,200	210,033	173,950
Sweden .. .. .	180,767	206,308	146,092
Austria .. .. .	199,642	198,192	143,550
Czecho-Slovakia .. .. .	204,133	262,358	137,917
Finland .. .. .	—	4,275	90,958
France .. .. .	158,542	44,233	2,133
Other Countries .. .. .	208,183	227,234	207,834
Total .. .. .	22,941,225	21,990,883	19,391,492

## IMPORTS OF BUTTER INTO CERTAIN EUROPEAN COUNTRIES.

The United Kingdom and Germany between them take by far the greater part of the butter entering world trade. In the past two or three years, however, certain other European countries, notably France, Belgium and Switzerland, have begun to figure to an increasing extent as importers of butter ; some of these, until comparatively recently, were self-contained or even net-exporters. While the proportion of total supplies which they take is relatively small, demand from these countries is capable of exercising an important effect on the major markets.

A short summary of the trend of foreign trade in butter in certain countries in the four years 1928 to 1931 is given in the following paragraphs. All of the countries mentioned have taken steps to limit imports, and an indication of the methods is given.

### FRANCE.

From being a net exporter of butter until 1929, France in the past two years has become a net importer on a large scale. Imports in 1931 showed a more than threefold increase compared with 1930, while exports declined by a further 9 per cent. and were little more than one-fourth as heavy as the quantity imported.

The increase in imports would undoubtedly have been even more pronounced but for the adoption of the quota system, which placed a limit on imports in the last quarter of 1931. The system has been continued in 1932.

Denmark is the principal source of foreign butter imported into France, and doubled its supplies in 1931. Imports registered as from the United Kingdom, which would include a considerable proportion of box butter, were five times as heavy as in 1930, and materially increased quantities were imported from the Netherlands. No details are given regarding the substantially increased imports from other sources, but the bulk of these was probably of Baltic and Argentine origin.

Algeria is the principal market for French butter, and has taken increasing quantities in recent years. Exports to the United Kingdom have fallen off considerably, and were practically negligible in 1931.

Details of the imports and exports of butter in the four years 1928 to 1931 are given in the following table :—

TABLE I.—*France: Imports and Exports of Butter.*

—	1928.	1929.	1930.	1931.
<i>Imports—</i>	cwts.	cwts.	cwts.	cwts.
From Denmark .. ..	6,089	25,335	50,606	102,758
United Kingdom ..	20,516	11,246	14,595	72,386
Netherlands ..	11,711	19,097	18,569	65,195
Other Countries ..	13,492	31,409	31,612	124,295
Total Imports .. ..	51,808	87,087	115,382	364,634
<i>Exports—</i>				
To Algeria .. ..	24,780	24,551	34,184	45,972
United Kingdom ..	71,396	34,281	5,723	1,567
Other Countries ..	125,608	90,479	68,187	51,008
Total Exports .. ..	221,784	149,311	108,094	98,547
Net Imports (+) or Exports (-).	-169,976	-62,224	+7,288	+266,087

BELGIUM.

Imports of butter into Belgium have shown considerable expansion in recent years, and the total quantity imported in 1931, amounting to 371,000 cwts., was 85 per cent. greater than in 1930. Total imports in 1928 were only 26,000 cwts., and in that year were exceeded by exports.

Supplies from Denmark have increased at a rapid rate, and that country has supplanted the Netherlands as the chief source of imported butter, the quantity of Danish butter imported in 1931 being 75 per cent. greater than in 1930. Imports from the Netherlands increased by 23 per cent. The quantity shown as from the United Kingdom was nearly three times as great as in the previous year.

Imports from other sources have increased from under 6,000 cwts. in 1929 to 106,000 cwts. in the year under review. About one-third of these supplies in 1931 was from Poland and Latvia, and it is probable that imports from Baltic countries as a whole constitute the greater part of this quantity.

The import duty on butter was raised from 20 francs to 161 francs per 100 kilogrammes as from 27th November, 1931. In April, 1932, a further modification occurred in the introduction of a quota system.

The following table gives details of the gross and net imports of butter into Belgium during each of the past four years :—

TABLE II.—*Belgium : Imports and Exports of Butter.*

Country whence consigned.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.
Denmark .. .. .	994	17,228	74,803	130,626
Netherlands .. .. .	7,177	51,667	74,498	91,437
United Kingdom .. .. .	14,421	10,872	15,228	42,920
Other Countries .. .. .	3,288	5,587	35,599	106,111
Total .. .. .	25,880	85,354	200,128	371,094
Exports .. .. .	33,148	25,687	23,640	24,608
Net Imports (+) or Exports (-).	-7,268	+59,667	+176,488	+346,486

SWITZERLAND.

Imports of butter into Switzerland have tended to increase since 1929 and a further advance was recorded in 1931, when the total quantity imported was 24 per cent. greater than in the preceding year. Denmark is the principal source of the imports, accounting for 54 per cent. of the total in the year under review. A feature of interest is the rapid increase in supplies from Poland, and, to a less marked extent, from the other Baltic countries, but imports from France have suffered a drastic decline. Imports from Argentina have advanced appreciably, and small quantities were also imported from Australia and New Zealand during 1931.

In December, 1931, the tariff on imported butter was raised from 120 to 180 Swiss francs per 100 kg. In April, 1932, importation was made subject to licence, to be regulated in accordance with the quantity of home-produced butter available, the tariff being fixed at 120 francs per 100 kg.

The following table shows the imports of butter into Switzerland in the four years 1928-1931. Exports are negligible.

TABLE III.—Imports of Butter into Switzerland.

Country whence consigned.	1928.	1929.	1930.	1931.
	cwts.	cwts.	cwts.	cwts.
Denmark .. .. .	89,013	84,485	83,371	113,181
Poland .. .. .	4	555	25,225	35,864
Argentina .. .. .	14,980	7,769	8,767	15,669
Estonia .. .. .	} 228	2,337	6,004	9,868
Latvia .. .. .				
Lithuania .. .. .	36	777	4,631	9,871
France .. .. .	39,862	29,129	11,230	5,321
Italy .. .. .	9,059	9,696	9,026	3,921
Sweden .. .. .	—	41	5,413	3,759
Australia .. .. .	41	—	—	1,770
New Zealand .. .. .	—	—	—	674
Other Countries .. .. .	8,018	13,849	14,136	8,582
Total .. .. .	161,241	148,638	167,803	208,480

ITALY.

Imports of butter into Italy are comparatively small, but have increased appreciably in the past two years, and the figure for 1931 was practically twice as heavy as for 1930. Argentina, which supplied three times as much as in 1930, was the principal source of the imports, but increased quantities were received from certain European countries and Australia. Imports from Denmark, however, were less than in the previous year.

Exports of butter from Italy declined in 1931, due principally to smaller supplies to Switzerland.

The duties on fresh butter and salted butter imported into Italy were raised from 66 lire and 88 lire per 100 kg. respectively, to 350 lire and 378 lire respectively, plus 15 per cent. *ad valorem*, as from 4th March, 1932.

The following table gives details of the imports and exports of butter in each of the past four years.

TABLE IV.—*Italy: Imports and Exports of Butter.*

—	1928.	1929.	1930.	1931.
Imports.				
<i>Fresh Butter</i> :—	cwts.	cwts.	cwts.	cwts.
Argentina .. ..	5,088	6,428	8,221	24,646
Poland .. ..	—	—	2,890	7,805
Hungary .. ..	24	2	2,677	7,421
Australia .. ..	1,894	79	1,290	4,205
Denmark .. ..	3,374	7,925	7,508	3,947
Other Countries ..	21,059	2,476	5,213	7,202
Total, Fresh ..	31,439	16,910	27,799	55,226
Total Imports (all kinds)	31,559	17,298	27,945	55,388
Exports.				
<i>Fresh, Salted, etc</i> :—				
United States of America	2,303	3,156	5,278	5,113
Switzerland .. ..	8,112	8,327	7,756	3,357
Other Countries ..	5,472	3,260	3,492	3,042
Total Exports .. ..	15,887	14,743	16,526	11,512
Net Imports .. ..	15,672	2,555	11,419	43,876

E.M.B. 53.

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# EMPIRE MARKETING BOARD

MAY 1931 to MAY 1932



JUNE 1932

LONDON

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE  
To be purchased directly from H.M. STATIONERY OFFICE at the following addresses  
Astrak House, Kingsway, London, W.C.2 ; 120, George Street, Edinburgh  
York Street, Manchester ; 1, St. Andrew's Crescent, Cardiff  
15, Donegall Square West, Belfast  
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1932

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88-501-33

X9(J):51.1-3, dN2:1

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## PREFACE.

### THE EMPIRE MARKETING BOARD IN 1931-32.

THE habit of Empire buying continued to spread among the population of the United Kingdom in 1931. The attached table shows twenty-five products for which new records were set up. These records, given in quantities, afford a clear proof of the way in which numerous foods from the overseas Empire are establishing themselves in the dietary of the people of Great Britain. In more than half of these products the previous best figure is for the year immediately preceding, while in many others it is for 1929, showing the steady upward tendency now at work.

Commodity.	Country of Origin.	Quantity in 1931.	Previous Record.
Wheat ..	Australia ..	23,248,000 cwt.	20,109,000 cwt. in 1921
Wheat flour	Australia ..	2,560,000 "	1,852,000 " " 1917
Lamb,	New Zealand ..	8,168,000 carcasses	7,141,000 carcasses " 1930
frozen.	Australia ..	3,257,000 "	2,818,000 " " 1922
Pork, frozen	Australia ..	86,000 cwt.	23,000 cwt. " 1930
Pigs, live ..	I.F.S. ..	479,000* "	415,000 " " 1930
	New Zealand ..	1,935,000 cwt.	1,564,000 " " 1930
Butter	Australia ..	1,559,000 "	1,161,000 " " 1925
	S. Africa ..	40,000 "	33,000 " " 1918
	Australia ..	9,145,000 doz.	5,547,000 doz. " 1930
Eggs	South Africa ..	5,893,000 "	4,741,000 " " 1930
Tea ..	Ceylon ..	159,000,000 lb.	153,000,000 lb. " 1929
	South Africa ..	2,506,000 cwt.	2,149,000 cwt. " 1930
Sugar	Australia ..	4,796,000 "	4,239,000 " " 1929
Canned pine-apple.	B. Malaya ..	685,000 "	648,000 " " 1929
Wine ..	South Africa ..	789,000 gallons	558,000 gallons " 1930
Tobacco ..	Canada ..	6,278,000 lb.	6,029,000 lb. " 1928
Bananas ..	British West Indies.	6,970,000 bunches	5,926,000 bunches " 1930
Plums ..	South Africa ..	29,100 cwt.	27,000 cwt. " 1930
	South Africa ..	65,500 "	46,800 " " 1930
Grapefruit	Palestine ..	35,500 "	10,300 " " 1930
Grapes ..	South Africa ..	59,200 "	50,500 " " 1927
	Australia ..	145,000 "	130,000 " " 1930
Pears	New Zealand ..	19,500 "	19,400 " " 1930

\* Since 1924, when separate returns were first issued.

Other high records were established among commodities which have not yet assumed a prominent position in the United Kingdom's import trade, and among these may be mentioned South African apples, of which 10,800 cwts. were imported last year, as compared with a previous high record of 3,300 cwts. in 1929, and Cyprus oranges, last year's total of 3,100 cwts. being nearly double the highest figure previously recorded, also in 1929.

The experience of the past year suggests that Nigerian pineapples may very soon be shipped in appreciable quantities. Other products such as oranges and grapefruit from Nigeria, Avocado pears from the West Indies, mangoes from India and the West Indies, tomatoes from Grenada, and tomatoes and eggs from Palestine hold out promising possibilities.

A few commodities which failed to establish new records in 1931 but yet reached a high level of shipments may perhaps be singled out. Coffee from British East Africa totalled 291,000 cwts., falling short of the 1930 record, but exceeding by 40,000 cwts. the highest figure reached in any other year. South African oranges, totalling 969,000 cwts., were slightly below the 1930 figure, but were 300,000 cwts. more than in any previous year, while oranges from Palestine were within 6 per cent. of the record established in 1927. Imports of New Zealand cheese in 1931 have hitherto been exceeded only in 1929 and 1930, and fresh pork from the Irish Free State only in 1928. Australian beef reached the highest level in any year since 1925, and the same Dominion's shipments of frozen rabbits were the largest since 1920. Although imports of Australian wine fell considerably short of the figure of the quantity imported in 1927, a new record was established by the quantity entered for home consumption, which reached 2,391,000 gallons, or 48,000 gallons more than in 1929.

This buying has been the buying of people whose incomes have been in very many cases materially less than in former years. There has been less money to be spent, but the Empire has received a larger share of it.

#### REDUCED EXPENDITURE.

In the summer the Board themselves were involved in the drastic economies which had to be effected in public expenditure. The Committee on National Expenditure had, indeed, recommended the abolition of the Board. His Majesty's Government informed the Dominion Governments that they did not contemplate giving effect to this

recommendation. But they had to reduce the money available for the Board, and decided that for the year 1932-33 their net vote would be £300,000 instead of £550,000. For the year 1931-32 the Board were called upon to surrender £110,000 by effecting rigorous economies. Research has proved, naturally, the least elastic of the Board's activities from the financial point of view. Work has to be planned years ahead and cannot be abandoned in the later stages without obvious and grave waste. Much of the work is dependent upon other work being continued at some other centre. In addition, the practice of the Board has been to make grants in conjunction with other bodies, and it is seldom free to withdraw. Nevertheless the goodwill of those in charge of the research work and in receipt of grants and their zealous co-operation in the quest for possible economies enabled reductions in research commitments, ranging from 10 to 25 per cent., to be effected throughout the range of the Board's commitments.

Similar reductions were effected in publicity work and in office expenses.

#### THE "BUY BRITISH" CAMPAIGN.

The events of the summer had lent a special significance to the Board's endeavours to make Empire buying a national habit and after the General Election it was realised that now, if ever, was the time to concentrate the publicity resources of the country for a short period in an intensive nation-wide appeal to buy British goods. The campaign was opened simultaneously in all parts of the United Kingdom on Monday, November 16th. The result was a remarkable demonstration of the national will to overcome present difficulties by developing and utilising Empire resources at home and beyond the seas. The campaign was inaugurated by H.R.H. The Prince of Wales in a broadcast speech on the first day, and within a few days the Board's message "Buy British, from the Empire at Home and Overseas" was a familiar phrase in every quarter of the Kingdom, from the Scillies to the Shetlands. More than four million posters, of several sizes and designs, were needed to meet demands for display in the windows of shops and other business premises, on public hoardings and private notice boards, in Post Offices and the windows of Government Departments, in trams, buses and trains, in factories, on motor cars and aeroplanes—in short, on every kind of site generally used for poster display and in thousands of places where posters had never before been seen. A huge electric sign on the east side

proclaimed the message across Trafalgar Square. Newspapers and wireless carried the message into the homes of the people, and it followed them wherever they went, whether for business or for pleasure. Films, theatre programmes, football and race cards kept it alive in their leisure moments, while the vast outdoor display thrust it prominently before them at the most important moment of all—the actual moment of purchase. The movement spread to embrace such activities as holiday travel and the enjoyment of natural amenities, and there were soon innumerable examples of the useful forms the new economic patriotism could assume.

The campaign, on this unprecedented scale, was made possible only by the generous co-operation of every section of the community, all of whom gave freely whatever they could offer—service, or free advertising space, or special facilities. The Ministries of Labour in Great Britain and Northern Ireland placed at the Board's disposal for the receipt and issue of posters their Employment Exchanges and the services of their Managers. The Heads of Civic Authorities throughout the country responded freely to the Board's appeal to forward the campaign in their own localities. Over 80 National Trade Associations and over 500 Local Associations actively co-operated in the campaign. Everywhere the Boy Scouts and Girl Guides, in answer to a personal appeal from the Chief Scout, undertook the local distribution of posters, while the English and Scottish Federations of Women's Institutes made special arrangements to carry the Board's message into the rural areas. Owners of advertising space, especially proprietors of newspapers, hoardings and transport undertaking, gave their space free of all cost, while private advertisers of British goods readily agreed to incorporate the "Buy British" theme in their own advertising matter. This spirit enabled the campaign to be run very economically. While the total cost of the campaign to the Board was in the neighbourhood of £12,000, the ascertainable value of the commercial advertising space provided ran into hundreds of thousands, while the value of other facilities is incalculable, for the reason that they would never be granted to a commercial advertiser.

Equally incalculable, on any statistical basis, will be the ultimate effect of the campaign. The trend of Empire trade can be judged only by reference to trade returns extending over a period of years, and the factors at work are so closely interconnected that no attempt

can be made to separate their individual results. It can, however, be said that the reports which have reached the Board from all quarters indicate that the "Buy British" campaign has definitely increased the determination on the part of the public to buy, and on the part of the retailer to sell, British goods, and that this determination is more than transitory. More than that the Board do not presume to claim; but they are strongly convinced that the enthusiastic way in which the "Buy British" appeal was taken up in every part of the country testifies to the usefulness of the work that has been done in the past to inculcate the spirit of Empire buying. The public has been eager to learn about the Empire and swift to realise the great part it is called upon to play as the chief market of the Empire. The meaning of the slogan "Buyers are Builders" is being realised to the full, and the future outlook for the cause of Empire buying is remarkably bright.

#### OTHER PUBLICITY ACTIVITIES.

Apart from the "Buy British" campaign, the Board have continued, as widely as the funds at their disposal allowed, to urge the importance of buying from the Empire and to demonstrate the practical application of their theme through all the media of publicity hitherto employed. They have continued their poster campaign on their 1,700 special frames distributed over 475 towns in the United Kingdom and 25,700 schools have now applied to be placed on the Board's standing list to receive poster reproductions and leaflets. Advertisements have been inserted in trade and local papers. Many new designs for display material for shops have been issued, and leaflets, both for housewives and for schools, have been sent out in large numbers. The special posters have continued to be issued to United Kingdom factories in receipt of orders from the Empire overseas, and an extension of the scheme, by the design and issue of special labels for affixing to goods made here for the Empire overseas, has been enthusiastically taken up by manufacturers. Wireless talks to housewives have been continued, through the courtesy of the British Broadcasting Corporation. Lectures have been given to women's organisations and many meetings of business men, traders and producers have been addressed. The Board have participated in important exhibitions in various centres, notably at Olympia on the occasion of the British Industries Fair. The Fair broke all records for attendance, and it was the general opinion of the Dominion

and Colonial representatives who participated that the results in trade enquiries and demands for samples were 50 per cent. better than on any previous occasion. The Board have also developed the plan of leasing premises for six months in large cities and organising them as Empire shops, which are placed at the disposal of the Empire countries in turn for a fortnight each ; such Empire shops having been organised this year in Birmingham, Blackpool and Liverpool. They have also assisted in Empire shopping weeks all over the United Kingdom. The Board's film unit has continued the production and re-editing of films and a library of Empire films has been created, with the copious and invaluable help of the Dominion Governments. These resources have been placed, in response to an eager demand, at the disposal of schools and other bodies owning cinema projectors.

#### MARKET PROMOTION.

The Board's entry into the field of direct market promotion, which was signalled two years ago by the establishment of the Marketing Committee, has led to active developments in the period under review. In the forefront has been the work of approaching local authorities, public institutions and other bulk purchasers. As the result of visits by specially appointed Marketing Officers and of correspondence, the Board have been freely invited to suggest revisions in existing forms of tender designed to promote the purchase of Empire products. They have been able to suggest such revisions in the case of some 1,250 institutions, while 70 per cent. of the local authorities visited have notified the Board that their recommendations have been adopted. The Board's Marketing Officers have also approached railway, shipping and hotel companies and the large public schools.

In their task of gathering practical information about a wide variety of Empire products, and assisting their entry into the market, the Board have met with great assistance from the distributive trades, who have freely placed their expert knowledge at the service of the Board. The Board's work has been conducted throughout in close consultation with the Trade Commissioners of Empire Governments and the London representatives of organised bodies of Empire consumers, whose constant help and advice the Board desire very cordially to acknowledge. At no point was their help more effective than in the Board's successful canvass of Lancashire butter retailers in the spring and summer of 1931.



The market promotion work of the Board is set against a background of statistical work and market intelligence development conducted by its Statistics and Intelligence Branch. This important work, which includes surveys of conditions in the countries whose produce competes with Empire produce, is capable of great development to the advantage of producers and distributors in the Empire overseas as well as in the United Kingdom. This side of the Board's work received special point and direction at the Imperial Conference of 1930, when the first resolution dealing with the Board read as follows :—

“ 1. The Conference, having surveyed the work of the Empire Marketing Board, is satisfied that it is valuable to the Commonwealth as a whole, and recommends its continuance and its existence in certain directions, notably in the spheres of market intelligence, statistical surveys and market promotion.”

#### CHANGE IN MEMBERSHIP.

The change of Government in August led to various substitutions in the composition of the Board and their Committees. Mr. Malcolm MacDonald, Parliamentary Under Secretary of State for the Dominions, became Vice-Chairman of the Board in place of Mr. W. Lunn, who became an ordinary member of the Board. Major Walter Elliot took the place of Mr. F. Pethick Lawrence as Financial Secretary of the Treasury, Mr. A. N. Skelton, Parliamentary Under Secretary of State for Scotland, took the place of the outgoing Lord Privy Seal, Mr. T. Johnston, and Sir Robert Hamilton replaced Dr. Drummond Shiels as Parliamentary Under Secretary of State for the Colonies, and Chairman of the Research Grants Committee, Mr. Malcolm MacDonald became Chairman of the Publicity and Film Committees, and Mr. A. N. Skelton Chairman of the Marketing Committee and Food Products Committee. The Board received with great regret the resignation from the Publicity Committee of Mr. Frank Pick, owing to the increasing demands of his many public duties. Since the inception of the Board, Mr. Pick's unique experience, particularly in the field of poster publicity, has been of inestimable value, and to his efforts is very largely due the success which the Board's posters have achieved. The Board suffered a heavy loss in February, 1932, by the death of Professor R. Stenhouse-Williams, Director of the National Institute for Research in Dairying, who was the Chairman of the Dairy Research Committee.

## I. GRANTS FOR RESEARCH AND DEVELOPMENT.\*

### THE FINANCIAL POSITION AND ITS EFFECT UPON RESEARCH.

As indicated in the Preface to this Report, the Board were called upon to surrender £110,000 of their Vote for the financial year 1931-32, and were informed that their Vote for 1932-33 would be reduced by £250,000. The Retrenchment Committee, which was appointed to consider the manner in which the surrender of £110,000 in the year 1931-32 should be made, prepared a scheme which was put into force. This provided for a saving of £90,000 on the research activities of the Board and necessitated a most careful examination of research commitments in consultation with all grantees. As a result, reductions ranging from 10 to 25 per cent., with a few even more severe reductions, have been effected in practically every one of the Board's research liabilities. Certain grants which had been provisionally sanctioned have been suspended and scarcely any new grants have been made during the year under review. It has been impossible for the Board's Research Grants Committee to stimulate new proposals, to initiate projects which have long been under discussion, or to continue, to the extent desirable, the system of scientific liaison in the shape of interchange of scientific personnel.

The limits thus set upon the development of projects of considerable economic importance may be gathered from the account of research activities included in this section of the Report. The Board desire to acknowledge and place on record their appreciation of the willing response to their appeal for economies from all the recipients of grants. Without their co-operation a solution of the Board's financial difficulties would have presented a still more acute problem.

### THE PLANNING OF JOINT PROGRAMMES OF RESEARCH.

The Imperial Conference of 1930 commended especially "that feature of the Board's policy which aims at the concentration and development in the most appropriate centres of scientific team work

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\* Provision was made in the printed Estimates for 1931-32 for an expenditure on research of £425,000. Owing to the financial crisis this item was reduced to £335,000.

upon problems of interest to the Commonwealth as a whole." Moreover, the Report of the Sub-Committee on the Empire Marketing Board contained a recommendation that "it should be a part of the Board's function not merely to receive applications for grants but to co-operate with existing research organisations for the purpose of planning joint programmes of research on a broad Empire basis."

The limits within which the Board can contribute financially to new schemes are, of necessity, determined by the limits of the funds at their disposal, and present financial circumstances are such as to preclude any considerable expansion of the Board's activities in the field of research. The Board have felt it desirable, none the less, in accordance with the above recommendations, to initiate an interchange of views in regard to the future development of research on a co-operative basis. To this end the Board have invited home and overseas research organisations and Departments of Agriculture to supply considered statements indicating what major problems they consider most urgently to demand, in the general economic interests of the Empire, further scientific research, and on which of these problems they think that, in the present state of knowledge, effort can most profitably be concentrated. At the time of preparing this report replies are to hand from the Commonwealth of Australia, the Union of South Africa and Southern Rhodesia.

#### *Australia.*

The preservation and transport of perishable foodstuffs is clearly a field in which the planning of joint programmes of research is specially appropriate. The Australian reply suggests that fundamental investigations into certain aspects of animal and plant physiology are urgently required as a basis for applied studies. In the field of applied investigations a free exchange of ideas is essential between workers throughout the Empire, and information, particularly in regard to the pre-storage and storage factors influencing the "storage lives" of fruit, is required for apples, pears, oranges and bananas. The problems of the preservation of beef in the chilled condition for relatively long periods and the successful preservation of edible offal are also questions of wide significance to the meat-exporting Dominions. As regards transport, previous surveys, conducted by the Food Investigation Board of the United Kingdom, have shown the difficulties involved in securing the more uniform physical conditions in insulated holds of ships necessary for the safe carriage of perishable foodstuffs. The problems are essentially similar

in each country and co-operative investigations in this field, if possible by a survey team, Empire-wide in scope and personnel, are recommended. The reply also suggests that the development of wool research is of outstanding importance at the present time, particularly from the point of view of production and of the correlation of results with those obtained from investigations in the United Kingdom on the manufacturing side. More research is required on the physical properties of various types of wool, and on genetic factors, with a view to the elimination of undesirable qualities and the general improvement of fleece characters. Such research would link up the efforts of the breeder with the requirements of the manufacturer and thus assure more profitable and less fluctuating returns.

Pasture problems, particularly those affecting the semi-arid and the tropical and sub-tropical parts of the Empire, give scope for further research. Already close co-operation with the Welsh Plant Breeding Station, Aberystwyth, is greatly assisting the study of grassland improvement in the temperate regions.

Other important subjects suggested by Australia are the problems associated with biological control of insect pests; cattle-breeding experiments, which aim at evolving a breed of cattle more suitable than the purely British breeds for those parts of the tropics with seasonal periods of rainfall with alternating droughts, high temperatures and insect pests; and forest products research, particularly from the point of view of securing the closest co-operation in the study of fundamental problems. Dairy research and fuel research are also mentioned as subjects ripe for development on an Empire basis.

With regard to the centre or centres within the Empire most appropriate for such investigations, it is felt that, while general principles might be established at a central institution, most of the big questions could be studied only in the countries where they arise, or by means of team work among workers in different parts of the Empire.

#### *South Africa.*

The Union of South Africa suggests three subjects of widespread importance upon which co-operation in research could be established. The first is the intestinal worms of sheep. Two main lines of research are indicated: (a) a study of the life-histories of all the important worms of sheep and (b) the chemo-therapy of worm infections and the study of other methods of treatment or prevention. This subject

is already included in the scheme of research which is being undertaken at the Onderstepoort Veterinary Research Laboratory with the assistance of a grant from the Empire Marketing Fund, but the problem is so vast that many more workers could, with profit, be engaged upon it. At the present time investigations are proceeding in most parts of the Empire and as the problem is one of the major handicaps to successful sheep-breeding in the Empire, it lends itself admirably to a scheme of co-ordinated research. The Union authorities suggest that this research might be concentrated at three centres, namely, the Imperial Bureau of Agricultural Parasitology or some other suitable centre in Great Britain, the Onderstepoort Veterinary Research Laboratory in South Africa, and Glenfield or some other suitable centre in Australia.

The second problem is the destruction of ecto-parasites of domestic animals. The groups of parasites such as ticks, scab mites, lice, etc., are responsible for enormous losses in the Dominions and Colonies, and to a less extent in Great Britain. The known methods of destruction are not altogether satisfactory, and it is believed that better methods could be discovered through research. This subject is also included in the approved scheme of research at Onderstepoort, but again it is desirable that the work should be extended, chiefly on the chemical side. Such work might be concentrated at a suitable centre in Great Britain, where the preliminary chemical work and small-scale animal tests could be undertaken, and at Onderstepoort. The third subject suggested is one affecting both chemistry and plant industry, namely, the influence of soils, fertilisers and climatic factors, more especially rainfall and temperature, on the storage life and keeping qualities of fruit.

#### *Southern Rhodesia.*

Southern Rhodesia suggests that co-ordinated research is required on a number of problems affecting livestock, crops, forestry, and agricultural tractor power. A number of questions arising out of cattle improvement need attention, as, for instance, whether beef, dairy or dual purpose stock should be raised; what degree of improvement is practicable under local conditions, and what breeding policy should be followed to bring about the desired result. An aspect of nutritional research which might repay investigation at, say, Onderstepoort, is the possibility of improving the winter conditions of livestock or the development of young animals by supplementing the normal acids which are found to be lacking.

The control of the tsetse fly constitutes one of the most urgent problems with which Southern Rhodesia, and other parts of Africa, are confronted to-day. The fly infested areas in Southern Rhodesia alone increased between 1908 and 1918 from about 4,000 to about 9,000 square miles; between 1918 and 1928 the increase was from about 9,000 to 18,000 square miles. Considerable further encroachment has occurred during the past two years. Much energy and money has been spent on control measures such as organised grass burning, clearance of forest, poisoning, reduction of game, etc., but so far no thoroughly satisfactory method has been formulated. The Southern Rhodesian Authorities suggest that a fully equipped and staffed biological station, situated in the fly zone, might be able to find some weakness in the tsetse fly's defences which would enable control measures to be devised.

The loss of condition of stock and the arrested development of young stock, apparently due to the poor feeding value of the indigenous grasslands during winter months, point to a protein deficiency in crops. The remedy for this appears to be the suitable management of grasslands to retain the feeding value longer into the winter months, and the provision of some concentrated protein food calculated to make up certain precise protein or mineral deficiencies. It is suggested that the systematic breeding of legumes of different types both for grain and hay at a central plant-breeding establishment would give results of great value to the African livestock industry and would well repay expenditure.

The pasture research investigations now being carried out in Southern Rhodesia with assistance from the Empire Marketing Board show great promise. The results will, however, only form the foundation upon which the future system of natural grassland management must be built. A thorough knowledge of grasses and other plants, and particularly of the legumes grown in association with grasses, is necessary,

#### BIOLOGICAL AND AGRICULTURAL SCIENCES.

*Development of Biological and Agricultural Departments of the University of Cambridge.*

The Board's Report for the year 1929-30 referred to the offer of a grant of £10,000 per annum for five years to the University of Cambridge in aid of the scheme for the development of the Biological

and Agricultural Departments agreed between the University and the International Education Board of the Rockefeller Foundation. The total estimated cost of the scheme, which included the provision of a new University Library, was £1,179,000. Towards this sum the International Education Board offered £700,000 on condition that the University raised £479,000 from other sources.

The University in June, 1930, announced that the conditions of the International Education Board had been fulfilled and that they were thus able to accept the offer of the Rockefeller Foundation. The scheme is now proceeding, and the first two years' instalments of £10,000 have been paid by the Board. The building of the new Library, designed by Sir Giles Gilbert Scott, is in hand and, when complete, will house some 47 miles of books. Sites have been allocated for the extensions to the Schools of Agriculture, Botany and Physiology and the buildings will be pushed forward as rapidly as possible. Plans for the Entomological Field Station and new buildings for the Department of Zoology are now under consideration.

#### FOOD PRESERVATION AND LOW TEMPERATURE RESEARCH.

The Board have continued to support, during the year 1931-32, low temperature research at Cambridge and at the Ditton Laboratory, East Malling, and research into the preservation and transport of fish at Aberdeen. A further grant has been approved for the year 1932-33, but, on account of the reductions in the Board's resources, this has been reduced by 25 per cent. compared with the grant for 1931-32.

##### *Cambridge Low Temperature Research Station.*

In the section dealing with meat, a critical examination of the rapid-freezing process has been continued, with special reference to the influence of the size of the mass of meat and of the temperature of storage. Attention has also been given to the deterioration of home-killed meat in small refrigerators with a view to reducing contamination and inhibiting the growth of micro-organisms. The methods of following the development of rancidity in fats, which were evolved during an investigation on the effects of light on the oxidation of fats, have been applied to the practical problems connected with the preparation and storage of beef, mutton, pork and bacon. Progress has also been made in the attempt to predict the keeping qualities of a fat from its chemical constitution.

Considerable progress has been made in the practical application of gas-storage to fruits and vegetables. There are now four commercial gas-stores for apples in operation in Kent. The results are being watched with keen interest, and have been so satisfactory that a number of other gas-stores are in contemplation. The best keeping home-grown cooking apples can only be kept in good condition for about six months in an ordinary cold store. The new method of storage doubles this period, and makes it possible for the home grower to market his apples over a whole year. The use of atmospheric control in retarding the ripening of bananas has given promising results, and the Low Temperature Research Station in Trinidad is now carrying this investigation further.

The preservation of fruits and vegetables by freezing has been studied. Methods of commercial value have been developed which prevent these products from deteriorating in colour and flavour during storage. These methods so far apply particularly to peas and runner beans among vegetables, and to cherries, plums and strawberries among fruits. In many cases the preservation by freezing has been shown to be superior to that attainable by canning. In a number of cases, however, difficulties arise. Post-mortem changes during or after thawing, or even during storage at  $-20^{\circ}\text{C}$ ., destroy the natural colour or flavour of the product. The nature of these changes is under investigation, but in the meantime it has been shown that a short treatment with heat, prior to freezing, sufficient only to destroy enzymes, is a practical though not completely satisfactory way out of the difficulty. It has not yet been possible to confirm the advantages claimed for rapid freezing at very low temperatures. The investigation of the effect upon storage of the use of small, regulated amounts of vapours in the atmosphere has led to the discovery that ammonia vapour has remarkable effects in inhibiting fungal rotting in certain fruits and has no harmful effect. The practical application of this discovery, as also of the previous discovery of the similar action of acetaldehyde vapour, has yet to be followed up. Early information, in both cases, was given to the Dominions and Colonies.

On the biological engineering side, work has continued upon the rate of moisture evaporation from stored materials. The variability in rate of water-loss from a population of eggs has been studied, and the effect of the type of package and of certain properties of the egg-shell examined. The movement of water from white to yolk of the



egg raises interesting questions, both practical and theoretical, and has been investigated in some detail, particularly in relation to the effects of temperature and of an atmosphere of pure carbon dioxide. The rate of water-loss from New Zealand cheeses has received some attention from the point of view of the effects of temperature, humidity and waxing of the surface. The effect of air movement on the rate of evaporation from apples is being studied. The influence of evaporation on the control of humidity in a stack of apples has been the subject of a theoretical study, and it has been shown that an equilibrium humidity of 92-95 per cent. is characteristic for the variety taken when stored in bulk under a fairly wide range of conditions. The cooling of a cargo of apples when loaded into a ship at various temperatures has also been the subject of a simple mathematical investigation which emphasises the biological advantages of pre-cooling.

As regards pig products, imports from Australia and New Zealand can be treated in two ways. In the first place, frozen pork can be exported for the pork market or for the manufacture of bacon in this country. A large-scale experiment has shown that bacon of good quality can be made from frozen pork, and that any defects which may arise can usually be traced to deterioration of the frozen pork during storage, rather than to the effects of freezing and thawing. Within the last few years an increasing amount of frozen pork has been successfully used for the manufacture of bacon in this country, and considerable quantities of frozen pork are now imported annually for this purpose and for the pork market. In 1931 New Zealand sent 121,803 cwts. and Australia 85,805 cwts. of frozen pork to Great Britain.

It has been suggested that, instead of exporting frozen pork, it might be advisable for Australia and New Zealand to export mild-cured bacon in the green condition, i.e., unsmoked. This, however, has proved to be unsatisfactory. Owing to the risk of spoilage by the superficial growth of micro-organisms, it would be necessary to freeze the bacon and transport it at  $-10^{\circ}$  C. ( $14^{\circ}$  F.). Large-scale experiments have shown that by freezing at  $-30^{\circ}$  C. ( $-22^{\circ}$  F.) and storing at  $-10^{\circ}$  C. ( $14^{\circ}$  F.), the lean of mild-cured bacon can be kept in excellent condition, even after five months' storage, but that the fat will become rancid even when the storage lasts for only six weeks. This is due to the fact that the fat of bacon continues to take up oxygen even when frozen. It has been shown that the fat of smoked

bacon keeps better than that of unsmoked bacon, but rancidity develops even in smoked bacon after it has been stored for nine weeks at  $-10^{\circ}$  C. ( $14^{\circ}$  F.). Thus, the transport of mild-cured, green bacon in the frozen condition from Australia and New Zealand cannot be carried out successfully by ordinary commercial methods. Other methods, however, are being investigated.

On the canning side a study of the raw materials of tin-plate has revealed wide variations in the susceptibility of different sheets, and even different portions of the same sheet, of the steel base to attack by a given fruit acid. The variations persist when the steel is coupled with tin, and may account for a proportion of the differences found in practice in the permanence of cans filled with the same material under the same conditions. An attempt is therefore being made to discover the factors which have most influence on the steel base during manufacture. Progress has also been made towards an understanding of the interaction of the various factors effecting the corrosion of tin-plate. In particular, it has been shown that while traces of tin salts in solution have an inhibiting effect on the corrosion of iron, traces of salts of iron in solution, in the presence of oxygen, accelerate the rate of corrosion of both iron and tin.

*Torry Research Station, Aberdeen.*

At this Research Station various problems connected with the preservation and handling of fish are being investigated. Study of the application of brine-freezing and low-temperature storage to long-distance steam trawlers has been proceeded with during the year, and quantities of white fish (haddock, cod, etc.) freshly caught by the Research Vessel "City of Edinburgh" have been cold-stored for periods far exceeding the most extended long-distance voyage likely to be made by a steam trawler. After a number of tests it has been found that the alteration in the texture and flavour of the fish, which is one of the recognised disadvantages of freezing and cold storage in air by the methods and at the temperatures hitherto employed in this country, can be avoided by a combination of brine-freezing at  $-5^{\circ}$  F. and cold storage at the same or at a lower temperature. Perfectly fresh fish thus treated will emerge at the end of, say, three months with all its pristine perfection of appearance, flavour and texture. This method has been brought to the notice of the industry by means of various press articles and other communications.

Brine-freezing and cold storage of herrings is also being investigated at Torry. It is thought that if fish caught during seasonal gluts could be stored at convenient centres on shore, seasonal shortages could be made good from home instead of from foreign supplies.

Investigations on the smoke-curing of fish are also being carried out. Experimental data have been assembled for a study of the physical and chemical processes involved, so that improvements in methods may be suggested to the industry. The study of the fats and oils of various types of fish has been continued, and information of considerable medical interest has been gained by determining their vitamin content and other characteristics. The bacteriology of fish is also being intensively studied. Knowledge in this direction, hitherto lacking, is essential for the better preservation of fish as food. The chemistry of post-mortem changes in the flesh of fish is also being actively pursued.

*Ditton Laboratory, East Malling.*

The first season's work with the Experimental Hold was of an exploratory nature.

One hundred and twelve tons of apples (Bramley's Seedlings) were stored for 132 days. During this period the distribution of temperature and transfer of heat characteristic of different methods of refrigeration were studied. Readings were taken, at intervals of eight hours, of the temperature at 200 positions within and round the stack of fruit, and of the heat abstracted by the refrigerant. Measurements of the moisture deposited and analyses of the atmosphere were made daily.

From these data it has been possible to compare the efficiency of different cooling circuits, and different combinations of circuits, on both the roof and sides of the store. The effect of forced air-circulation also has been studied while using these methods of cooling, and also when the external cooler has been employed. The heat balance sheets have enabled the heat production of the apples to be estimated with fair accuracy. The result is in agreement with an independent estimate based on the rate of production of carbon dioxide by the fruit. The importance of studying the distribution of temperature and its control was emphasised by the result of storing at room temperature, after unloading the store, samples of apples from the warmest and coolest part of the stack. The wastage after three weeks was twice as great in the former as in the latter. Experiments

on gas storage are in progress in three of the four small chambers which were completed during the summer. Four varieties of apples are being stored, in ten different mixtures of nitrogen, oxygen and carbon dioxide, at three temperatures. The possibilities of the small uninsulated, automatically refrigerated store are being explored. It has been filled with fruit during the season, and the temperatures, both in the fruit and of the outside air, have been recorded.

*Food Preservation Research in Australia.*

The Australian Commonwealth Council for Scientific and Industrial Research have decided to proceed with the creation of a Section of Food Preservation under the charge of Dr. J. R. Vickery, an officer of the Council, who, for the last four years, has been at the Cambridge Low Temperature Research Station. Owing to the present financial stringency it will not be practicable yet to develop the work on such a wide basis as was originally hoped, but the Council have received from various sources offers of co-operation and assistance in investigations on the preservation and transport of foodstuffs, and it will thus be possible to make a beginning with the work of the new section on an effective, though limited, scale. A Report by Dr. Vickery outlines a scheme of research.\*

ANIMAL HUSBANDRY.

*Research on the Mineral Content of Natural Pastures.*

The work on the mineral content of pastures has been continued during the year, the main effort being directed to the application in practice of the information obtained in research in the last few years.

In Scotland the research has developed into an investigation of the influence of deficiencies in the pasture on the incidence of disease. Experiments are in progress with large groups of sheep kept under natural conditions to ascertain the extent to which there is a correlation between the composition of the pastures, the chemical composition of the blood, the immunological reactions of the blood and the susceptibility of the grazing animals to disease.

In Kenya the work has been further developed and at the station at Naivasha results of the past researches are being applied in practice. The financing and control of the Kenya work has passed

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\* "Refrigeration Applied to the Preservation and Transport of Australian Foodstuffs—A Survey and a Scheme of Research" by J. R. Vickery, Ph.D. (Pamphlet No. 23 of the Commonwealth Council for Scientific and Industrial Research, Melbourne 1931.)

from the Empire Marketing Board and the Rowett Research Institute to the Colonial Office and the Department of Agriculture in Kenya with the assistance of a grant from the Colonial Development Fund.

In Australia efforts are being made to establish the precise influence of species, stage of growth, fertilisers, soil type and rate of growth on the mineral content of pasture species. The growing of standard pastures under definitely controlled conditions on soils from representative mineral-deficient areas is also being developed. Included amongst these are "bush-sick" soils, "coasty" soils and the manganese-deficient soils of the "Denmark" disease area of Western Australia, on which acute osteomalacia in cattle develops.

In New Zealand the chemical composition of pastures has been determined under different seasonal conditions and the influence of the application of mineral fertilisers on the growth and composition of pastures has been determined. It has been found that in lime-deficient areas the application of lime leads to an increased carrying capacity and to the better growth of the lambs and reduction of disease. The previous work on bush-sickness has been confirmed and extended and wider use is now being made of iron salts for the prevention of this disease. A disease called "dopiness," which occurs on certain pastures, is being investigated with a view to ascertaining whether it is caused by deficiencies in the pasture.

In Southern Rhodesia chemical studies have been made of the seasonal variations in the composition of veld cut periodically and veld left uncut. These studies have shown the importance to the stock breeder of practising a system of veld control as against the common practice of allowing stock a free range. A series of experiments is in progress to determine the influence of moderate applications of different fertilisers on the yield of hay and the chemical and botanical composition of the veld herbage. A study is also being made of the influence on growth and fertility of feeding a mineral supplement to animals on a free range as against animals grazing without a mineral supplement on controlled and fertilised veld.

#### *Cattle Feeding and Dairying Experiments in Palestine.*

The grant approved in 1928 in support of a scheme of experiments in Palestine to test whether modern methods of milk production could be applied under the conditions prevailing in many parts of the Empire came to an end in 1931.

The results of the work both on the feeding of dairy cows and on the production of fodder crops were distinctly encouraging. Apart from the salary of the research worker, the milk production part of the scheme has been made practically self-supporting, whilst the work on the production of fodder crops has yielded results which may be of considerable economic importance to many parts of the Empire. The Jewish Agency for Palestine, who, with the Empire Marketing Board, jointly financed the first three years' work, are continuing the scheme on lines recommended in a report drawn up by Dr. Orr, Director of the Rowett Research Institute, and Dr. Kohn, of the Jewish Agency. The research work on fodder growing has been taken over by the Agricultural Experiment Station at Tel Aviv, and the dairying part of the scheme is being run as a separate venture under the executive control of the Colonization Department of the Jewish Agency. This ensures that the work will be carried on without further assistance from the Empire Marketing Board. The results will be communicated periodically to the Board and the Imperial Bureau of Animal Nutrition and thus made available to workers in all parts of the Empire.

*Milk Yield, etc., of Cows Crossbred from the Indian Zebu.*

In the Annual Report for 1929-30 it was reported that a grant had been made to enable Mr. John Hammond, of the Cambridge University School of Agriculture, to visit Trinidad and Jamaica to investigate the inheritance of milk yield, fat percentage and other characters of cows crossbred from the Indian Zebu.

Mr. Hammond's Report is being published in the Board's "Grey Book" series of Reports as a contribution to the study of live-stock in the tropics. It is hoped that his conclusions will draw attention to the possibilities of using Zebu blood in the building up of herds more suited to the climatic and pasture conditions of many tropical countries.

#### ANIMAL HEALTH.

*Onderstepoort Veterinary Research Station, South Africa.*

The Library building, which was erected with the aid of the capital grant of £10,000 from the Board, has now been completed. The fittings and equipment are being put in the different rooms, and the building will be occupied within two or three months time. This building forms a very notable addition to the Onderstepoort Institute, and the more liberal library space which is now available will prove

of very material assistance to research workers. A suitable tablet commemorating the Board's donation will be placed in the entrance hall of the building.

The three Research Fellows, who were appointed at the end of 1930, have now started work at Onderstepoort.

Mr. R. A. Alexander, B.Sc., B.V.Sc., who was appointed to undertake researches on virus diseases and tissue culture, was required to spend one year at European institutes to study the latest methods in connection with this problem. He sailed from South Africa in February, 1931, and resumed duties at Onderstepoort on the 1st February, 1932. During his stay in Europe he spent a considerable amount of time at Cambridge, doing tissue culture work in the Strangways Research Laboratory under Dr. H. B. Fell. He also visited the Lister Institute, the National Medical Research Institute with its branch institute at Mill Hill, the Veterinary Research Laboratory at Weybridge, the London School of Hygiene and Tropical Medicine, the Burroughs Wellcome Research Laboratory, and other institutes in Great Britain. On the Continent of Europe, the Institut Pasteur in Paris, the Veterinary College in Berne, the Universities at Giesen, Utrecht, Amsterdam, Hanover and Berlin, the Kaiser Wilhelm Institute, the Robert Koch Institute and the City Hospital in Berlin were visited, as well as the Foot and Mouth Research Station on the Island of Reims, the University of Copenhagen, and the Institut für Schiffs und Tropenkrankheiten in Hamburg. At each of these Institutes Mr. Alexander spent as much time as was necessary to obtain a thorough insight into the research work in progress and particularly into the technique employed by the different research workers.

Mr. Alexander is now engaged on work which can be classified under the following headings: (i) concentration of virus, especially Horse-sickness and Bluetongue viruses, by means of cataphoresis; (ii) improvements in the method of vaccination against Horsesickness with formalised vaccine; (iii) cultivation of virus *in vitro*; and (iv) different problems in connection with Heartwater. Some of this work is being undertaken in conjunction with other officers of the Onderstepoort staff.

Mr. J. H. Mason, M.R.C.V.S., arrived at Onderstepoort in June, 1931. The work he has in hand may be classified under the following headings:—

(i) *Bacterial flora of the intestine of sheep.*—Quite a number of sheep varying in age from one day to three months have so far

been examined. An attempt has been made to estimate quantitatively the number of bacteria present. Particular attention has been paid to such organisms as *B. coli*, streptococci and anaerobes, especially as regards their pathogenicity for small laboratory animals.

This is the basic problem for which the appointment was made and the study of it will involve detailed and laborious research. It is expected that ultimately the application of the knowledge thus gained will prove of great practical value.

(ii) *New pathogenic B. sporogenes-like anaerobes*.—The differentiation of the putrefactive anaerobes from sheep's intestines has been undertaken, chiefly from an agglutination standpoint.

(iii) "*Lumpy wool*" in sheep (in collaboration with Dr. Bekker).—Isolation of causative organism, transmission experiments and prevention or cure.

(iv) *Lamb dysentery* (in collaboration with Drs. Robinson and Scheuber).—The application of methods learned at the Wellcome Physiological Research Laboratories to the production of potent "bloedpens" anaculture and antitoxin.

Also investigation of "vanants" (surface colony work) of the "*Lamb dysentery*" bacillus and of *B. paludis* (McEwen).

(v) *B. botulinus* (in collaboration with Dr. Robinson).—Attempts are being made to purify cultures by different methods. The toxins of the various strains are being investigated serologically.

(vi) *Heartwater in sheep and B. proteus X* (in collaboration with Mr. Alexander).—Attempts are being made to isolate a *B. proteus X* strain (or other organism) following the technique of Weil and Felix.

Dr. C. Rimington, holder of the Fellowship for the chemical investigation of poisonous plants, commenced his duties on 1st July, 1931. Before leaving for South Africa he visited the more important European centres of Phytochemical Research in Paris, Amsterdam, Utrecht, Leiden, Cologne, Heidelberg, Basel, Lucerne, Zurich, Innsbruck, Munich, Vienna, Prague, Leipzig and Berlin. In September he sailed for South Africa and assumed duty at Onderstepoort in October. The following problems were assigned to Dr. Rimington and are now being studied:—



(i) The active principle of *Dimorphotheca spectabilis* has been isolated in pure crystalline form and shown to be an unstable cyanogenetic glucoside—the glucose ether of acetone-cyanhydrin. The same substance is responsible for the poisonous properties of *Dimorphotheca zeyheri*. In contact with enzymes present in the plant the glucoside liberates hydrogen cyanide causing rapid death. The enzymes concerned are now under close examination.

(ii) *Geigeria passerinoides*.—Two lots of material from different localities have been examined but the plants were not poisonous, possibly owing to abnormal climatic conditions for the time of the year.

(iii) *Dichaeptalum cymosum*.—Much progress has been made in the purification of the toxic principle of this plant, but isolation has not yet been achieved. Owing to the uncompromising character of the toxin, the work has been laborious and exacting. Certain definite statements can, however, be made concerning its chemical nature. It is neither a glucoside, carbohydrate nor alkaloid and behaves neither as a base nor an acid. It is fairly stable but soluble only in water and chemically inert.

During the course of the work a poisonous base of the choline type has been isolated from this plant. Although very toxic to cold-blooded animals, it is comparatively innocuous when given *per os* or subcutaneously to mammals and can only be considered to be an incidental toxic constituent. There have also been isolated and studied the following non-toxic substances:—A catechol tannin, present in large quantity, a glucoside of rhamnose and an unidentified flavanoid pigment, a complex uronic acid, some choline and other bases. Investigations are still in progress.

(iv) *Cucumis myriocarpus*.—Work has been commenced upon *Cucumis myriocarpus* and a toxic substance isolated which has been shown to be closely related to Picrotoxin. Further investigation is in progress.

Two short communications have been sent to the correspondence columns of "Nature."

Other research work in progress is as follows:—

(1) *Mineral Survey Work*.—This work was commenced at the beginning of 1931 with the concurrence and financial support of the Empire Marketing Board. The object is to study the distribution and extent of mineral deficiencies in South African

soils and pastures. It is also intended to correlate the data obtained from the analyses of the soil with those obtained from the analyses of the pastures and again with those obtained from the analyses of the blood of animals grazing on such pastures. During 1931 four surveys were completed, involving about 10,000 individual analyses. Samples were obtained from forty different areas in the Union. The following constituents were determined in the grass samples :—Phosphorus, calcium, magnesium, potassium, sodium, chlorine, crude protein, fibre, nitrogen-free extract plus ether soluble extract. One publication has already gone to the press and data have accumulated for several others. It is expected that the results obtained in this survey will be of great interest not only to South Africa, but to other parts of the world. The study of the problem on such a big scale will clearly demonstrate the value of the different methods employed.

A separate problem under this general heading is the relation between the iodine-content of common foodstuffs grown and consumed in several localities where goitre is prevalent, and the incidence of goitre. This work is also yielding interesting results.

(2) *The Destruction of Ecto-parasites by Means of Dips.*—This problem is of great importance not only to South Africa but also to other parts of the Empire and other pastoral countries. The programme of work includes investigations into the composition of lime-sulphur dips with particular reference to methods of analysis; the decomposition and oxidation of such dips with particular reference to the mechanism involved and the products formed; and the question of finding a method for *rapid* field testing. Experiments to determine the *lowest* effective concentration of polysulphides have been carried out and a field survey is in progress, various samples being collected from all areas of the Union in which dipping with lime-sulphur is undertaken at the moment. The effect of various polysulphides and their decomposition products on the wool fibre is being studied.

Three articles recording the results obtained to date are now in the press.

(3) *Helminthological Problems.*—Dr. R. J. Ortlepp, one-time Senior Assistant to Dr. R. T. Leiper, Director of the Imperial Bureau of Agricultural Parasitology, has been engaged for this work. Dr. Ortlepp assumed duties in July, 1931, and is occupied with the following problems :—

(i) Investigations into the structure, life-history, bionomics and methods of spread of *Gaigeria pachyscelis*, a hookworm of sheep. Up to the present the bionomics and structure of the larvae up to the infective stage have been studied, while the life-history and methods of spread are still being investigated.

(ii) Investigations into the life-history and methods of spread of the *Moniezia*s of sheep. This work has been somewhat held up because of the very dry summer and consequent lack of material. However, material has since become available and investigations are now in full swing. This work is being carried out in collaboration with Dr. H. O. Mönning.

(iii) A systematic study of the helminth parasites of poultry in the Union. It is hoped to extend this work so as to include studies of their life-history.

(iv) A systematic study of the helminth parasites of the wild fauna of the Union with a view to elucidating their relationships and effects on those helminths occurring in domesticated animals. In this connection four papers have already been prepared, one of which has appeared, and the others are in the press. In these a number of helminths new to science are described and discussed.

(4) *Tsetse Fly Investigations*.—For this work Dr. B. A. Whitnall, M.Sc., was appointed and was sent to the tsetse country in Zululand. One of the objects of this investigation was to study the incidence of trypanosome infection in tsetse flies caught in Zululand. It was thought that the occurrence of salivary gland infection in an area such as Zululand, where sleeping sickness does not occur, would be of particular interest. The occurrence of this mode of infection has now been definitely demonstrated by Mr. Whitnall. Other problems, such as the influence of tsetse fly trapping, the influence of game, etc., are also being studied.

Other problems, which were originally included in the programme of research to be undertaken at Onderstepoort under the Empire Marketing Board grant, were provisionally cancelled owing to the necessity for reduction of expenditure.

*Investigations into the use of B.C.G. Vaccine in the Protection of Calves against Tuberculosis.*

In last year's Report (page 15) reference was made to experiments devised to test the efficacy of the immunity produced by vaccination with the B.C.G. strain of tubercle bacillus against an experimental

infection with virulent bovine tubercle bacilli. The selected method of immunising and the resistance test, which consisted of an intravenous injection of 0.25 mg. to 1.0 mg. of young cultures of virulent bovine bacilli, were described. All the control calves died in from 15½ to 33 days of acute general miliary tuberculosis. Notwithstanding the severity of the test dose, the duration of life of the great majority of vaccinated animals exceeded that of the controls, and in half of them was prolonged for periods ranging from four months to four years. Eight of the twenty-eight animals were alive when the first report was published; six of these have since been killed and examined; the remaining two are still alive, and one of them has borne two healthy calves.

The six animals were killed at periods ranging from 466 to 698 days after the test dose which had killed the controls within 33 days. The amount of disease found on post-mortem examination was slight. Indeed, in one calf no lesions were found except in the meninges. The lungs, which were the organs most severely affected in the controls, showed no lesions in five of the vaccinated animals, and only seven small nodules in one. The central nervous system was affected to some extent in all the animals.

It was decided to modify the method of administering the test dose, so as to resemble more closely a natural infection. Six calves were accordingly vaccinated by the intravenous injection of 10 mg. of B.C.G., followed after three weeks by a dose of 100 mg. Three months later the resistance test was applied. The six vaccinated calves and two normal controls were fed by pipette with an emulsion of young cultures of virulent bovine tubercle bacilli, each animal receiving 5.0 mg.

The controls which were killed 172 and 194 days after the test dose, showed numerous lesions, especially in the abdominal organs and associated lymphatic glands.

In four of the six vaccinated calves no lesions were found. In one a few minute grey granules were seen on the surface of the lung and from these, two acid fast bacilli were found. There were no other lesions. In the other, four small shotty bodies were found in the lymphoid tissue of Peyer's patches. Tubercle bacilli were not demonstrated in smears.

Guinea-pigs, inoculated with emulsions of various glands from all six calves, showed no trace of tuberculosis, and cultures sown with tissues from five were negative.

The experiments show that a high degree of immunity to virulent bovine bacilli, given by the mouth, can be induced in calves which have been vaccinated with B.C.G. in the manner adopted.

An investigation designed to show the duration of the immunity, and to determine whether or not a waning immunity can be reinforced, is proceeding.

*Animal Health Research in Australia.*

The scheme for animal health research in Australia, referred to in last year's Annual Report, has now been divided into two programmes, one dealing with research into diseases adversely affecting the sheep raising industry and the other with research into diseases affecting the cattle industry in Northern Australia. Both form part of the programme of the Commonwealth Council for Scientific and Industrial Research, the first through its Division of Animal Health and the second through its Division of Animal Nutrition.

A Pastoral Research Trust has been established in Australia for the purpose of raising funds in support of the scheme of research on sheep diseases. The Empire Marketing Board have agreed to contribute pound for pound with the Pastoralists over a period of five years up to a maximum of £3,000 per annum. Already £2,000 per annum has been provided in Australian contributions, and it is hoped that the remaining £1,000 per annum will soon be forthcoming. A generous gift of £20,000 made to the Council for Scientific and Industrial Research by Mr. F. D. McMaster has enabled a laboratory to be erected and equipped at the University of Sydney. This laboratory was opened in November last, and work is now in progress on important problems such as internal parasites of sheep, caseous lymphadenitis, contagious mammitis, footrot of sheep, etc.

As regards research on cattle diseases in Northern Australia, the Queensland Government hope to raise about £3,500 per annum by means of a levy of one shilling per 100 head of cattle and a contribution from General Revenue. The Empire Marketing Board have promised to contribute pound for pound over a period of five years up to a maximum of £5,000 per annum. At present plans have been drawn up on the basis of a total fund of £7,000 per annum being available. A laboratory at Townsville has been made available by the Queensland Government, and this will form the centre for the investigation of major problems such as ticks and tick fever, pleuro-pneumonia, tuberculosis, peg-leg disease, walkabout disease, blackleg, onchocerciasis (worm nodules) and internal parasites.

*Parasitological Research in Canada.*

In April, 1931, the Board approved a grant to meet half the recurrent expenditure over a period of three years to be incurred in establishing an Institute of Helminthology at Macdonald College, McGill University, Montreal, for the investigation of parasitic diseases of domestic animals. It is proposed that this unit should carry out an extensive survey of the distribution, prevalence and economic importance of the parasites of sheep, swine and poultry, and make a thorough study from the applied side with a view to suggesting practical methods of prevention. The problems of animal parasitology are not merely of local importance, since the same or related parasites constitute one of the principal limiting factors wherever the same classes of live-stock are reared.

This scheme of research will be developed under a special Committee of the National Research Council of Canada. The College have secured from the Quebec Government sufficient money for the capital expenditure on laboratory buildings and outhouses. A detailed scheme of work is now being drawn up. The other half of the maintenance costs will be provided by the National Research Council.

WOOL.

*Wool Industries Research Association, Leeds.*

Under the grant from the Empire Marketing Board, the work on the standardisation of wool quality is now taking more definite shape and much of the earlier fundamental research is bearing fruit. During the year work has been published dealing with the relationship between fibre length and fibre thickness in various wools and with observations on the apparent fineness and freedom from kemp of naturally coloured wools. Further contributions have been made on the subject of colour inheritance in sheep. Work is also proceeding on the study of the normal production of hair and wool and the various factors which affect its growth.

A report has been published embodying the results of the Empire tour by Dr. J. E. Nichols.\* A series of wools collected during the tour is being examined and an attempt is being made to study the growth of wool under different conditions, the effects of environment, etc.

On the biochemical side, work on the distribution of sulphur in different parts of the fleece, and on the chemical composition of wool keratin is in progress. The distribution of grease, suint and sand in

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\*"A Study of Empire Wool Production," by J. E. Nichols. Wool Industries Research Association, Torridon, Headingley, Leeds, May, 1932 (Price 5s. net).

the staple is also receiving attention. In the Wool Measurement Department, the work on international standardisation of the fineness of wool tops and their relation to wool quality has been completed. An investigation is now proceeding on a method for the determination of the resilience of wool, the felting power of wool, and the spinning properties in relation to quality of a complete range of Australian and New Zealand wools.

Apart from this laboratory work under the auspices of the Empire Marketing Board, a book on "Wool Quality" has been written and published during the year.\* This book is intended to act as an incentive to, and a basis for, research work throughout the Empire. It embodies a study of the history of fibre measurement, and incorporates the latest results of research throughout the world.

Further progress has been made in co-operation with various other bodies on the study of nutrition and wool production. As a result of the Imperial Wool Research Conference organised by the Board in 1930, a Wool Fibre Committee of the Wool Industries Research Association has been inaugurated, under the chairmanship of the President of the British Wool Federation. Representatives of the Dominions, home wool interests, and all phases of the manufacturing industry are included. Already reports have been furnished by this Committee to Australia, New Zealand and South Africa, and to various Colonies and Protectorates throughout the Empire. These reports take the form of actual laboratory examinations, practical mill tests and considered opinions of wool men in Bradford and elsewhere. It is hoped that increasing use will be made of this Committee, which is a direct link between producer and manufacturer, where for the first time common problems can be fully discussed.

During the year a number of Dominion students from Australia, New Zealand and South Africa have enjoyed the hospitality of the laboratories and have now returned to carry on the work in their respective Dominions.

#### DAIRYING.

##### *Cheese Research Problems in New Zealand and British Columbia.*

The New Zealand Dairy Research Institute at Palmerston North has continued its investigations into the problem of "openness" in cheese. It has been shown that this characteristic is induced by a

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\* "Wool Quality—A Study of the Influence of Various Contributory Factors, their Significance and the Technique of their Measurement." By S. G. Barker, Ph.D., D.I.C., etc. (Published December, 1931, by H.M. Stationery Office.)

physical reaction of the chemical conditions of the curd at the time of hooping. This is in turn dependent on the biochemical changes occurring in the making process, and, in particular, on the individual and combined influences of the state of the cheese solids in the raw milk, the starter, and any extraneous organisms that may be present in the milk. These questions are being closely studied.

Reference was made in last year's Annual Report to the grant to the University of British Columbia for research on cheese ripening problems. This is proving of considerable interest and value to New Zealand, and, as a result of the visit to British Columbia of Dr. Marsden, Secretary of the New Zealand Department of Scientific and Industrial Research, close liaison has been established. One of the objects is to develop a chemical method of analysis to indicate the degree of ripeness in cheese, so that the optimum conditions may be worked out for storage and transport with a view to delivering a mature product on the United Kingdom market.

*"Journal of Dairy Research."*

The Board have continued during the past year their support for this Journal, and have received evidence from workers at home, and from those Dominions where dairying is a major industry, that it is satisfying a real need and proving of considerable value. In the past year there has been a rapid growth in the number of original papers submitted from different parts of the Empire. This indicates that the Journal is becoming recognised by scientific workers as a medium for the publication of the results of scientific research. More space will, in the future, be devoted to the publication of such contributions.

The cause of dairy research has suffered a grave loss through the death in February last of Professor R. Stenhouse Williams, Director of the National Institute for Research in Dairying, University of Reading. Professor Stenhouse Williams' work will be valued and remembered in particular by the Dairy Research Committee of the Board, of which he was Chairman, and by all those associated with the "Journal of Dairy Research," of which he was Editor. No less will the loss be felt by dairy research workers throughout the Empire, whose interests Professor Stenhouse Williams was always concerned to promote.

*Study of Tuberculosis Infection of Milk.*

This scheme, details of which were given in last year's Report, aims at ascertaining the extent of infection of the milk supply in Scotland, with particular reference to the relative infection of milk from different



localities, and of milk treated by different commercial processes. Satisfactory progress has been made in the past year, and the investigation is reaching the report stage. Owing, however, to the drastic reductions of the Board's resources, it was found necessary to call for economies in expenditure. As a result, each of the four Scottish municipalities will deal only with 1,000 samples of milk (raw, pasteurised and bulked) instead of 1,950 samples as originally planned, while the Hannah Dairy Research Institute's part of the work will be limited to an examination of graded milks and to bulked milk samples from creameries, the examination of further samples of dried and condensed milks being dropped. The number of samples to be examined at the Institute has been reduced by one-half from 1,000 graded samples and 1,000 miscellaneous samples to 750 graded samples, 250 bulked samples and 50 samples of condensed and dried milks. Although this curtailment means that the study of the relative infection of dried and condensed milks must be left until a more promising time makes it possible to collect significant data, it will not invalidate the findings nor prevent a report of definite significance being presented.

#### *Survey of Dairy Research.*

The Survey of Dairy Research by Sir William Dampier, F.R.S., mentioned in last year's Annual Report, has now been published by the Board.\* This Report is of considerable value to dairy research workers throughout the Empire and brings into focus the many problems with which they are concerned.

In dealing with the division of work on immediate problems among Home Institutes, Sir William Dampier recommended that work on the storage of milk and the ripening and storage of butter and cheese should be concentrated at the National Institute for Research in Dairying at Reading. Such work requires that a cold store should be available to enable observers to control both temperature and humidity. A grant for the erection at the Reading Institute of a small low-temperature station was recommended by the Board in

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\* "Dairy Research. A Report to the Empire Marketing Board" by Sir William Dampier, Sc.D., F.R.S. (formerly Dampier-Whetham), November, 1931. E.M.B. 44, published by H.M. Stationery Office (Price 1s.).

July last, but the financial crisis and the severe reduction in the Board's resources which followed have made it impossible for the Board to implement this recommendation.

*Standardisation of Volumetric Glassware used for Testing Milk and Milk Products.*

The Imperial Agricultural Research Conference of 1927 drew attention to the need for establishing greater uniformity throughout the Empire in the official specifications prescribed for volumetric glassware used in testing milk and milk products. Greater co-ordination in this field would enable the testing authorities in different parts of the Empire to work on a common basis and obtain results of greater scientific value; and, in addition, the manufacturers of glassware would have the assurance that apparatus made in accordance with the agreed regulations would be marketable in any part of the Empire. It was recommended that steps should be taken to collect information on existing methods and standards with a view to suggesting a practical scheme for standardisation of glassware.

To this end the Dairy Research Committee of the Empire Marketing Board prepared a memorandum and questionnaire on the subject which was circulated to the Governments of the Empire and to Government Departments at home.\* The replies to the questionnaire, particularly from those countries where dairying is an important industry, and in which the testing of volumetric glassware is already compulsory, indicated widespread agreement in favour of the principle of uniform specifications for glassware and uniform methods of testing milk and milk products.

A Sub-Committee were accordingly appointed to prepare specifications and detailed directions for test. This Sub-Committee have now made considerable progress towards the completion of the first part of their task, namely, the drafting of a set of specifications and the preparation of draft methods of test. In preparing these draft specifications and methods the Sub-Committee have had before them the replies to the original questionnaire received from overseas Governments and Government Departments at home. These replies

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\* "Testing of Milk and Milk Products in the Empire. Proposed Standardisation of Volumetric Glassware. Memorandum and Questionnaire by the Dairy Research Committee" (Issued by the Empire Marketing Board in May, 1928).

furnished details of existing Acts and Regulations relating to volumetric glassware and the methods of test already employed, as well as much other valuable information.

These drafts, when completed, will be submitted to Empire Governments for criticism or approval. On receipt of replies the Subcommittee hope to be in a position to issue final draft specifications and methods. If and when this position is reached the specifications and methods will be put forward in published form as suggested standards, and it will be for the Government of each country to decide whether the suggested standards should be adopted for use in its own territories, and, if so, to consider what action, whether by Act, Regulation or otherwise, is desirable to that end.

#### EXPORT OF PEDIGREE LIVESTOCK.

##### *" Assisted Passages " Scheme.*

When the Board were informed in September, 1931, of the drastic cuts in their Vote they were forced to suspend for the time being their contributions to the " assisted passages " schemes. This decision affects British Columbia, Australia, Southern Rhodesia, Kenya and Northern Rhodesia.

The table on page 38 gives the number and types of animals which have been exported under these schemes from their inception up to their suspension in September, 1931.

##### *London Quarantine Station.*

The London Quarantine Station continues to facilitate the export of pedigree livestock from this country to oversea Empire countries in spite of the suspension of the " assisted passages " schemes. Since its establishment in 1928, 2,063 animals have passed through the station to Australia, the Union of South Africa, Northern Ireland, the Irish Free State, Southern and Northern Rhodesia, Nigeria, the Gold Coast, Trinidad, Antigua, Cyprus and Palestine. The net cost per animal quarantined, after crediting to the Ministry of Agriculture the veterinary inspection fees due to them, was just under £2. 8s. 0d. for an average period of quarantine of two weeks. The thanks of the Board are due to the Royal Agricultural Society of England for the economical and harmonious administration made possible by their efficient management of the station.

CATTLE.						PIGS.					
	Australia.	British Columbia.	Kenya.	Northern Rhodesia.	Southern Rhodesia.		Australia.	British Columbia.	Kenya.	Northern Rhodesia.	Southern Rhodesia.
Aberdeen Angus :						Berkshire :					
Bulls .. ..	4	—	2	—	3	Boars .. ..	6	—	5	—	—
Heifers .. ..	20	—	—	—	—	Gilts .. ..	—	—	4	—	—
Ayrshire :						Sows .. ..	8	—	—	—	—
Bulls .. ..	1	2	37	—	12	Large Blacks :					
Heifers .. ..	—	62	21	—	24	Boars .. ..	—	—	2	—	—
Unclassified .. ..	—	56	—	—	—	Gilts .. ..	—	—	1	—	—
Blue Albion :						Sows .. ..	2	—	—	—	—
Bulls .. ..	—	—	2	—	—	Large White :					
Cumberland Dual-purpose :						Boars .. ..	6	—	1	—	2
Bulls .. ..	—	—	—	—	6	Gilts .. ..	—	—	1	—	3
Dairy Shorthorn :						Sows .. ..	5	—	3	—	—
Bulls .. ..	1	—	19	—	—	Middle White :					
Heifers .. ..	—	—	12	—	—	Boars .. ..	1	—	—	—	—
Devon :						Gilts .. ..	—	—	—	—	5
Bull .. ..	6	—	—	—	—	Sows .. ..	2	—	—	—	—
Heifers .. ..	1	—	—	—	—	Tamworth :					
Friesland :						Boars .. ..	4	—	—	—	—
Bulls .. ..	—	—	13	—	—	Gilts .. ..	—	—	1	—	—
Heifers .. ..	—	—	2	—	—	Sows .. ..	5	—	2	—	—
Galloway :						Wessex Saddle-backs :					
Unclassified .. ..	—	—	4	—	—	Boars .. ..	1	—	—	—	—
Guernsey :						Sows .. ..	1	—	—	—	—
Bulls .. ..	4	—	4	—	—	Unclassified :					
Heifers .. ..	14	—	—	—	—	Boars .. ..	—	—	4	—	—
Hereford :						Sows .. ..	—	—	6	—	—
Bulls .. ..	12	—	—	4	6		41	—	30	—	10
Heifers .. ..	6	—	—	—	2						
Jersey :						SHEEP.					
Bulls .. ..	17	—	2	—	1	Border Leicester :					
Heifers .. ..	62	—	2	—	10	Ewes .. ..	10	—	—	—	—
Lincoln Red :						Rams .. ..	5	—	—	—	—
Bulls .. ..	—	—	1	—	3	Cheviot :					
Red Poll :						Ewes .. ..	—	2	4	—	—
Bulls .. ..	3	1	35	—	11	Rams .. ..	—	3	1	—	—
Heifers .. ..	4	—	3	—	36	Dorset Horn :					
Scotch Shorthorn :						Ewes .. ..	3	—	18	—	—
Bulls .. ..	—	—	1	—	—	Rams .. ..	5	—	2	—	—
Shorthorn :						Kerry Hill :					
Bulls .. ..	8	—	9	6	21	Ewes .. ..	—	6	—	—	—
Heifers .. ..	7	—	—	7	15	Rams .. ..	—	2	—	—	—
Unclassified .. ..	—	15	—	—	—	Oxford Down :					
South Devon :						Ewes .. ..	—	1	—	—	—
Bulls .. ..	4	—	—	—	3	Rams .. ..	—	—	—	—	—
Sussex :						Romney :					
Bulls .. ..	—	—	—	—	16	Ewes .. ..	—	1	1	—	—
Heifers .. ..	—	—	—	—	2	Rams .. ..	—	4	14	—	—
Welsh Black :						Unclassified .. ..	—	—	1	—	—
Bulls .. ..	—	—	5	—	—	Ryeland : .. ..					
Unclassified .. ..	—	—	2	3	—	Ewes .. ..	5	—	—	—	—
	174	136	176	20	171	Southdown :					
						Ewes .. ..	97	4	—	—	—
						Rams .. ..	20	2	—	—	—
						Suffolk :					
						Ewes .. ..	2	1	—	—	—
						Rams .. ..	3	1	2	—	2
							154	23	43	—	2

## ENTOMOLOGY.

### *Parasite Laboratory, Farnham Royal.*

During the past year the staff of the laboratory continued investigations on a number of serious insect pests on behalf of the Governments of the Dominions and Colonies. Shipments of parasites of the European Earwig, the Sirex Wood Wasps, the Codling Moth, the Greenhouse Whitefly and the Cabbage Caterpillar were despatched to New Zealand; of the European Earwig, the Western Wheat-stem Sawfly, and the Larch Case Bearer to Canada; of the Pear Slug to New South Wales; of the White Fly to the Irish Free State and to Northern Ireland; of a predaceous fly attacking the House Fly to Fiji; of the Trichogramma egg parasite to Egypt and Ceylon; and of the Aphelinus, parasitic on the Woolly Aphis, to a number of correspondents in Great Britain. Consignments of several insects attacking ragwort, gorse, and blackberry have also been despatched to New Zealand.

The Entomologist of the Australian Commonwealth Council for Scientific and Industrial Research, who is attached to the laboratory, has continued to investigate and to ship to Australia the insects attacking St. John's Wort.

Up to 31st December, 1931, a total of 70 consignments, comprising in all over 459,000 specimens, have been sent out from the laboratory. During the five-year period, ended 31st December, 1931, a total of 187 consignments, comprising 1,053,710 insects, have been despatched, and 37 different pests have been investigated. Several important parasites of major pests, such as the Pear Midge, the Sheep Blowfly, the European Fruit Scale, the Pine Shoot Moth, the Western Wheat-stem Sawfly, and two of the principal insect enemies of gorse and ragwort have become established in infested areas in the Dominions and Colonies as a result of these shipments. According to the local entomologists, the parasite introduced into Western Canada against the European Fruit Scale attacking shade trees has already increased to such an extent that it has not been necessary to devote any funds to measures of artificial control during the past winter.

Forty-five papers, giving the results of the investigations undertaken by various members of the staff, have been published during the past five years and several others are now in preparation or in course of publication.

The severe restriction of expenditure has, however, very seriously hampered the progress of the work. To effect the necessary economies the staff of technical workers was reduced from seven to four, two field assistants and one gardener were dismissed ; all field work that could not be carried out in the vicinity of the laboratory was discontinued, as well as the employment of casual workers for the collection, sorting, and packing of mass collections of parasite material. The sub-station in the Mediterranean area, where conditions are especially favourable for the study and rearing of tropical or sub-tropical pests and their parasites under natural conditions, was closed. These drastic economies have meant dropping several of the most important projects at a time when the investigations on them were approaching an important phase, and although urgent requests for material had been received. Among the projects thus abandoned were the investigations of the Codling Moth, of which parasites had been requested by Canada, Australia, New Zealand and South Africa ; the Oriental Peach Moth, and the Pine Shoot Moth, which are of major importance to Canada ; and the Pear Slug, a pest of importance both in Australia and New Zealand.

Investigations of the natural enemies of Bark Beetles on behalf of South Africa and New Zealand, of the Wheat-stem Sawfly, the Larch Sawfly, and of the two forest insect pests known as *Diprion polytomum* and the Balsam woolly aphid on behalf of Canada, of the Pine Chermes on behalf of New Zealand and Australia, and Mealybugs on behalf of Kenya, are, however, still in progress and will be pushed forward as rapidly as the available funds permit.

#### *Biological Control of Insect Pests in the West Indies.*

During the past year Dr. J. G. Myers, of the Imperial Institute of Entomology, has continued his investigations into the biological control of insect pests in the West Indies and parts of South America. A preliminary report on his work was published by the Empire Marketing Board in July, 1931.\* Studies on the problem of the *Diatraea* borer of Sugar-cane have been carried on under the supervision of Dr. Myers in Antigua and British Guiana by entomologists specially appointed for the purpose. An important parasite of *Diatraea*, obtained from Cuba, has been introduced into Antigua and Barbados, whilst large numbers of a Chalcid attacking the eggs of

\* "Preliminary Report on an Investigation into the Biological Control of West Indian Insect Pests." By J. G. Myers, Sc.D., F.E.S. (E.M.B. 42, published by H.M. Stationery Office. Price 1s.)

the Cane Root-borer, *Diaprepes*, have been shipped from Haiti to Barbados, where it has been bred in quantity and liberated in infested fields. A promising parasite of the Large Moth-borer of Sugar Cane has been discovered in British Guiana and will be introduced into Trinidad as soon as possible. An extensive search will be made during the coming year for parasites of the Trinidad Froghopper in Brazil.

*Campaign against locusts.*

The contribution to the field work and the headquarters expenses of the locust control scheme authorised from the Empire Marketing Fund for the financial year 1931-2 was originally £3,080, but, owing to the reduction of the Board's Vote and the slowing down of expenditure on the scheme, the call upon the Empire Marketing Fund has been reduced to £1,600. A further grant has been approved for the continuation of the campaign during the financial year 1932-3.

During the past year the terms of reference of the Committee on Locust Control of the Economic Advisory Council were extended to cover all Tropical African Locusts, as both the Tropical Migratory Locust and the Red Locust had become a serious menace. In the same period the two locust investigators appointed under the scheme took up their duties. One has recently advised the Government of Uganda on the situation that has arisen owing to the invasions of the Migratory Locust (*Locusta migratoria migratorioides* R. and F.) and particularly on the failure of poison bait in that Protectorate. The other investigator is studying the breeding of the Desert Locust in the Sudan.

The French Committee for Locust Research, consisting of entomologists and chiefs of plant protection services in all the French African Colonies, has agreed to recognise the Imperial Institute of Entomology in London as the international centre for the collection of data on the appearance and movements of locust swarms. This decision follows on the Locust Conference which was held recently in Rome to discuss methods of international co-operation in locust research, and which was attended by British, French and Italian representatives.

As a result of this resolution, the Imperial Institute of Entomology will in future receive automatically all the information on locusts available in the French African possessions. This is being regularly transmitted by local authorities to the Algiers Regional Station.

British entomologists from Nigeria will also co-operate in the locust investigations in the Timbuktu area, which French entomologists hope to undertake. This area is strongly suspected of being the breeding place of many of the swarms which have invaded the East African Colonies during the last two years.

Information on the movements of locusts is now being received by the Imperial Institute of Entomology from 16 Empire and 25 foreign countries. The Institute's object is to obtain as complete a picture as possible of all past and present movements of each species of locust, so that a preliminary idea can be formed as to the breeding centres and lines of migration of invading swarms. Already certain tentative conclusions with regard to the Desert Locust (*Schistocerca gregaria* Forsk) have been drawn. Both breeding areas and the routes taken by swarms seem to be fairly regular. There are generally two generations a year, the first of which develops in winter in more or less permanent breeding grounds selected, probably, for such reasons as the amount of winter rainfall and the physical properties of the soil. It is the adults of this generation who are responsible for the destructive migratory swarms.

The summer generation is produced wherever the swarms find favourable conditions—generally among the crops and pastures of long-suffering tribesmen. In the tropics there are often several generations in a season. The progeny nearly always try to return to the regular breeding grounds. It is clear, therefore, that control measures should concentrate on the winter breeding grounds and aim at dealing with incipient swarms. Once they have invaded cultivated areas all that can be done is to defend the crops.

#### *Stored Products Research.*

The Board have agreed to continue during 1932-3 their support of the Biological Field Station at Slough, whose work is directed against the insects and fungi which infest stored products.

The research work now in progress can be divided into three main sections, entomological, mycological and physico-chemical. The study of stored products infestation problems is comparable in some respects to the work of the Food Investigation Board on low temperature storage. The latter deals with the transport and storage of active biological material, whilst stored products work deals with the transport, storage and marketing of inactive but infested biological material. The fundamental problems occurring in both



types of work are similar. The main problems to be dealt with are the reactions of living organisms to temperature and humidity conditions and to gases inhibiting or deterring biological processes. Already research work on the behaviour of gases in admixture has enabled the Slough Station to suggest and to introduce in practice improved methods of fumigation, and to give reliable advice to wharfingers and merchants on the one hand and to the industrial chemists and fumigation experts on the other.

Abundant evidence of the need for improvement in the storage and marketing of Empire produce has been forthcoming. Improved packing methods and improved sterilization methods are still of high importance to the Australian dried fruit industry. The infestation of tobacco by the moth *Ephestia elutella* has caused the Southern Rhodesian Government to pass a special Insect Pest Suppression Act, and the Northern Rhodesian and Nyasaland Governments are also concerned about this new pest of tobacco. As a result of the report on infestation of cacao in London warehouses,\* the London Cocoa Association and the Confectioners' Alliance have formed a joint committee to consider action towards an improvement in cocoa storage both prior to and after shipment. A large firm of caterers has adopted the practice of fumigating all its cocoa stocks on arrival in London, and other big buyers are expected to follow their example.

Requests for advice or co-operation in dealing with infestation problems have been received from the Australian Commonwealth Council for Scientific and Industrial Research, from the Departments of Agriculture in Nigeria, the Gold Coast, Sierra Leone, Malaya, Trinidad and Fiji. New Zealand has asked for assistance in dealing with moulds affecting dairy produce and has appointed a mycologist to work on that problem at the Slough Station. Advice on fumigation practice has been sought by wharfingers and merchants and by various firms in the chemical industry. Various firms have provided funds for the investigation of insects attacking their products in store; the Imperial Tobacco Company and seven firms outside that combine have, with the Southern Rhodesian Government, provided funds for the investigation of insects affecting tobacco; and one section of the furniture industry has provided funds for the investigation of mites affecting upholstery fibres and other materials.

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\* "Report on Insect Infestation of Stored Cacao." By J. W. Munro, M.A., D.Sc. and W. S. Thomson, M.A. (E.M.B. 24, published by H.M. Stationery Office. Price 1s. 6d.

In view of the need for economy, expenditure has been drastically overhauled and some re-organisation of the work has been arranged so that provision will be made for a steady and uninterrupted programme of basic research work. In future, survey and inspection work will normally be carried out on the basis of repayment by the interests concerned.

*Entomological Research in Australia.*

Much attention has been given in the past year to the buffalo-fly and blowfly. Last year's Annual Report referred to the decision to carry out part of the buffalo-fly investigations at Buitenzorg in Java, since a thorough comparative study of the life-history and habits of the fly in the two contrasted regions of Northern Australia and the Netherlands East Indies is essential before any insect likely to be beneficial can be introduced. It is now proposed to breed up a stock of parasites at the State Veterinary Institute at Buitenzorg and the most suitable types of parasites will be introduced into Australia. Here they will be bred in large numbers and distributed at strategic points with a view to discovering the best possible parasite or combination of parasites. Whilst this method of biological control cannot entirely eradicate the pest, it is capable of reducing the incidence of fly attack below the average level at which the fly causes economic loss to the cattle industry. A general account of the problem of buffalo-fly in Australia by Dr. R. J. Tillyard, F.R.S., Chief of the Division of Economic Entomology of the Commonwealth Council for Scientific and Industrial Research, has been published.\*

As regards blowfly, a co-ordinated attack on the problem is being developed by the Council for Scientific and Industrial Research and the New South Wales Department of Agriculture. There seems good reason to believe that the varying degrees of susceptibility to blowfly attack of different types of sheep have an important bearing on the problem. Evidence has also been obtained that the attraction for the fly may be due to some bacterial agency. Two officers of the Division of Economic Entomology have recently made a tour of the north-western part of New South Wales to examine sheep over a wide area of country, and arrangements have been made for the Division to have a small flock of sheep available for study at Canberra. The method of biological control is thought to be inapplicable to

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\* "The Buffalo-Fly in Australia." Journal of the Council for Scientific and Industrial Research, Melbourne, Nov. 1931, pp. 234-43.

the blowfly; the entomological aspect of the work has, therefore, been somewhat diminished while the veterinary aspect has come more strongly into evidence. Because of this, future work on the blowfly will be carried out under the direction of a Committee consisting of the Chief of the Division of Animal Health, the Chief of the Division of Entomology and a representative of the New South Wales Department of Agriculture.

Work has also been carried out during the year on apple thrips attacking the leaves of apple trees, the Australian tobacco split-worm, the pine aphid (an insect pest of pine trees), the "white ant," etc. Studies have been made of insects attacking species of troublesome weeds belonging to the genus *Xanthium* and of the possibility of controlling bracken fern by means of insects.

Close relationship continues to be maintained with the Parasite Laboratory at Farnham Royal. The Entomologist of the Commonwealth Council for Scientific and Industrial Research attached to the Laboratory has continued to investigate and ship to Australia the insects attacking St. John's Wort. (See page 39.)

#### *Noxious Weeds Research in New Zealand.*

The investigation into the biological control of noxious weeds in New Zealand was begun in January, 1927. It has been jointly financed by the Board and the New Zealand Government, and carried out partly in New Zealand and partly at the Parasite Laboratory at Farnham Royal, Buckinghamshire.

Blackberry, ragwort, gorse and "piri-piri" were selected for the main attack. The blackberry is closely related to economic plants such as the rose and the apple, and considerable difficulty, therefore, has been met with in selecting insects which confine their activities strictly to the weed. The choice was eventually narrowed down to six insects, which were sent to New Zealand. Five of these were afterwards discarded as dangerous, and hopes were pinned to the remaining one, a beetle called *Coroebus rubi*, collected in the South of France. Quantities of beetles have been bred at Farnham Royal and shipped to the Cawthron Institute for the last five seasons. Very great caution has been exercised, and, as it is not felt that absolute safety has been attained, the beetle has not yet been liberated.

Ragwort, another troublesome weed, is not botanically related to agricultural crops and there are several insects which confine themselves to eating its foliage. Of these, the Cinnabar moth (*Tyria*

*jacobaeae*) has been selected for the attack. Over 216,000 pupae were imported from England, and tests on economic plants were carried out for two years. The first liberation took place in the autumn of 1929, and, up to the end of 1931, about 2,333,000 eggs had been distributed. Surveys of the insect under field conditions have indicated that it is becoming established and is beginning to control the ragwort.

With regard to gorse, extensive studies have been made of a weevil (*Apion ulicis*), which bores its way inside the pods and eats the seeds. This insect has proved extremely difficult to rear in captivity. A number of individuals have, however, been raised in cages at Nelson, and last year the first releases were made in the field.

The burrs of piri-piri have been estimated to reduce the value of wool in New Zealand by £250,000 annually. This weed also occupies large areas that would otherwise be under pasture. It differs from the other plants tackled in that it is a native of the Southern Hemisphere, and its natural enemies must, therefore, be sought outside Europe. A promising sawfly (*Antholcus varinervis*), whose larvae feed upon piri-piri foliage in winter and spring, was located in Chile. Dr. Miller went over to fetch supplies back to the Cawthron Institute, and the insect is now being established in the Dominion.

The first five years of this investigation are now completed, and are considered by entomologists to be distinctly promising. The danger that these insects might do more harm than good by turning to economic plants under the stress, for instance, of starvation is being continually borne in mind. It will, however, take several years of further research before the efficacy of the method of biological control, as applied to noxious weeds, can be effectively assessed.

#### *Campaign against Warble Fly.*

The Warble Fly Campaign has been successfully continued during 1931 by the Warble Fly Committee of the Leathersellers' Company. The efficacy of the form of treatment recommended by the Committee has been thoroughly demonstrated and certain fundamental researches are now being undertaken. One of these relates to the area over which individual flies travel. It is generally understood that an individual fly does not move far from the place of its birth, but exact scientific information in regard to the movements of the fly during its life are lacking. Another enquiry in progress relates to the

loss of milk and meat due to the warble pest. No scientific investigations regarding the loss of weight in cattle and of milk in cows due to the warble have been made and sound information on this subject would be of considerable propaganda value.

In the past two years the Committee has provided material and assisted in staging a number of exhibits at agricultural shows and elsewhere demonstrating the damage done by the warble. These have aroused much interest and an organised effort is now being made to get the exhibits shown at every agricultural show or similar gathering of farmers. Show cases will be acquired and filled with suitable exhibits.

The original offer of the Empire Marketing Board was a contribution of half the total expenditure of the Committee during the first year of the campaign up to a maximum of £1,000. Since, however, the work of the Committee involves experiments and research work spread over several seasons, the Board have agreed that their grant may run over two seasons instead of one.

A full report on the campaign during 1931 has been published by the Leathersellers' Company.\*

#### *Blow Fly Research.*

In September, 1929, a three years' grant was approved to enable the Department of Entomology of the London School of Hygiene and Tropical Medicine to carry out research work on the digestion of meat by the larvae of flies and on the part played by micro-organisms in the nutrition of the larvae.

The larva, or maggot, of the Green Bottle or Blow Fly (*Lucilia sericata*) causes great damage to sheep in all pastoral countries. The damage which it and its relations cause in Australia alone is estimated at £4,000,000 a year (Journ. Council Sci. Ind. Research, Vol. 3, 1930). The damage in South Africa, New Zealand, and Great Britain is also very great. The larvae get through the sheep's skin and cause extensive ulcers: they cause direct damage to wool, hide and meat, and also indirect damage owing to the sheep's loss of condition. There are other flies which cause rather similar damage

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\* "Report on Warble Fly Campaign, 1931, by the Leathersellers' Company's Warble Fly Committee." Leathersellers' Hall, St. Helen's Place, London, E.C.3.

to other domestic animals and to man. As a subsidiary problem there is the damage to butcher's meat by the maggots of the Blow Fly and its relatives.

The work which is here described was carried out entirely with *Lucilia sericata*. At the time it was undertaken it was not known how the tiny larva which had just escaped from the fly's eggs could enter the body of the sheep. It was possible that it penetrated the hide through an injury, or by secreting a digestive juice capable of dissolving the hide, or that it could only do so in combination with particular bacteria. The digestive processes of the maggot after it has arrived in the meat of the sheep were also obscure. It was not known whether they broke up the meat by virtue of their own digestive juices operating outside their bodies or whether they collaborated with bacteria: if bacteria were necessary it was not known whether they were those normally present in an ulcer or whether they were special bacteria, always working in association with the maggot. It was felt that if these questions could be answered they would lead to a much clearer understanding of the problem, and provide a ready means of controlling the damage.

In the course of nearly three years' work Dr. R. P. Hobson, has greatly increased our knowledge on these subjects. The problem bristled with obstacles. The small size of the larvae produced technical difficulties in studying their digestive juices. Much of the work lay on the border-line between entomology and biochemistry: bacteriology was also involved, for it was essential to distinguish between the activities of the maggots and of the bacteria with which they are generally associated. Dr. Hobson studied first the structure and histology of the gut of the larva and its normal digestive processes. It sucks the juices from meat, and digests them in its intestine; it also voids digestive juices in its excrement, which liquefy food outside its body. In its digestive juices he searched for an enzyme which could dissolve keratin, the horny substance of which the surface layers of skin and hide consist. He showed that no such digestive enzyme exists in these larvae so that they cannot penetrate the sheep's body by dissolving a hole in its surface. In order to study the digestive processes of the larvae in detail, a method had to be devised of sterilising the eggs without killing them: this was necessary in order that the effect of the larva on meat might be investigated in the absence of bacteria, which complicate what is happening. Hobson used sterile eggs and sterile food, and borrowed much of

the bacteriologist's technique ; he found that sterile food is adequate and that larvae can complete their growth in a normal way in the absence of bacteria. But certain sterile foods, e.g. muscle, are "incomplete" : on such foods larvae can only grow in the presence of bacteria, which seem to supply a vitamin.

Dr. Hobson's work has, therefore, solved two problems :—(1) The precise method by which the maggot digests its food ; and (2) the relation (which is found to be unimportant) between maggot and bacteria.

The outstanding problems which remain appear to be :—(1) What is it which attracts the fly to lay eggs on the sheep ? (2) How does the maggot penetrate the skin, by mechanical means, or through an injury ? (3) How much of the damage, under natural conditions, is due to the larva, and how much to bacteria ?

These problems have been frequently discussed, and partly studied. The work already done in the laboratory under unnatural conditions supplies fundamental knowledge on the physiology of the insect. It should now be possible to use this new knowledge, and study the problem as it exists in the wool of the live animal.

#### *Entomological Investigations in Mauritius and Seychelles.*

It was notified in last year's Annual Report that a grant had been approved for the employment of an entomologist for a period of two years to investigate methods of control of the beetle *Phytalus smithi*, an injurious insect pest of sugar cane in Mauritius, and to search for parasites or predators of the Yellow and Black Thread Scale insects which attack coconuts in the Seychelles. This work was not started immediately owing to the difficulty of securing the services of an entomologist experienced in methods of biological control. It has now had to be postponed for the time being on account of financial stringency.

### MYCOLOGY AND PLANT PATHOLOGY.

#### *Virus Diseases of Plants.*

With some virus diseases and with many hosts (including tomato) satisfactory symptoms cannot be obtained in winter owing to the shortness of daylight (see last year's Report, p. 25). Winter daylight has been artificially prolonged by the use of lamps at the Rothamsted Experimental Station, and the success of the results has increased the working season considerably. A small specially designed insectary has been added to the equipment. Further work has confirmed the previous findings that virus does not travel through the plant in the

water stream, and probably exists almost entirely inside the cells; and a method has been devised of estimating the number of virus particles present. An attempt to determine the actual size of these particles by differential filtration is in progress. Two (possibly more) new virus diseases have been discovered in commercial crops of Henbane (*Hyoscyamus*), where they were causing much damage, and are being studied; the particles of one of these viruses are apparently unusually large.

The results of the past season's work at the Experimental and Research Station at Cheshunt have confirmed the fact that Mosaic disease of the cucumber, tomato and tobacco is carried in the seed. The disease is absent in crops grown from clean seed distributed by the Station. The effect of the virus of Mosaic disease on the metabolism of the tomato has been studied. Preliminary results suggest that under conditions of high temperature and light intensity there is first an increase in the carbohydrate content of tomato plants infected with Aucuba Mosaic, and then a reduction. During the winter, when light intensity is low, the period of carbohydrate increase is greatly prolonged. A form of disease known to growers as "peppery stripe" has proved to be the result of infection with a mixed virus. Comparative studies with this disease and "stripe" disease have been started; the two diseases are not identical. The effect of low soil temperatures and wetness of the soil on the incidence and severity of tomato Mosaic is also being studied.

The work at the Plant Breeding Station, Corstophine (Scottish Society for Research in Plant Breeding), has been concerned principally with a physiological investigation of Leaf-Roll in two varieties. The aim was to establish the nature, if any, of the differences in carbohydrate, nitrogen and ash metabolism in healthy and diseased plants. The carbohydrate side of the estimations has been completed and the data have been statistically examined. The various conditions governing the formation of carbohydrates in healthy plants have been discovered as well as the sugar of translocation. Similar data obtained for the Leaf-Roll material have shown that the formation of carbohydrates takes a different course, and the nature of the translocatory sugar is also different. A preliminary series of field experiments was also started on a small scale to determine the method and rate of spread of a number of different virus diseases. The results will be available during the coming season. The work principally carried out at the Ainville Sub-Station was stock raising for next year's experimental material, when it is hoped



that a similar physiological survey will be made on the Crinkle, Paracrinkle and Mosaic diseases of the potato. Investigations at the North of Scotland Sub-Station, at Gibston Farm, Huntly, Aberdeenshire, are being confined to a study of potato Mosaic diseases. Varietal differences in visible symptoms due to the presence of Mosaic virus from a single source were examined by means of grafts and by inoculations between varieties of potato and seven other species of solanaceous plants. Henbane was found to be of value in discriminating between Mosaics, and also in determining the presence of viruses of the Mosaic and necrotic types latent in apparently healthy plants. Preliminary data, obtained in 1930, pointing to a significant difference between the hydrogen ion concentration in healthy and Mosaic infected plants were confirmed. Sap from diseased plants was found to be slightly more acid than sap from corresponding parts of healthy plants. A study of the carbohydrate metabolism of healthy and Mosaic infected plants is in progress. Further data were obtained on the relation between virus diseases in parent plants and the health of progenies. This investigation is to be continued with seed obtained during the year.

During the year under review an account\* was published by the Albert Agricultural College, Glasnevin, Dublin, of a detailed histological examination of virus-infected potatoes, undertaken primarily with the object of comparing the behaviour of slightly-reacting and strongly-reacting varieties. The work was afterwards extended to include a comparison of the effects of a number of different virus diseases on the host cell, with a view to the possible discovery of more certain methods of diagnosis.

An entirely new outlook on the mutual relationships of the potato viruses has been opened up by the recent discovery that two viruses are involved in certain common Mosaics. It has been shown† that one of the more severe forms of potato Mosaic is a compound of simple Mosaic and another virus. It is considered likely that the separation of what have been taken to be single viruses into simpler constituents

\* "Cytological Studies of Potato Plants affected with certain Virus Diseases," by Phyllis Clinch, M.Sc., Ph.D., Sc. Proc. R. Dublin Soc., Vol 20 (N.S.), 1931.

† "La Production d'un 'crinkle' des pommes de terre par un mélange de virus," by Paul A. Murphy and Robert McKay. Rap. 2<sup>me</sup> Con. Internat. de Pathologie Comparée, Paris, 1931.

"The Compound Nature of Crinkle, and its Production by means of a Mixture of Viruses," by Paul A. Murphy and Robert McKay. Sc. Proc. Dublin Soc., Vol. 20 (N.S.), pp. 227-247, 1932.

will be effected in other cases. The ultimate results are likely to be of great theoretical and practical value. Meanwhile the whole question of the nature and individuality of Mosaic viruses is in a state of flux. An attempt has been made to summarise some of the more important recent work, and to propound a coherent theory to explain it.\* An understanding of the constitution of what have been held to be virus units, and of the relationship of the diseases they cause, is fundamental; and until this matter is placed on a more satisfactory footing, progress in other directions is impeded or prevented. A good deal of successful work is also being done on the insect transmission of viruses and virus constituents, but it is not yet ripe for a report.

#### *Cotton Disease Research.*

The experiments at Rothamsted Experimental Station on the influence of environmental conditions on the black-arm, or angular leaf spot disease of cotton plants have been continued during 1931. The work has dealt mainly with the influence of air temperature, atmospheric humidity and alternating environmental conditions on the disease.

A paper giving the results of the experiments on constant air temperatures has been published\*\* and also a paper describing the construction of a new type of humidity control.† The results of the experiments on the influence of humidity will be embodied in a paper in course of preparation.

### PLANT BREEDING.

#### *Welsh Plant Breeding Station, Aberystwyth.*

During 1931 approximately 30 acres of pedigree grasses were harvested for seed and 20 additional acres were sown with a view to testing the suitability of various districts for seed production of grasses. Demonstration plots of cocksfoot and timothy were established in order to draw the attention of farmers to the method of growing pedigree grasses in drills for seed production, while fourteen strains of pedigree red clovers were grown for seed in 1931. These

\* "A Critical Review of some Recent Work on the occurrence of Virus Complexes in the Potato," by Paul A. Murphy. Sc. Proc. R. Dublin Soc., Vol. 20 (N.S.), pp. 193-210, 1932.

\*\* "The influence of environmental conditions on the development of the Angular Leaf-Spot disease of Cotton. III. The influence of air temperature on infection." *Annals of Applied Biology*, Vol. XVIII, 524-534.

† "An improved method of maintaining constant humidity in closed chambers." *Journal of Scientific Instruments*, Vol. VII, 164-166.

were in the first stage of growing-on. Investigations have been conducted into (a) the effect of various manures on the production of seed in the case of a number of strains of pedigree grasses ; (b) the effect of time of application of manures on seed production ; (c) the management of grasses for seed production ; (d) the possibility of autumn sowings of grasses for seed production ; (e) rate of sowing ; and (f) the effect of harvesting at various stages of ripeness on the quality of the seed.

Up to the present, practically all the seed of the pedigree strains harvested in Montgomeryshire and elsewhere has been used for experimental sward trials. Over two hundred acres have been sown in experiments of this sort. It is interesting to record that excellent reports on the behaviour of the pedigree cocksfoot have been received from the highlands of Natal. Arrangements are now under discussion with the Seed Trade Association of the United Kingdom for the growing-on and distribution of some of the most valuable of the strains so far produced by the Station.

Definite problems of plant physiology, which have come to light as the result of field work, are now being taken up. The occurrence of delayed establishment in some species of cultivated grasses has been under investigation for some time, and, as a result of the physiological studies now under review, is believed to be explained by the ability of their seedlings to persist for long periods in a latent condition and to develop normally afterwards. In this connection the effect on other grasses of competition with *Lolium italicum* has been thoroughly studied. It is hoped to publish this work shortly. Attempts to stimulate the germination of grass seeds by soaking the seeds in solutions of various chemicals have been unsuccessful. Seeds soaked in water and afterwards partially dried do, however, germinate earlier and give a higher total germination than untreated seeds, and these differences are sufficiently large to suggest the possibility of practical application.

As the result of the Station's close contact with oversea workers, a large number of strains are received every year for growing-on and for critical report. Mr. William Davies (whose appointment as Empire Grassland Officer was made possible by a grant from the Empire Marketing Fund) brought back from New Zealand a number of strains of perennial rye-grass and cocksfoot and the results obtained from these have tended to confirm the interesting conclusions of Mr. Bruce Levy and Mr. Davies as to the great differences that

exist between the Hawke's Bay and Canterbury perennial rye-grass. In all, 22 reports covering some 200 samples were sent out during the year. This is a service that is much appreciated, both at home and overseas. It also provides the Station with valuable and interesting plant material.

At the joint invitation of the Commonwealth Council for Scientific and Industrial Research and the Australian Dairy Council, Mr. Davies left this country in September on a visit to Australia, to advise and co-operate on problems of grassland research now in progress in the Commonwealth. Mr. Davies will remain for a year in Australia and will work in collaboration with the State Departments of Agriculture and the State Committees of the Commonwealth Council for Scientific and Industrial Research as well as with the representatives of the Australian Dairy Council.

The Dominion Government of Canada have invited Mr. Davies to visit Canada in 1933.

It may be mentioned here that the review by Dr. O. McConkey of the Ontario Agricultural College on "Recent Advances in Pasture Management," which was published by the Board in July, 1931 (E.M.B. 43), has aroused considerable interest in Canada and is serving to develop a new viewpoint towards the pasture crop. A conference of Dominion and Provincial workers has been called and a Committee has been formed to co-ordinate and consult on future policy and experiments. This review by Dr. McConkey was written after a visit to Aberystwyth, Cambridge, Aberdeen and other grassland centres and was based upon first-hand knowledge of recent advances in research on grassland problems.

#### *New Zealand Plant Breeding and Seed Research Station.*

Marked advances in a number of directions have characterised the activities of the Plant Research Station at Palmerston North during the year. Effective control of the serious club-root disease of turnips has been achieved by the use of resistant strains and the application of lime and non-acid phosphates to the soil. These simple precautions are easy of adoption by the farming community and will make it possible again to grow swedes and turnips in many areas where, on account of the ravages of this disease, they have been abandoned as farm crops.

Steady development with strains of pasture grasses and clovers has proceeded and, through certification, the time is fast approaching when it will be possible, by the proper utilisation of approved strains

of pasture plants, to increase the stock-carrying capacity of the Dominion's grasslands. It is satisfactory that the local strains of rye-grass, cocksfoot, white clover and other grasses have shown themselves, after trials conducted at the Plant Research Station, to be unsurpassed by the best imported lines in their suitability as permanent pasture grasses.

Control of dry-rot in swedes has been shown to be dependent on the use of disease-free seed, supplies of which it is possible to grow locally. Useful light has been thrown on the problem of controlling wheat rust; improvements in the growth of lucerne have been secured through the use of special cultures; investigations on strains of rape and lucerne have been commenced and show promise. Experiments in top dressing have ascertained the best times for the application of fertilisers, and shown the advantages of frequent small applications of phosphates. Similar progress has been made with almost every farm crop. These advances come at a time when low prices have adversely affected farmers' returns; and their application will have some influence, not only in mitigating these losses, but in encouraging higher yields per acre in the future.

*Division of Plant Industry : Commonwealth Council for Scientific and Industrial Research.*

The work of erecting a Plant House for the Division of Plant Industry at Canberra is now nearing completion.

The Department of Home Affairs has granted to the Council for Scientific and Industrial Research a lease, rent free, of a part of the farm area of the former Duntroon Military College, comprising about 100 acres of some of the best soil in the Federal Capital Territory. This area is admirably suited for experimental plots for the Division of Plant Industry. With the Board's two years' maintenance grant work is being developed on wheat, fruit and pasture plant problems.

In connection with wheat, work on the four problems of flag smut, root rots, drought resistance and yield has been started. Flag smut is responsible for an average annual loss in yield of about three per cent. of the crop, or £600,000 at three shillings per bushel. The disease is caused by *Urocystis tritici*, a soil-borne smut, and the only method of control is the development of resistant varieties. This calls, therefore, for studies of infection and resistance, and for the development of smut resistant, good quality, types from resistant parents. Root-rots of wheat, including "take-all," account for an

average annual loss of at least five per cent. of the total crop. Several soil-borne organisms are involved and the actual role of each is uncertain, which renders the problem of breeding for disease resistance more difficult. Drought resistance is highly desirable in Australian wheats, and studies are being made of the factors, physiological and morphological, which confer drought resistance, and on their mode of inheritance.

The fruit work deals mainly with apples, citrus and vines. A good deal has already been done on such troubles as bitter-pit, water core, drought spot, etc. : bitter-pit, in particular, is a problem of long standing and losses are estimated at £100,000 per annum. Other work in progress concerns fruit bud and root investigations which will be correlated with physiological reactions due to pruning, manuring, climate, etc., to see whether fluctuations in the apple crops of alternate years can be reduced, so that export may be facilitated and quality improved.

Pasture plants constitute the most important crop in Australia, especially in the better rainfall areas where ninety per cent. of sheep and cattle are carried. It is planned to extend the introduction from abroad of grasses and forage plants likely to be of economic value to Australia. Careful studies are necessary to determine the most suitable strains of pasture plants for particular environments, and it is proposed to link together the work of plant introduction and agrostology. Special studies will be made of Aberystwyth, New Zealand and other types for Tasmanian and Victorian conditions, and of pasture plants for warmer areas.

*Visit of Dr. I. B. Pole-Evans to the Bechuanaland Protectorate.*

Dr. I. B. Pole-Evans, Chief of the Division of Plant Industry in the Union of South Africa, returned in May from a tour through the Bechuanaland Protectorate during which he covered over 800 miles of country and collected much valuable material including a number of new and promising grasses. These are now well established in greenhouses at Pretoria and have made good growth since they were planted out. Dr. Pole-Evans found the country in the neighbourhood of the Great Makarikari Lake extremely interesting from a pasture point of view. At Mumpswi, in particular, a remarkable short pasture grass remains green during the winter months and carries vast herds of game. It is believed to be extremely rich in phosphorus and to indicate phosphates in the soil. Dr. Pole-Evans has since visited Swaziland.

## HORTICULTURE.

### *East Malling Research Station, Kent.*

The first three years routine work of the Statistical section in computing and analysing twelve years' data upon individual trees bore fruit during 1931. A series of papers was published showing the inadequacy of the old methods of horticultural field experimentation, the possibilities of applying modern methods of randomization, etc., to perennial plants, and the way in which to handle the resulting figures. Typical plot layouts were described and the possibilities of applying these to tropical crops discussed. Another paper dealt with the planning of demonstration plots. Many enquiries from different parts of the Empire have been dealt with and projected plans for experiments submitted and discussed.

This section is now exploring ways and means of reducing the essential records to their simplest form, whilst maintaining a true picture of the plant's cycle from year to year.

An interesting paper from the pomological section has summarized all the automatic devices which the Station has put into use over a period of years to speed up, and ensure the accuracy of, its biometrics. The measuring, weighing and counting apparatus are fully described. The root development work, in which the actual daily growth of roots has been watched and recorded on young and mature apple trees, has emphasised the significance of the mechanical condition of the soil, temperature, aeration and moisture. Attempts are being made to design apparatus for recording and controlling these factors for experimental purposes, and an East Malling worker, Mr. S. W. Rogers, has been sent to Canada to study them under conditions of artificial irrigation. This work will ultimately be applied to determining the right times for applying quick and slow acting fertilizers, to obtaining the best results from cover cropping, and to regulating the irrigation supply. A Canadian investigator, Mr. R. C. Palmer of the Summerland Experimental Station, British Columbia, is studying the methods of vegetative stock raising at East Malling with a view to applying them to some of the oversea problems. Consignments of vegetative stocks have now been sent to all the Dominions. Meanwhile the demand by the home trade for an increased supply as a nucleus for commercial distribution has rapidly developed.

The breeding and testing of a range of Woolly Aphis immune stocks is proceeding in collaboration with the fruit geneticist at the John Innes Horticultural Institution. Each institution aims at the production of 500 new seedlings a year. The Entomological section has so improved its technique of inoculation against the pest that it hopes to cope with 1,000 plants per annum. Not more than 5 per cent. of the crosses prove to be immune, and not all of these are likely to prove ideal root-stocks. The first batch of immunes, raised by the John Innes Institution, have been vegetatively multiplied and are now being tested for their rootstock suitability at East Malling. A few individuals of each have been sent to oversea entomologists to test their resistance under varying climatic and other conditions.

A preliminary report on the susceptibility of certain rootstocks to Crown Gall disease has been published during the year, and the work has been extended.

The troubles of the Strawberry and the Cane fruits are continuing to receive detailed attention both from the pathological and entomological sections. Methods for raising clonal races free from virus diseases, which, in several instances, have now proved to be the causes of "degeneration," are being explored with very promising results. The possible part played by mites both as "vectors" and injurious parasites is being followed up. The work has reached the stage when an exchange of investigators, working upon these problems under different climatic conditions, would be mutually profitable.

Progress has been made by the Physiological and Biochemical sections in their analyses of the principles underlying rootstock-scion influence, and in their search for more intimate knowledge of the annual cycle of the fruit plant. The root, shoot, and leaf development of a young apple tree has been followed throughout the year, and a satisfactory method has been established for measuring the leaf area of the mature tree. This should prove valuable in an assessment of the effects of all cultural and nutritional treatments upon the tree. It has been established that there are significant differences in the leaf relations of trees on different stocks. Two preliminary reports on the chemistry of rootstock-scion effect have revealed the presence of some 21 elements in young apple trees. These are mostly distributed throughout the plant, but lead is restricted to the roots, and one element, molybdenum, has been found in the roots and stock stem portion of trees on the very precocious



No. IX rootstock, but was absent from all parts of trees on the vigorous slower cropping. No. XII. Methods for testing the functions of some of these elements, by inducing living plants to absorb them in solution, are being explored, and progress has been made in the study of the nature of immunity to Woolly Aphis.

The Director, Mr. R. G. Hatton, returned from his visit to various fruit growing areas of the Empire in March, 1931. One of the results has been a considerable increase in the correspondence with oversea research workers, with whom several rootstock experiments have been arranged. It is of interest to note that the Trustees of the Commonwealth of Australia Science and Industry Endowment Fund have decided to create a studentship tenable for one year at the East Malling Research Station. The appointee will devote his time particularly to work on the Northern Spy Stock. The Queensland Committee of Direction of Fruit Marketing have agreed to provide the salary of the appointee for a period of three years on his return to Australia in order that he may specialise on fruit production problems in Queensland. Dr. H. Evans, who was appointed in April, 1931, to the post of Research Botanist to the Mauritius Sugar Research Station is engaged on a special course of instruction on root stock studies at East Malling.

A further grant from the Empire Marketing Fund has been approved in support of the Station's work during the financial year 1932-3.

#### *Long Ashton Agricultural and Horticultural Research Station.*

A previous report outlined the scope of the work on the effect of certain orchard factors on the storage qualities of fruit and gave a summary of tentative conclusions drawn from preliminary experiments (see Annual Report for 1929-30, page 53.) In the experiments carried out up to that time it had been possible to examine, in a preliminary way, the effects of several pre-storage factors on the keeping qualities of various fruits, mainly apples, under the conditions which exist in an ordinary temperature store and in a low temperature store. The effects of the orchard factors concerned on certain chemical and physiological features of the fruits had also been determined.

These experiments have been extended during the past two seasons and substantial progress has been made. Comprehensive studies have been carried out on the effects of orchard factors such as climate (producing seasonal effects); soil, including nutrient and water

factors; rootstocks; age of trees; orchard practices, including cultural operations, systems of manuring, pruning methods, bark ringing, blossom and fruit thinning; time of picking; crop weight; the position of the fruit on the blossom truss; and size grading. The interaction of certain factors such as soil and rootstocks, manuring and pruning, time of picking and bark ringing, etc., have also been examined. The results have, in general, confirmed those previously reported and are capable of extensive practical application.

The more important facts relating to storage which have emerged are (1) that, in assessing the effects of pre-storage factors on storage life, it is important to specify exactly the details of storage conditions, e.g., potassium deficiency may lengthen the storage life in an ordinary temperature store but lead to premature breakdown at low temperatures; (2) that the storage life of fruits (under any given set of storage conditions) is determined by the interaction of orchard and other pre-storage factors, so that the problem of foretelling storage behaviour is thus somewhat complicated. In the majority of cases, however, certain factors exercise pronounced effects, and thus enable fairly accurate forecasts to be made in particular cases; (3) that pre-storage factors not only affect the length of storage life but may actually alter the form of breakdown which occurs. Thus Superficial Scald and Internal Breakdown may be induced by appropriate treatments in cases where the normal method of breakdown is Core Flush.

The following detailed effects are worth special mention:—(a) rootstocks may produce marked effects under particular environmental conditions but, under others, these effects may be of minor importance; (b) fruits from young trees are more susceptible to rots and various forms of breakdown than those from older but otherwise comparable trees; (c) grass culture systems are potent in checking the onset of various breakdowns; (d) nitrogenous manuring under arable conditions tends to shorten storage life; (e) potash deficiency encourages storage breakdown at low temperatures and tends to promote Internal Breakdown instead of Core Flush. In ordinary store, low potash fruits are usually long keepers but show much shrivelling; (f) the effect of manuring with a combination of nitrogen and potash may produce a totally different effect on keeping quality from that resulting from the use of potash only, though the orchard effects may appear similar; (g) the system of pruning may affect the form of storage breakdown, especially in years of heavy crops, e.g., spur pruning favours Internal Breakdown and regulated pruning

Core Flush ; (*h*) fruit thinning effects are similar to those resulting from spur pruning but are usually less pronounced ; (*i*) bark ringing produces very pronounced effects on keeping quality. In the ordinary temperature store it may greatly alter a Bitter Pit problem, whilst it is strongly conducive to Low Temperature Breakdown and Superficial Scald ; (*j*) time of picking is important in determining storage life—early picking favours the development of Superficial Scald and shrivelling, but retards flesh breakdown ; (*k*) heavy crops tend to keep better than light crops and appear to mitigate any form of breakdown which is prevalent in any particular case ; (*l*) the operation of size grading tends also to grade the amount and kind of breakdown. Thus, large fruits tend to show Internal Breakdown or Bitter Pit, whereas the smaller ones tend to develop Core Flush, and Bitter Pit is usually negligible.

Important facts which have emerged on the chemical side show (1) that the nitrogen content of fruits can be substantially altered by manurial and cultural methods. Grass systems of culture and bark ringing produce low nitrogen contents ; (2) that cane sugar is increased by factors which tend to provide more favourable conditions for the development of the fruits ; (3) that small fruits invariably show low potash contents, but such fruits are not to be regarded as potash deficient ; (4) that when fruits are graded for size, the contents of cane sugar, ash and potash are also graded, the percentages of these decreasing down the grades ; (5) that the contents of nitrogen, sugars, acidity, ash and ash constituents are not reliable guides to storage behaviour, but nevertheless show relationships to certain fruit characters and orchard factors.

A further grant, on a reduced scale, has been approved to assist the Station's work till the 31st March, 1933.

#### *Fruit Research in New Zealand.*

During the past year good progress has been made in the development of fruit research in New Zealand. The experimental orchard at Appleby contains some twenty-nine acres of mixed export varieties of apples and pears in full bearing, together with a large vacant area to be used for further planting. This orchard is intended for experiments on the major problems confronting the fruit industry and the work will be carried out in close association with the Cawthron Institute at Nelson, the Plant Research Station at Palmerston North and the Department of Agriculture. The general programme will

deal with rootstocks, manurial and cultural methods, the control of insect and fungoid pests, and cold storage trials. A limited amount of oversea transport investigation was conducted during the year, initial trials indicating that the adoption of corrugated cardboard linings in ordinary fruit cases reduced the amount of damage due to bruising.

The scheme affords several interesting examples of Empire co-operation. On the entomological side, an attempt is being made, in co-operation with the Parasite Laboratory at Farnham Royal, to control the codlin moth and mealy bug through the introduction of their natural parasites; the mycological investigations deal with such problems as black spot and mildew, silver blight, fire-blight and fungous rots in co-operation with the Imperial Mycological Institute in London; the rootstock work links up closely with the work of the East Malling Fruit Research Station in Kent and a range of East Malling stocks has already been secured and planted out in New Zealand; and the cold storage investigations are being carried out in co-operation with workers at the Cambridge Low Temperature Research Station. Mr. R. G. Hatton, Director of the East Malling Fruit Research Station, visited New Zealand and was able to give valuable advice in the planning of the present fruit research programme.

#### DIETETICS.

##### *Research into the Vitamin Content of Fruit, Vegetables and Dairy Products.*

The five-year period covered by the Board's grant to the Medical Research Council for vitamin research at the Lister Institute comes to an end with the publication of this Report; but, in view of the importance of the subject and the promising lines of research already opened up, the Board have agreed that the unexpended balance of the grant may be used to continue the work. This unexpended balance is accounted for by short spendings in the early years and by economies effected at the Board's request when the financial crisis arose. The number of assistants has been reduced by two, and expenditure on experimental material has been cut down to a minimum. As a result, expenditure for the full year 1931-32 has been kept down to about £3,800, or 24 per cent. less than the maximum annual value of the grant.

During the past year papers have appeared on the Vitamin C content of Apples, Oranges and Grapefruit\* and on the vitamin content of the Mango.† A great deal of experimental work on dairy produce, including work on Australian and New Zealand butters and dried milk of various types has been in progress and a full report will shortly be published in a Monograph of the Medical Research Council.

In all branches of the work close collaboration is maintained with workers in related fields, e.g. the Food Investigation Board and the Cambridge Low Temperature Research Station, the Long Ashton Horticultural Research Station on fruit, and the National Institute for Research in Dairying on dairy produce.

#### TROPICAL RESEARCH STATIONS.

##### *East African Agricultural Research Station, Amani, Tanganyika Territory.*

A five-year programme of research, approved by the Colonial Advisory Council of Agriculture and Animal Health, is now in operation. This embraces investigations on soil types; crops, including coffee, sisal, tea, cinchona, and pasture and browse plants; virus diseases with special reference to crops of importance to East Africa; and entomological problems such as the resistance of plants to insect attacks. Other work in progress includes the collection of plants of possible economic value to East Africa, and ornithological studies. The Station acts as a central quarantine station for plant introductions into the East African dependencies and the Director and specialist members of the staff are available for consultation by Departments of Agriculture in East Africa and for assistance on specific problems.

\* "The Antiscorbutic Vitamin in Apples," by Mary F. Bracewell, E. Hoyle and S. S. Zilva. Medical Research Council Special Report Series, No. 146, published by H.M. Stationery Office (price 9d.).

"The Antiscorbutic Potency of Apples, II," by Mary F. Bracewell, Franklin Kidd, Cyril West and S. S. Zilva: "The Antiscorbutic Potency of Apples, III," by Mary F. Bracewell, Thomas Wallace and S. S. Zilva. The Biochemical Journal, Vol. XXV, No. 1, pp. 138-146, 1931.

"The Antiscorbutic Vitamin of Apples, IV," by M. B. Crane and S. S. Zilva. Journal of Pomology and Horticultural Science, Vol. IX, No. 3, Sept., 1931.

"Vitamin C in the Orange and the Grape Fruit," by Mary F. Bracewell and S. S. Zilva. The Biochemical Journal, Vol. XXV, No. 4, pp. 1081-1089, 1931.

† "Preliminary Report on the Vitamin Content of the Mango," by Edith O. V. Perry and S. S. Zilva. Empire Marketing Board, March, 1932.

During the past year the finances of the Station have been subjected to detailed scrutiny and economies effected wherever possible on the administrative side, in salaries and on other charges. The object has been to preserve the present establishment as a skeleton upon which to build in more prosperous times.

The Board have agreed to maintain their contribution to the Station in 1932-33 on the same basis as in 1931-32, and the Governments of the East African territories have agreed to make similar provision so that the Station may be able to discharge the fundamental agricultural research for which it was designed, and be maintained both as a nucleus of joint agricultural research work by the East African dependencies and as a link in the organisation of such research within the Empire.

*Imperial College of Tropical Agriculture, Trinidad.*

In the past year the Board have agreed to continue their support of the Imperial College of Tropical Agriculture in Trinidad, but, owing to reduced resources, the maximum grant which the Board can afford to offer in respect of the College year ending August, 1932, is £14,400, as compared with £16,000 for the year 1931. In present circumstances it has not been possible for the Board to enter into a definite commitment beyond the current College year, but they have agreed to regard a block maintenance grant to the College as one of the prior claims upon the Empire Marketing Fund during the next four years.

#### BANANA RESEARCH.

During the past year two further Reports have been published by the Board dealing with banana research at the Imperial College of Tropical Agriculture in Trinidad. The first Report by Dr. Wardlaw and Dr. McGuire embodies the outcome of a detailed investigation into the transport and storage of bananas with special reference to chilling.\* The second Report by Professor Cheesman gives an account of the progress of breeding work which is directed towards evolving a new banana immune to Panama disease and yet retaining the characters of hardiness and attractive appearance of the Gros

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\* "Transport and Storage of Bananas with special reference to Chilling," by Claude W. Wardlaw, Ph.D., D.Sc., F.R.S.E., and Laurence P. McGuire, Ph.D., M.Sc., D.I.C. E.M.B. 45, published by H.M. Stationery Office (price 1s.).

Michel, which have placed it in the forefront of commercial bananas.\* Dr. Marsden, Secretary of the New Zealand Department of Scientific and Industrial Research, who is Chairman of a Commission on banana growing and transport from the Cook Islands and Samoa, states that these reports have proved of considerable value to New Zealand.

In view of the growth of Canadian trade with the West Indies, experiments on the storage of tomatoes were begun in 1931 at the Low Temperature Station at the College.

#### RICE.

##### *Rice Research in Burma and Bengal.*

The scheme of rice research in India, with special reference to the introduction and development of types best suited for the export market, was put into operation in July last and a satisfactory start has been made. Owing, however, to the drastic reductions in the Board's resources since this grant was originally approved, it has been necessary to arrange, by agreement with the Imperial Council of Agricultural Research for India, for some deceleration of expenditure, at least in the first two years. As a result, the capital charges and maintenance expenditure on the Burma and Bengal parts of the scheme, of which the Board had undertaken to bear one-half, have been reduced from an estimated total in the first two years of Rs. 198,000 to Rs. 180,000. The call upon the Board in this period will accordingly be reduced from Rs. 99,000 to Rs. 90,000.

#### SUGAR.

##### *Imperial Sugar Cane Research Conference.*

The Imperial Sugar Cane Research Conference, convened by the Board, was opened on the 20th July, 1931, by Dr. T. Drummond Shiels, then Parliamentary Under-Secretary of State for the Colonies and Chairman of the Board's Research Grants Committee. The Conference was attended by representatives of the Union of South Africa, India, and the Colonial Empire, by representatives of Institutes and Bureaux and by members of the Board and individuals interested in the subject. Among the questions discussed were the world economic position of sugar and the economics of sugar production in various Empire countries, sugar cane research, the entomological aspects of sugar cane cultivation, quarantine and sugar cane

\* "Banana Breeding at the Imperial College of Tropical Agriculture," by E. E. Cheesman, M.Sc., A.R.C.S. E.M.B. 47, published by H.M. Stationery Office (price 1s.).

diseases, and the utilisation of sugar cane by-products. A Committee was appointed to consider the co-ordination of schemes of research submitted by several Colonies in the West Indian area, and this Committee was assisted in its work by Professor Sir Roland Biffen and Professor F. L. Engledow of the Cambridge University School of Agriculture.

It is believed that this Conference will prove of value to those responsible for the systematic development of sugar cane research in the Empire. A Report of its Proceedings, which includes a reprint of the Conference papers, has been published by the Board.\*

*Sugar Research in the West Indian area.*

The grants notified in last year's Annual Report for the continuation of work on the breeding of improved varieties of sugar cane in Barbados and British Guiana were specifically approved for one year only pending the holding of the Imperial Sugar Cane Research Conference. The Committee appointed to consider the requirements of the sugar industry in the West Indian area in respect of research and investigation recommended that a central cane breeding station should be established in Barbados to serve the needs of the West Indian area, and that a central quarantine station should be established at the Imperial College of Tropical Agriculture in Trinidad for the purpose of effectively quarantining introduced plant material. It was also recommended that provision should be made for continuing cane breeding work in British Guiana, and that some assistance from Imperial funds should be provided for soil, ecological and entomological investigations in connection with the estate cultivation of sugar cane and for investigations in connection with cane farming in Trinidad. The need for fundamental research on such basic problems as sterility in cane varieties, hybrid vigour, etc., was urged in order to add to the knowledge on which the plant breeder can base his operations and it was recommended that consideration should be given to such work being undertaken at the Imperial College of Tropical Agriculture in Trinidad when the central cane breeding station in Barbados has been in operation for some time.

The Colonial Governments concerned are considering these recommendations and drawing up plans for their adoption. Whilst part of the cost involved will naturally fall upon these Governments,

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\* "Imperial Sugar Cane Research Conference, London, 1931—Report of Proceedings." H.M. Stationery Office (price 2s. 6d.).



it is clear that, in the present state of financial stringency in the West Indies, the total requirements cannot be met without some measure of assistance from Imperial sources such as the Empire Marketing Fund and the Colonial Development Fund. The Conference recognised this and suggested that the Empire Marketing Board might consider meeting one-third of the annual cost of the proposed central cane breeding station in Barbados for a period of three years, and continue for a further period of three years their grant of £1,000 to British Guiana. It was suggested that the Colonial Development Fund should provide a capital grant of £3,500 for the establishment of the proposed quarantine station in Trinidad. It was suggested that assistance should be provided to Trinidad from Imperial funds, for a period of three years, to cover one-third of the estimated annual cost of soil, ecological and entomological investigations in connection with the estate cultivation of sugar cane and investigations in connection with cane farming in the Colony. The Board hope that it will be possible for them to recommend some measure of assistance from the Empire Marketing Fund, but the degree of assistance will have to be considered in the light of the resources available for new schemes, and it is by no means certain that they will be able to implement to the full the recommendations of the Conference.

#### *Sugar Research in Mauritius.*

A grant of £2,000 per annum for five years to meet half the recurrent expenditure of the Mauritius Sugar Cane Research Station was announced in the Board's Annual Report for 1929-30. The Station was opened in January, 1930. Its object is to attack the more pressing problems connected with the genetics, physiology and biochemistry of the sugar cane in Mauritius. The most urgent problem in hand is the search for a new cane variety to replace the Big Tanna which has now "run out" after 30 years supremacy in the Island.

The first season's work was devoted to a study of the flowering characteristics of all local varieties. As many reasonable crosses as possible were made in order to obtain data regarding the best parent types and the modes of inheritance. As a result, some promising male and female parents have been set aside for future use. The beginning of 1931 saw the planting out of the 1930 seedlings. These have shown satisfactory growth and will be ready for selecting this year. A crossing programme has been drawn up with the object of testing the seedlings of various crosses for their resistance

to Gumming Disease. All selected seedlings will afterwards undergo a gum resistance trial, and all those showing too great a susceptibility will be discarded.

Dr. H. Evans, who was appointed in April, 1931, to the post of Research Botanist, is engaged on a special course of instruction on root stock studies at the East Malling Fruit Research Station in Kent.

In view of the reductions in the Board's resources the Government of Mauritius agreed to reduce by £330 the call upon the Empire Marketing Fund in the financial year 1931-32.

#### TOBACCO.

##### *Tobacco Research in Southern Rhodesia.*

Last year's Report notified a two years' grant to assist the Government of Southern Rhodesia in establishing a Tobacco Research Station at Marandellas. A full scheme of research covering the use of artificial fertilisers, plant breeding, strain and variety investigations, methods of field management, and diseases, such as Red Rust and White Mould, has now been drawn up. Experiments are in progress at a number of small sub-stations situated on private farms. Thirty-four plots distributed throughout the nine principal tobacco growing areas are being used this season to test the suitability of the varieties White Stem Orinoco, Willow Leaf, Improved Gold Leaf, Cash, Hester and Hickory Pryor to the varying soil and climatic conditions of the areas.

In response to the Board's appeal for economies following the reductions in their resources, the Southern Rhodesian Government undertook to bear all expenditure on this scheme up to the 31st March. No call upon the Empire Marketing Fund was, therefore, made in the financial year 1931-32, and payment of the Board's promised grant is being postponed to the financial years 1932-33 and 1933-34.

#### TUNG OIL.

##### *Tung Oil Production and Research.*

The possibility of producing Tung Oil in the British Empire received attention throughout the year by the Imperial Institute Sub-Committee on Tung Oil, in collaboration with the Royal Botanic Gardens, Kew, and the Research Association of British Paint, Colour and Varnish Manufacturers. Further supplies of seed were distributed by Kew for cultivation, particularly to Assam and Kenya. Additional samples of fruits grown in the Empire were received from

the Transvaal and India, and the oils prepared from them were examined in comparison with Tung Oil from China and the United States. The cultivation trials now in progress, together with the results of the comparative examination of Empire-grown fruits, indicate that Tung Oil of excellent quality can be produced in some parts of the Empire, and as the experimental plantations come into bearing it will be possible to determine the economic possibilities of cultivation on a commercial scale.

The Paint Research Association continued their investigations of the related chemical and technical problems, the solution of which should have the effect of increasing the quantities of Tung oil used in industry. As a potential aid to the evaluation of the oil, further study has been made of the process of its gelation under heat and of the nature of the product formed. Attention has also been given to the extraction of the oil by solvents and the oil thus prepared has been found to be equal in quality to pressed oil. A comparison of the chemical properties and composition of the oils of *Aleurites Fordii* and *A. montana*, the two trees from which the Chinese wood oil of commerce is derived, is in progress with the object of ascertaining whether the latter oil is of equal value to the former for the usual technical purposes.

In view of the need for economy, arrangements were made for the research work being carried out by the Research Association of British Paint, Colour and Varnish Manufacturers to be continued on the basis of a reduced grant of £500 instead of £750 per annum.

#### FLAX.

*Linen Industry Research Association, Lambeg, Northern Ireland.*

With the aid of a capital grant provided by the Board and the Government of Northern Ireland, the necessary buildings to house a complete plant for the production of fibre from flax on a commercial scale have been erected. The Research Association has provided, out of its own resources, a complete range of plant on a commercial scale for carrying out all the processes of the linen industry on the fibre produced by the factory up to the production of finished goods. The flax factory is equipped with a standard seed-cleaning plant, a range of retting tanks, an artificial drying and scutching plant, etc. In fact, on a small but commercial scale, the factory is better equipped than the best Belgian factory and work in accordance with the approved programme is now in progress.

The present aims of the Flax and Fibre Production Department are to cut down the amount of handling required and to mechanise the manual skill of the Belgian ; to reduce to a scientific basis the technical but highly " rule of thumb " skill of the Belgian in retting flax ; to study and to solve the problem involved in the lamination and artificial drying of flax ; to study the possibility of completely side-tracking any part of the normal flax production procedure, more particularly the retting or later in flax preparation the hackling ; and to study costs so as to be able, when opportunity arises, to supply complete figures for the organisation of a new flax industry.

The present moment is specially opportune for an intensive attack on the problem of producing flax fibre on a factory basis. The main sources of supply for the British linen industry are Russia and other parts of Eastern Europe, Belgium and Northern Ireland. If the Research Association can succeed in evolving an economic factory unit for fibre production, immediately the prospect of securing a valuable alternative crop will be opened up to farmers not only in the United Kingdom but throughout the Empire. Already a number of successful new strains of high quality flax have been produced by the Association and demands are coming in from Ontario and other parts of the Empire for supplies of these strains. Two of these strains, Liral Crown and Liral Monarch, gave crops of outstanding merit, when grown on His Majesty's Sandringham estate in 1931. These crops have been processed by the experimental factory at Lambeg.

In response to the appeal for economies following the reductions in the Board's resources, the Research Association arranged to curtail the work of the Flax and Fibre Production Department as from the 1st October, 1931, so as to reduce as far as possible the call upon the Empire Marketing Fund in the financial years 1931-32 and 1932-33.

#### PINEAPPLES.

##### *Pineapple Canning Industry in Mauritius.*

In April, 1931, a grant of £1,250 was approved to meet one half of the cost of importing 300,000 pineapple crowns from Hawaii into Mauritius.

The Colony's present financial difficulties make it very desirable that alternative industries to sugar should be developed, and an attempt is being made to establish a pineapple canning industry. The Colonial Government have granted a loan of Rs. 150,000 to

meet the estimated capital outlay on the purchase of land, erection of factory, purchase and installation of manufacturing plant, etc., and a similar sum has been subscribed by a Company which has been formed. It appears that the problem of marketing the comparatively small supplies which may become available from Mauritius in the early years should not present great difficulties. Apart from the United Kingdom there are still large areas, e.g., continental Europe, where the consumption of canned pineapples is relatively small.

#### FORESTRY AND FOREST PRODUCTS.

##### *Forest Products Research Laboratory, Princes Risborough.*

The work on Empire timbers under the auspices of the Empire Timbers Committee continues to increase in volume. During 1931 preliminary tests on ten species have been in progress. Preliminary tests on East African Camphor were so satisfactory as to warrant major scale tests being undertaken. Owing, however, to the difficulty of supplying the large quantity of material required, these have not yet been started. An effort is being made to circumvent the difficulty by obtaining assistance from trade interests and co-operation in the form of reduced freight charges from the shipping company. Tests on African Walnut were undertaken on behalf of the Timber Panel of the Sectional Aircraft Committee of the British Engineering Standards Association to determine whether it was suitable for use in the manufacture of air screws. A report has been issued. Three species of Sapele Mahogany and British Guiana Crabwood have also been under investigation in connection with the air screw tests. It has been shown that the former are not generally suitable for air screw manufacture owing to a tendency to warping due to growth characters. As regards the latter, tests of the mechanical and physical properties of the green timber are nearing completion. An attempt is being made to discover uses for the smaller sized timbers of British Guiana Greenheart which are unfit for marine work. Its use for flooring purposes will be explored. No export trade in British Guiana Wallaba at present exists and an outlet for the large quantities available would be of considerable value to the Colony. The tests on the species have revealed the presence of a considerable quantity of gum which exuded from the pores for some time after cutting, and "honeycombing" was found to occur during kiln seasoning. Arrangements have been made for Wallaba to be tested in Canada as to its suitability for the manufacture of

paper pulp. Tests on Malayan Meranti Tembaga, which resembles the "Red Lauan" at present imported from the Philippines, are being undertaken at the request of a British firm interested in the exploitation of Malayan Timbers. A report will be issued shortly. Malayan Keruing is being tested at the request of the same firm. British Honduras Santa Maria is being subjected to preliminary tests and to an examination of its suitability for veneer.

No major scale tests have been undertaken owing to the difficulty of obtaining the relatively large quantity of material required at a time of financial stringency and enforced economy, but a number of applications for tests of a special nature have been accepted. These will deal with the defect known as "collapse" in Australian Black-bean in collaboration with the Forest Products Research Laboratory of the Commonwealth of Australia; the working qualities of Queensland Walnut; the mechanical properties of Australian Turpentine with a view to providing a specification for use in piling and marine constructional work; the working and finishing qualities and resistance to decay of British Columbian Western Hemlock and Western Red Cedar, etc.

Commercial trials are proceeding to determine the suitability of New Zealand Beech for use as rifle stocks, furniture, flooring and motor body building, and to indicate to what degree the properties of Indian grown Honduras Mahogany agree with those of the native grown timber.

A scheme for the collection of information and statistics relating to the Empire's forest resources is being steadily carried forward, and it is now possible to visualise with some approximation to accuracy to what extent the British Empire draws on outside forest areas for its timber supplies and also the extent of the export trade in timber from Empire sources to foreign countries. An attempt has been made to determine how far it would be possible to supply the whole of the Empire's demands for timber from Empire forests, and it would appear that a vigorous policy of development and exploitation of forest resources could eventually render the whole Empire almost if not quite independent of all foreign supplies of hardwoods. Softwoods are in a different category, yet it is clear from statistics already obtained that there is room for a considerably greater consumption of Canadian softwoods within the Empire.

A further grant has been approved from the Empire Marketing Fund in support of the work of the laboratory in the financial year 1932-33.

## MECHANICAL TRANSPORT.

In last year's Report mention was made of the transport unit which was being built for the Oversea Mechanical Transport Council, in accordance with the requirements of the Directing Committee. The object of the unit, which will handle a useful load of 15 tons carried by an eight-wheeled tractor and two eight-wheeled trailers, is to enable economic loads to be carried over low-grade roads, the laden axle weight being kept down to a figure well below that of the standard heavy lorry.

The unit has now been completed and trials are being conducted with it. These trials are of a searching character, being carried out over surfaces and gradients such as are likely to be met with in oversea conditions, so as to test thoroughly every component part of the unit and to detect any weak spots. Such modifications to the vehicles as appear to be desirable are being carried out from time to time.

The present intention is to despatch this unit for service oversea after it has completed some 5,000 miles during trials in England, so that the vehicles may be tested also under actual working conditions. This unit has always been regarded by the Directing Committee as the first stage in the development of a unit to carry considerably heavier loads over the same class of cheap earth roads. There are two lines of approach to the solution of the problem, the first by means of caterpillar tracks, the second by means of a larger wheeled unit. For the reasons given in the last report, it has been found necessary to limit work as regards the former to test and experiment on a small scale. This is being continued.

As regards the second proposal, it had been the intention of the Committee to embody the lessons and practical experience gained in the production and trials of the 15-ton unit in the development of a 30-ton unit. Progress in this direction is now threatened, however, by lack of funds due to the heavy cut which it has been necessary to make in the grant from the Board. This is the more regrettable because while the Committee are confident that there is ample scope for the employment of the smaller unit, they feel sure that still more important results could be anticipated from the larger unit in opening up undeveloped areas, owing to the cheaper rate of transportation which would be thereby possible.

The production of "Diesel" engines for transport requirements is being closely watched by the Committee, but there has been such

a marked progress in their development commercially during the past year or so that it has not been thought necessary to devote any of the Council's depleted funds to this purpose. The 15-ton unit is designed, however, so that the standard petrol engine with which it is now fitted can be replaced by a "Diesel."

A number of experiments have been carried out with large section tyres, and after tests in England a 30-cwt. lorry has been despatched to the Sudan, in order that the comparative performance of tyres of three different designs may be ascertained over soft and sandy ground. In view of the difficulties that have been experienced in the past owing to the provision of insufficient cooling capacity in the cases of many vehicles in common use in the tropics, this lorry has been fitted with a special "Still" tube radiator, so designed as to be capable of being fitted to the standard vehicle with the minimum of alteration. The results of these experiments will be published in due course.

The Directing Committee are undertaking a series of trials of such new models of motor vehicles as seem likely to represent an advance in design for oversea work. Several of these trials have been carried out as a result of requests received from Colonial Governments, and confidential reports on the vehicles tested are circulated for the information of officers overseas. The Oversea Mechanical Transport Council would like to emphasise the point that the Directing Committee will willingly carry out tests for Oversea Governments and attempt to obtain for them information on any point in connection with motor transport or cheap road construction and maintenance.

The publication of the quarterly Bulletin has been continued during the year, and from the statements received from an increasing number of oversea officers it would appear that it is meeting a very real need.

#### FISHERIES.

##### *Fishery Research in Newfoundland.*

Last year's Annual Report mentioned that Dr. Harold Thompson's report and recommendations for a programme of fishery research in Newfoundland had been accepted by the Government of Newfoundland and the Empire Marketing Board. This Report has now been published.\*

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\* "A Survey of the Fisheries of Newfoundland and recommendations for a scheme of Research," by Harold Thompson, M.A., D.Sc. Vol. 1, No. 1, of Reports of the Newfoundland Fishery Research Commission, published by the Newfoundland Fishery Research Commission, St. John's, Newfoundland.



The new biological station at Bay Bulls was opened in July, 1931. This station, as well as providing laboratory accommodation and scientific apparatus for the study of improved methods of processing fish, also functions as a bureau for disseminating information and obtaining new knowledge of local resources and their means of exploitation. Part of the primary knowledge to be sought after will be that of the distribution and life-histories of Newfoundland's marine fauna. The steam trawler "Cape Agulhas" has been purchased by the Newfoundland Government and made available on hire for fishery research work.

The Fishery Research Commission have responded readily to an appeal for economies following the reduction in the Board's resources. They have agreed to forego any further expenditure on capital items, whilst on the maintenance side a considerable saving will be shown for the current year and an annual reduction of 10 per cent. will be effected in the two succeeding years. This is stated to be the maximum saving possible if the efficient conduct of the research scheme is to be maintained.

#### *Bermuda Marine Biological Station.*

In June, 1931, the Board recommended that a block grant of £2,500 should be made available from the Empire Marketing Fund as a contribution to the development of the Bermuda Marine Biological Station. Bermuda is admirably situated for developing large-scale oceanographical investigations and for a regular and systematic study of the waters of the North Atlantic. The station has attracted the attention of the Trustees of the Rockefeller Foundation, who have contributed £50,000 towards its development, whilst the Government of Bermuda have undertaken to purchase a site of twelve and a half acres for the new station and to make an annual grant of £200 for ten years towards its maintenance. A body of Trustees appointed by the Rockefeller Foundation includes three British experts, namely, Dr. A. G. Huntsman of Canada, Professor J. R. Ashworth of the University of Edinburgh, and Dr. E. J. Allen, Director of the Laboratory of the Marine Biological Association at Plymouth.

The Board were compelled, when the reductions in their vote were announced, to ask that their offer of a block grant of £2,500 should be regarded as postponed indefinitely until such time as the financial position makes it possible for them to reconsider the matter.

## MISCELLANEOUS.

### *Comparative Study of Methods of Soil Analysis.*

The two years' grant to the University College of North Wales for a comparative study of methods of soil analysis expired on the 16th February last, but a supplementary grant of £100 has been approved to continue the work up to the end of the present College session in June. By then it is expected that all the samples now in hand will be examined and the principal problems solved. A report will thereafter be presented which will embody recommendations satisfying the original purposes of the grant.

### *Research on Fluctuations in Numbers of Wild Rodents.*

The investigations being carried out at the Zoological Department of the University of Oxford by Mr. C. S. Elton and Dr. J. R. Baker on fluctuations in the numbers of wild rodents and on factors controlling the reproduction and breeding season of wild field mice are now in an advanced stage. Though some way from completion, they have already produced definite results of value. The fact has been confirmed that voles and mice have definite cycles of abundance and scarcity which can be correlated with those of other animals and to a certain extent with meteorological conditions. The economic bearings of this are clear, since most rodents are herbivorous and do considerable damage to growing crops and to stored foodstuffs. On the breeding side it has been possible, by keeping animals in groups under experimental conditions where they are subjected to different temperatures and amounts of light and darkness, to demonstrate the more important factors controlling breeding. At a Conference on Biological Cycles held in Canada in July last these investigations received a large measure of official support.

The period covered by the original grants from the Board for these investigations expired on the 30th June, 1931, but a small supplementary grant was approved to continue until the end of December the work on fluctuations in numbers. The breeding work was similarly continued until the termination of the grant on the 31st December, 1931. The University of Oxford have made a small grant to enable these experiments to be carried on during 1932. The Royal Society have made available to Mr. Elton from the Darwin Fund a grant of £500 per annum for four years for research on fluctuations in wild vole populations in Great Britain, together with an additional grant of £250 for capital outlay and field equipment, whilst the New

York Zoological Society have guaranteed Mr. Elton a part-time grant for three years for research into cycles in numbers of fur-bearing animals, by investigation of the old diaries of the Hudson's Bay Company, who are giving facilities, and also for directing the newly formed Bureau of Animal Population in the Department of Zoology and Comparative Anatomy, University of Oxford.

#### TRAVELLERS.

The Board's policy of promoting visits to oversea Empire countries by experts from the home country, and of inviting representatives of oversea producers and others to visit this country, has proved one of the most fruitful means of encouraging co-operation in scientific research and marketing. For obvious reasons it has not been possible during the year under review to continue this system of liaison to the extent desirable, but it has not been altogether suspended. Mention has already been made to the visit of Mr. William Davies, of the Welsh Plant Breeding Station, to Australia to advise on grassland research problems, to the exchange between Mr. S. W. Rogers, of the East Malling Fruit Research Station, and Mr. R. C. Palmer, Chief Assistant to the Superintendent of the Summerland Experimental Station, British Columbia, and to the visit of Dr. I. B. Pole-Evans, Chief of the Division of Plant Industry in the Union of South Africa, to the Bechuanaland Protectorate and Swaziland. Dr. G. S. Cheema, Horticulturist to the Government of Bombay, has visited this country to study recent advances in the commercial practice of cold storage with special reference to the transport of Indian Mangoes. He visited the Cambridge Low Temperature Research Station, the East Malling and Long Ashton Fruit Research Stations and other centres. Mr. R. Emslie, of the Ontario Agricultural College, is studying, under Dr. Orr at the Rowett Research Institute, Aberdeen, the physiology of the fowl, and will prepare a Report on Recent Advances in Poultry Husbandry for publication in the Board's "Grey Book" series of Reports. Mr. F. A. Stockdale, Agricultural Adviser to the Secretary of State for the Colonies, left this country in January for visits to Trinidad, British Guiana, the Windward and Leeward Islands, Bermuda, Jamaica and British Honduras. Whilst in the West Indian area he will take the opportunity of seeing the work in progress at the Imperial College of Tropical Agriculture and at other centres to which grants have been made from the Empire Marketing Fund.

## II. MARKETING, ECONOMIC INVESTIGATION AND MARKET INTELLIGENCE.

### MARKETING OF HOME AGRICULTURAL PRODUCE.

#### ENGLAND AND WALES.

##### (a) *Standardisation.*

With the aid of a grant of £42,500 from the Board, the Ministry of Agriculture and Fisheries has continued during the year 1931-32 its programme of standardisation on behalf of home agricultural produce. *Standardisation* is the first stage in the development of a rational system of marketing, and any marketing organisation, to be fully successful, must have a standardised product with which to work. Considerable progress was made in the year under review, and with regard to a number of products it may be said that standardisation is now firmly established.

In developing this programme a thorough investigation is first undertaken for each commodity with a view to the planning of reforms for practical demonstration, leading finally to their application to commercial practice.

*Investigations.*—The results of the investigations are published in the Economic Series of Reports, popularly known as the "Orange Books." The number of reports issued is now 31, and sales exceed 150,000 copies. During the year three new reports were issued dealing, respectively, with the marketing of honey and beeswax, butter and cream, and sheep, mutton and lamb, while a fourth gave the results of a comprehensive survey of the sugar beet industry at home and abroad. Further reports, on the marketing of vegetables, jam, calves and veal, and hides and skins, are in preparation.

*Demonstration.*—Demonstrations were staged at 11 of the principal agricultural shows during the summer of 1931. These dealt in a practical manner with the principle of standardisation as applied to products already marketed under the National Mark, and also with new National Mark schemes proposed for honey and cheese. Similar displays were arranged at other shows and exhibitions such as the Imperial Fruit Show and the London Dairy Show.

*Application.*—The Agricultural Produce (Grading and Marking) Act of 1928, which empowers the Minister of Agriculture to make regulations defining grade designations for agricultural produce,

forms the legislative basis of National Mark schemes for the voluntary standardisation of home agricultural produce, in terms of grades, pack and packages. The year was one of consolidation and further development. An Amending Act was passed in 1931 to widen the application of the principal Act so as to include manufactured agricultural products such as jam, and also the produce of the fishing industry. Further provision was made in this Act for safeguarding the National Mark.

National Mark commodity schemes are now in operation for beef (in London, Birmingham, Leeds, Bradford and Halifax), eggs, dressed poultry, apples, pears, strawberries, cherries, tomatoes, cucumbers, canned fruits, canned vegetables, cider, wheat flour, malt flour and malt extract. New schemes have been introduced for honey, bottled fruits and vegetables, and plums; these commodities will be on the market under National Mark labels for the first time in 1932. Schemes for applying the National Mark to jam, cheese and mutton and lamb are under consideration.

*Results.*—The quantity of produce packed and sold under the Mark has increased considerably. For instance, the National Mark egg packing stations handled 312 million eggs in 1931 as compared with 222 million in the previous year; the returns received for the early part of the present year suggest that a further substantial advance is likely to be made in 1932. The bulk of the rapidly increasing output of canned English fruits and vegetables is marketed under the National Mark and largely increased quantities of both canned fruits and vegetables will be available in 1932.

Satisfactory progress has been made in the three areas in which facilities for beef grading and marking have been provided; over 500,000 sides of beef have been graded and marked to date. Practically all beef of gradable quality slaughtered in London is now graded and marked with the National Mark. Since August, 1931, there has been a remarkable increase in the sales of National Mark beef in the Birmingham area, while steady progress can be recorded in the Leeds, Bradford and Halifax area. The beef grading scheme was the subject of an enquiry by an Inter-Departmental Committee, which reported in favour of its continuance and development.

The Board have made a grant for continuing these services on behalf of the home producer during the financial year 1932-33, but, owing to the need for economy, the grant has been reduced to £36,500, which is over 10 per cent. less than the grant for 1931-32.

(b) *Publicity.*

As a matter of administrative convenience and following the arrangement adopted in the previous year, a special grant of £55,000 was again made through the Empire Marketing Fund by His Majesty's Government for foreground publicity on behalf of the National Mark. The main items of publicity undertaken were :—

National Mark Shopping Weeks in some 11 provincial towns, at which displays of National Mark products were staged. Other local activities included advertising in the Press and on hoardings and public vehicles, shop window dressing competitions, film displays, essay-writing competitions for senior school children, and cookery competitions.

Displays of National Mark products in other towns, including London, where for two months in the summer of 1931 the Ministry occupied shop premises in Burlington Gardens.

Advertising of National Mark beef in the Birmingham, Leeds and Bradford newspapers, and of other products in trade newspapers and women's journals.

The Empire Marketing Board's advertising frames were leased on three occasions (in July, October and March), for the display of National Mark posters.

Advertisements on London omnibuses.

Display material issued to traders stocking National Mark products.

Publicity booklets and leaflets.

Lectures, films and cookery competitions.

In addition, several thousand circular letters were sent to local authorities, hotel and restaurant proprietors and other large consumers with regard to the use of National Mark products, and a considerable amount of material was prepared for articles, press paragraphs and for broadcasting. The "Buy British" campaign provided many opportunities for publicity of this nature.

The need for economy in national expenditure has led to a considerable reduction of the amount available for foreground publicity work in the financial year 1932-33. The amount voted for the year is £17,500.

(c) *Organisation.*

In 1929 a supplementary grant of £12,000 per annum for three years was made by the Empire Marketing Board for the investigation of methods and problems of marketing organisation at home and

abroad. A Report, in the Economic Series, on the Organisation of Potato Marketing was issued in the autumn of 1931, and a Report on the Organisation of Wool Marketing will be sent to press shortly. Investigations into milk marketing organisation are in progress and the results will be published in a Report in the same series.

(d) *Agricultural Marketing Act.*

This measure, designed to facilitate organisation by producers in the marketing of agricultural commodities produced in Great Britain, received the Royal Assent on the 31st July, 1931. A report in the Economic Series explaining the provisions of the Act has been published.

(e) *Miscellaneous.*

Sub-grants have been made by the Ministry to certain University Departments of Agriculture, Agricultural Colleges and to co-operative and other commercial organisations to enable them to conduct various marketing investigations or experiments, or to serve as demonstration centres.

SCOTLAND.

Grants amounting to £12,500, which included a special sum of £4,000 provided by His Majesty's Government for foreground publicity and passed through the Empire Marketing Fund as a matter of administrative convenience, were made available to the Department of Agriculture for Scotland for marketing services in 1931-32. These grants were devoted to services in respect of the marketing of eggs, tomatoes and canned fruit, beef grading, Scottish National Mark labels, exhibits of Scottish National Mark and other Scottish produce, economic enquiries, publicity for Scottish National Mark products and other activities. For the financial year 1932-33, a grant of £6,510 has been approved. This includes £2,060 for foreground publicity purposes but makes no provision for the continuance of the beef scheme.

*National Mark Schemes.*—The Scottish National Mark has now been applied to the following products:—eggs, tomatoes, ware potatoes, malt products, canned fruit and beef. The scheme for beef is still on an experimental basis.

*Eggs.*—The number of registered packers of eggs now operating is 39. Since the inception of the scheme 96,000 National Mark labels have been issued, representing approximately a quantity of 2½ million dozens of graded and tested eggs produced in Scotland.

*Tomatoes.*—Seventy-one firms have been approved as registered packers of Scottish National Mark tomatoes and to date 87,500 labels, representing nearly 470 tons of tomatoes, have been issued to them.

*Potatoes.*—Thirty-four potato growers and merchants are authorised under the Scottish National Mark scheme for ware potatoes and 41,500 labels have been issued.

*Malt.*—The number of manufacturing firms authorised as packers of malt extracts and malt flours manufactured wholly from Scottish home-grown barley is the same as in 1930, viz., twelve.

*Beef.*—The experimental scheme for the grading and marking of Scottish-killed beef which was begun in the north-east of Scotland in October, 1929, was continued in the counties of Aberdeen, Banff, and Moray throughout 1931. The number of butchers and dealers registered for the purposes of the scheme in 1931 was 192. During the year 85,675 sides of beef were graded and marked, representing approximately 12,000 tons of beef. Following the recommendation of an Inter-Departmental Committee facilities were provided also for the grading and marking in London of pieces of Scotch-killed beef consigned direct from other areas in Scotland. The Scottish Department are satisfied that the scheme has proved advantageous to the producer, and that it has tended to steady the price for Scottish beef at a higher level.

*Canned Fruit.*—With a view to assisting the development of the canning of Scottish-grown fruit the Department, on 17th July, 1931, instituted a National Mark scheme for plums, gooseberries, strawberries, raspberries, red currants and black currants grown and canned in Scotland. Four canning firms have been authorised to operate under the scheme and 246,500 Scottish National Mark labels have been issued to them. In addition, one of the firms was authorised to incorporate the National Mark design in its private brand labels. It is estimated that not less than 1,000,000 cans of Scottish National Mark canned fruit were placed on the market in 1931.

*Exhibitions.*—During the year the Department organised displays of representative Scottish agricultural and other produce at exhibitions and shows recognised by the Board in England and Scotland, at Empire Marketing Board shops, and also at a few of the more important agricultural shows in Scotland.

At the International Grocers' Exhibition in London in September, 1931, and at the British Industries Fair at Olympia in February, 1932, the Department presented a representative display of Scottish



- National Mark and other agricultural products, while at the Imperial Fruit Show held at Manchester in October and November, 1931, they staged an exhibit of seed potatoes. Reports received by the Department show that participation in these exhibitions has caused an increased demand for Scottish produce, resulting in increased business for the producers.

*National Mark Publicity.*—The monies made available for foreground publicity enabled the Department to continue their publicity service for Scottish National Mark products. Posters advertising Scottish National Mark eggs and tomatoes were exhibited on the Board's frames located in the principal towns of Scotland, and adhesive transparencies prepared to advertise these commodities were displayed on omnibuses in the south-west of Scotland. Publicity material for the advertisement of Scottish National Mark Canned Fruit was also prepared. In addition, a contribution was made towards the cost of advertising National Mark beef in London.

The funds made available by the Board for the year 1932 will ensure the continuance of the Department's activities in connection with the marketing of home agricultural produce.

*Improvement of Pork and Bacon Production.*—Practical feeding experiments with pigs are now in progress under the scheme of investigations into the improvement of pork and bacon production in Scotland which is being carried out by the Scottish Department with the aid of a grant from the Empire Marketing Fund.

*Economic Investigations.*—The very considerable volume of evidence relating to the trade in, and marketing of, live stock and potatoes in Scotland, was completed and in large measure analysed, and reports are in course of preparation, which will, it is hoped, be issued in the course of a few months.

During the year a further enquiry into the marketing of grain and grass seed in Scotland has been undertaken.

#### NORTHERN IRELAND.

A Report on the investigations into the conditions of marketing Northern Ireland agricultural produce, which have been aided during the past three years by a grant of £900 per annum from the Empire Marketing Fund, has just been published. The report shows the extent to which the old-fashioned markets and fairs of the country continue to provide the principal channels for the marketing of agricultural produce—especially in the case of the sale of live stock.

To some extent the attendance of farmers at markets for the sale of some classes of produce has fallen off in recent years due to the number of higglers and small dealers who now visit the farms. This development has been accentuated by the growth of road and motor transport and the report indicates several directions in which improvement is desirable alike in the control of markets and fairs and in the prevention of certain abuses which exist in connection with the purchase of produce at the farms by itinerant collectors and dealers. The Board have made a further grant of £650 to the Government of Northern Ireland which, with the balance from the existing grant, will enable the enquiries to be continued during the year 1932-33 and will allow certain schemes for the grading of flax and store cattle to be examined and initiated upon an experimental basis.

A second grant to the Government of Northern Ireland is in connection with an enquiry into the economic position of small farms. The contribution of the Board is £1,800 defrayed over a period of years and represents something less than 50 per cent. of the total cost of the enquiry, the balance being borne by the Government of Northern Ireland. Financial records are being kept in respect of a number of farms while the survey method has also been employed to obtain data regarding the economic position of the smallest type of holdings. During the year a report was published in the Journal of the Ministry of Agriculture, Northern Ireland, Volume III, on "An Economic Survey of Small Holdings in Northern Ireland" while the results of the first batch of financial accounts collected under the scheme are dealt with in a separate section of the Fifth Annual Report upon the Agricultural Statistics of Northern Ireland, 1929-30.

#### MARKETING BRANCH.

##### *Market Promotion.*

When the last Annual Report was prepared, the early work of the Marketing Committee had proved so successful as to give grounds for the hope that there might be a material extension of that work during the year now under review. That such an extension has not, in fact, occurred is not due to any lack of confidence in the methods which were being used experimentally some twelve months ago, but to the impossibility of providing funds for the extension of new or experimental services at a time when older activities of the Board, which have come to be regarded as inherent in its work, have had to be seriously curtailed or even abandoned.

### *Bulk Purchases.*

Those features of the Board's work, therefore, under the control of the Marketing Committee which have been most prominently in the public eye have been those which could be maintained at a minimum cost such as the approach to bulk or collective buyers (e.g., Local Authorities), who are in a position to make large purchases of Empire products and particularly of food products. During the year under review the tender forms of no less than 319 Local Authorities and Public Institutions were, as a result of suggestions made by the Board, revised with a view to the substitution of articles of Empire for those of foreign origin. On the completion of this series of visits to Local Authorities, the staff engaged have been able to devote more attention to the remaining consumers in this class. Those schools, such as the big Public Schools, not covered by visits to the County Education Authorities are now the subject of direct approach, while visits to Railway Companies, Hospitals and Hotel Proprietors have also been made. In the extension of this work the Board have found it advisable and profitable to deal with commodities other than foodstuffs and to frame their appeal upon the widest basis possible.

### *Commodity Enquiries and Trade Contact.*

The most notable feature of the work carried out under the direction of the Marketing Committee, however, probably remains in the field of trade contact and enquiry which has been successfully handled since the Board's inception.

Although this has been recorded before, it is not out of place to repeat that the most cordial relationship has throughout existed between the Board's staff and the representatives of the distributive trades and, in particular, of the food trades. The Board's work has been aided and extended through the various Trade Committees associated with the Marketing Committee. The Food Products Committee has been further strengthened since last year by the inclusion of additional members of acknowledged standing in the commercial world. The formation of a Committee representative of the Retail Bakery and Confectionery Trades assures to the Board expert advice from yet another important section of the food trade. During the year under review the Food Products Committee has carried out a number of investigations of first-class importance and

has been in direct consultation with representatives of producers from various parts of the Empire. Reports based upon their deliberations have been forwarded to the various Governments concerned, dealing among other subjects with the sales promotion prospects of Indian and Burmese rices, the demand for Empire beef for institutional consumption, the grading and marketing of Canadian canned salmon, the potential market for Grenada preserves, and the development of the trade in Malayan and Mauritius canned pineapple and in other Empire canned fruits.

Some idea of the complexity of the work carried out under the general heading of "Marketing" may be gathered from a morning's mail this year which included, in addition to the more ordinary and prosaic enquiries, requests for information as to sources of supply of Empire starch, a letter from a Colonial Government asking for advice in regard to the canning of Turtle, a communication from a dealer in hides enquiring as to the possibility of developing an Empire industry in Reindeer skins and an appeal from an hotel proprietor for the names of British Manufacturers of glass bottles and tumblers competitive in price and quality with cheap Continental pressed glass.

In placing enquirers in touch with suitable sources of information, by giving guidance based upon the opinions of its trade advisers as to the market in this country for certain Empire products and as to suitable methods of preparation and packing, the Marketing Committee is daily carrying out quietly and unobtrusively a work of considerable importance to the home and to the oversea producer, which is not without its utility also to the distributive trade in the United Kingdom.

#### DIRECTIONAL SELLING CAMPAIGNS.

The canvass of retailers in Lancashire in the interests of Empire butters, commenced during the period reviewed in the last Report, was concluded in September last. During the six months personal calls had been made on every wholesaler and retailer of butter in the principal Lancashire towns. There are given below figures showing the results of this canvass in so far as certain towns are concerned.

It had been intended to extend this canvass to Yorkshire in the autumn and also to undertake a similar selling campaign in respect

of Home canned fruits in Lancashire and South-west Scotland, but both these projects had to be abandoned in view of the urgent need for national economy.

Town.	No. of shops covered by calls.	No. already selling Empire Butter at time of first call.	No. not selling Empire Butter at time of first call.	Promises to stock Empire Butter made by owners of shops in Col. (4).	No. of promises fulfilled before revisit.	Total No. stocking Empire Butter on revisit.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Manchester	2,041	1,164 = 57%	877 = 43%	629	503	1,667 = 84.4%
Stockport ..	338	227 = 42.2%	311 = 57.8%	218	162	389 = 72.3%
Wigan ..	384	187 = 48.7%	197 = 51.3%	146	124	311 = 81%
Warrington	234	94 = 40.2%	140 = 59.8%	113	91	185 = 79%
Chorley ..	181	86 = 47.5%	95 = 52.5%	58	46	130 = 72.9%
Bolton ..	913	314 = 34.4%	599 = 65.6%	431	343	659 = 72%
Oldham ..	890	316 = 35.5%	574 = 64.5%	301	262	578 = 65%
Bury ..	194	65 = 33.5%	129 = 66.5%	80	51	116 = 60%
Rochdale ..	538	220 = 40.9%	318 = 59.1%	198	135	355 = 66%
Blackburn	707	267 = 37.8%	440 = 62.2%	263	246	513 = 72%
Preston ..	604	189 = 31.3%	415 = 68.7%	253	220	409 = 67.7%
Totals ..	7,224	3,129 = 43.3%	4,095 = 56.7%	2,690	2,183	5,312 = 73.5%

The Board are of the opinion that market promotion by retail canvass affords a most promising method of extending the consumption of Empire produce in this country. The district which was selected for experimental purposes in the case of the butter canvass was one in which it was known that foreign butters were predominant and where the greatest consumer resistance to such a sales campaign was to be expected. It was, moreover, a territory which had been systematically covered for years without marked effect by the representatives of commercial houses interested in the sale of Empire butters. The success which attended the approaches made by the Board's officers may properly be attributed in part to the fact that they were speciality salesmen engaged in pushing the sale of one commodity only, and in part to the unique position which the Board hold in the esteem of traders in this country. Six years' unobtrusive contact with the distributive food trades, supported by the Board's general background publicity, have established for the Board a respect and friendly atmosphere which is probably unique. This position has largely been established through the assistance of the many traders who have been good enough to serve upon the Board's Advisory Committees or to contribute to their work by their counsel and assistance in their individual capacities.

## MARKET INTELLIGENCE SERVICES.

### (i) *Existing Services.*

#### (a) *Fresh Fruit (Weekly Fruit Intelligence Notes).*

The first intelligence service to be established by the Board was that for fresh fruit, following a recommendation of the Imperial Economic Committee in its Third Report. The "Weekly Fruit Intelligence Notes" have, from the start, been circulated among Empire producers and fruit traders in this country and overseas, and, since the first issue more than five years ago, the scope of the service has been substantially enlarged. An organisation has now been built up by means of which both producers and traders are kept constantly informed of the supply position of practically all fruits and a number of the more important vegetables coming into the United Kingdom market. The annual subscription for the "Notes" was raised in April to £1 within the Empire and £2 to foreign subscribers, but producers and their representatives within the Empire continue to receive copies free. The weekly circulation is now about 2,500; of these 1,200 go to subscribers and 1,300 to producers.

The information given in these "Notes" covers a wide range of detail. The immediate supply position is indicated by statements showing weekly imports of each kind of fruit into the 25 chief ports in Great Britain, and by tables of arrivals and prospective arrivals based upon complete lists of fruit cargoes afloat to the United Kingdom. Crop reports and prospects in Empire and foreign fruit-growing countries give an indication of the probabilities of the future supply position, and particularly the intensity of the competition which Empire growers are likely to experience in the British and Continental fruit markets. These crop reports are supplemented by special reviews in which the available information is summarised and provisional estimates are made as to the coming season's supplies of the various fruits. Finally, the market possibilities over an even longer period are dealt with by showing the trend of production in fruit-growing countries, and the development of imports into important fruit-consuming countries.

*Prices at Auction Marts in the Netherlands.*—The special arrangements made in 1930 for the daily collection and dissemination of information about the prices realised at representative fruit auctions in the Netherlands were repeated during the 1931 soft fruit season.

This service is greatly appreciated by fruit growers in the United Kingdom, who are thus kept informed day by day of the prices realised for fruit by their chief continental competitors.

(b) *Dairy Produce and Pig and Poultry Products (Weekly Dairy Produce Notes).*

In its fourth report on Dairy Produce the Imperial Economic Committee recommended that an intelligence service similar to that which had previously been recommended for fruit should be started by the Board for Dairy Produce. The first number of "Weekly Dairy Produce Notes" was issued in May, 1929.

In their general form and in their subject matter these "Notes" resemble the "Fruit Notes," and like them, are distributed both to producers and to traders. A subscription of 10s. per annum within the British Empire was introduced in June, 1931, and increased to £1 in June of this year, although producers and their representatives continue to receive copies free. At present the circulation amounts to 2,500 copies weekly, the majority going to producers and dairies in the Empire, with a subscription list of 550.

The Imperial Economic Committee, in its twelfth report, recommended that the publication of similar weekly intelligence should be undertaken for pigs and pig products, and the Board felt that, in view of the close relationship existing between dairy and pig products, this recommendation could best be met by extending the scope of the "Weekly Dairy Produce Notes." From April, 1930, therefore, the "Weekly Dairy Produce Notes" have included information about pigs and pig products on similar lines to that already given for butter, cheese, condensed milk, poultry and eggs.

*Stocks of Butter in Cold Store.*—A special feature of these "Notes" is the publication of statistics of the stocks of butter held in cold stores throughout the United Kingdom. In December, 1929, the Board, with the approval of the provision trade and the co-operation of the proprietors of cold stores, was able to start the collection of these statistics and particulars of aggregate stocks have been published in the "Weekly Dairy Produce Notes" for over two years. The figures are furnished, voluntarily, at fortnightly intervals by proprietors of cold stores, and it is estimated that the aggregates secured represent fully 95 per cent. of the butter held in cold storage in the country. They are thus sufficiently complete to enable reasonably accurate calculations to be made, with the help of the figures of weekly imports, also published in "Weekly Dairy Produce Notes,"

of the movement of imported butter into consumption throughout the year. Moreover, as separate figures are obtained for box and cask butters, it is possible to measure the changes in relative consumption of the former, coming mainly from Australia and New Zealand, and the latter, which is imported chiefly from Denmark and other European countries.

(c) *Dried and Canned Fruit.*

At the suggestion of the Australian Canned Fruit Board and following meetings of an advisory committee of representatives of both producers and traders, an intelligence service for canned and dried fruits was instituted in May, 1931, consisting of a weekly stencilled circular giving details of the arrivals of canned fruits at the principal ports in the United Kingdom, and a monthly issue containing information as to the supply position during the month, monthly imports, crop reports, and special articles on production developments and the export trade in the countries chiefly concerned. The present circulation is about 550.

In addition to this service the provision of periodical surveys of the statistical position of currants, sultanas and raisins, for the use of the Australian and South African growers and their representative organisations, is being continued. This service began early in 1927.

*Annual Supplements to Intelligence Notes.*

The Board issued in 1931 a supplement to "Fruit Intelligence Notes" (Fruit Supplies in 1930, E.M.B. 38) setting out fully the statistics of imports of fruit and vegetables into the United Kingdom in 1930, with comparable figures for earlier years, together with reprints of a number of special reviews which had appeared in the "Notes" during the year. This supplement was extremely popular, and a similar volume has been issued this year, giving complete fruit import statistics for 1931 (Fruit Supplies in 1931, E.M.B. 49). Corresponding supplements (Dairy Produce Supplies in 1931, and Canned and Dried Fruit Supplies in 1931) are being issued this year for the first time, and it is hoped that these will prove equally valuable both to producers and to traders in the Empire.

(ii) *Extension of Intelligence Services.*

In February, 1930, the Board's Agricultural Economics Committee arranged for a Conference of Dominion representatives and representatives of the Ministry of Agriculture and Fisheries, with the object



of discussing proposals for the further development of the Board's intelligence services and world statistical surveys. This Conference agreed upon a list of products for which some improvement in existing intelligence services appeared to be required, and at their recommendation Colonial Governments were also consulted as to any additional products which might usefully be included. The list of additional products provisionally agreed upon by the Conference and amplified to meet the suggestions of Colonial Governments is given below.

- Beef and Mutton.
- Oilseeds and Nuts.
- Coffee and Cocoa.
- Rice.
- Hemp, Sisal and other fibres.
- Tobacco.
- Spices.

The organisation of intelligence services for the above groups of products has been deferred owing to the reduction in the Board's financial resources, but some preliminary consideration has already been given to spices.

The question of an intelligence service for grain was considered at the Conference, but in view of the importance of cereal crops to the Empire and in view also of the magnitude of the international trade in grain and of the vast amount of information which is already collected and disseminated by various agencies, it was decided to defer the question for later consideration. There is, however, no doubt that in a number of respects the existing services are inadequate, and the Board have made a beginning by securing, with the approval of the Government of Canada, the temporary services of a former officer of the Canadian Wheat Pool to organise such supplementary services as may be found necessary. This officer is at present in Russia, trying to obtain reliable information about the grain situation there.

The extension of the Board's intelligence services to grain and other products not now dealt with, and the improvement of the existing services, will, it is thought, involve the appointment of correspondents, either whole time or part time, in a number of key positions throughout the world. A representative, on a part-time basis, has been temporarily appointed in Argentina, but the appointment of

representatives in other areas, equally important, has been deferred, as the cost of representation in foreign countries is beyond the Board's present financial resources.

#### WORLD SURVEYS OF PRODUCTION AND TRADE.

Surveys of world production and trade in agricultural products, of which the Empire is an important producer, provide complete statistical pictures of individual commodities, and are of value not only to the producers concerned but also to those responsible for agricultural policy. The comprehensive view presented in these reports could only be secured by laborious compilation from materials which are not readily available to those most concerned, and the Board feel that the number of requests which have been received for surveys covering a wide range of commodities is sufficient justification for the extension of this useful line of research, which neither duplicates, nor conflicts with, the statistical surveys undertaken from time to time by the International Institute of Agriculture.

##### (i) *Current Activities.*

The preparation of this type of statistical survey arose out of requests received from producers in the Empire for advice as to the probable future balance of supply and demand in respect of particular crops. The first survey, on Oranges (E.M.B. 15), was issued in May, 1929, and the second, on Cocoa (E.M.B. 27), in May, 1930. All the available data as to the trend of production and consumption are assembled in these surveys; where possible, estimates are made as to the probable trend of future production and such conclusions as may legitimately be drawn as to the future possibilities of the industry are set out.

The favourable reception accorded to these reports led the Board to consider further developments in this field, and surveys have been undertaken for wool (with the assistance of a small advisory sub-committee), beef, oilseeds, mutton and lamb.

The report on production and trade in raw wool is now about to be issued, but the collection of statistical data is continuing and it is proposed to re-issue the report next year with later figures, and with particulars as to the utilization of wool and the international trade in woollen manufactures. A short preliminary report on oilseeds and vegetable oils was prepared during 1931, and circulated to the various Empire Governments interested. The more exhaustive survey will be

issued in several parts, each dealing with one or more products; of these one, dealing with oil palm products, has recently been issued and a second, on copra, is now in the press. The survey relating to beef and cattle is on the point of being issued and that on mutton and lamb is almost completed.

In addition, a world survey of the production and marketing of barley, undertaken by Professor H. C. Grant, of Manitoba Agricultural College, will shortly be published by the Board.

(ii) *Proposals for Development of World Surveys.*

The Conference arranged by the Agricultural Economics Committee, already referred to, agreed that there were many other commodities for which world surveys appeared to be needed, and a number of further suggestions have been received from the various Governments which were consulted. Among the commodities for which the Board propose to compile statistical surveys as opportunity permits are apples and other fresh fruits; butter, cheese and preserved milk; canned and dried fruits; pig products; eggs; tobacco; spices; coffee; and tanning materials.

#### RETAIL MARKET SURVEYS.

In their surveys of retail demand the Board have introduced a method of enquiry which, though for some time familiar in the United States, has not been used on a large scale in the United Kingdom. The novelty of the method required a careful approach to traders in order to enlist their goodwill and to remove any possible misunderstanding. The co-operation of the food distributing trades has now been secured and great readiness is shown in replying to the Board's enquiries.

The need for research into market requirements and consumers' preferences was early realised by the Board, and the results of the preliminary enquiries amply confirmed the value of this line of investigation as a means of assisting producers and their representatives in the development of their selling and advertising policies. It was felt that the full value of the method could only be realised if simultaneous enquiries were made in different areas, and as early as possible a survey was undertaken on a national scale. The first important enquiry of this nature related to butter. (The Demand for Empire Butter, E.M.B. 34.) Nearly 6,000 records from retailers in different parts of the country were obtained by personal interview, and information was also secured from the headquarters of multiple

organisations and from members of the wholesale trade. Problems of local preferences, competitive supplies and trends of consumption were investigated, and a special study was also made of distribution in relation to seasonal supply and ports of entry.

In the report of a similar investigation on canned fruits, which was published early last year (*The Demand for Canned Fruits, E.M.B. 37*), regional preferences for different fruits were discussed, specific recommendations to producers were made in regard to size of containers and methods of grading, and the scope of the enquiry was widened to include a comparative study of the systems of marketing adopted by various countries.

Later reports (*Changes in the Demand for Butter, E.M.B. 39*, and *Further Changes in the Demand for Butter, E.M.B. 48*) illustrate a further application of this method of enquiry. The large increase in the total supply of imported butter during 1930 and the heavy fall in wholesale prices made it apparent that very considerable changes in consumption and in the demand for different kinds of butter must have resulted. Special studies were, therefore, undertaken in certain Midland towns in key positions, inasmuch as they are at roughly equal distances from the chief ports of entry of the various types of butter. The results of these enquiries showed an increase in the average weekly sales, but the most striking feature brought out by the enquiries was that the consumption of New Zealand butter had more than doubled over the two-year period.

In addition to the surveys already enumerated, enquiries have been conducted on a more restricted scale into the retail marketing of cheese and of honey. The cheese survey was confined to London, and was published in November, 1929 (*The Demand for Cheese in London, E.M.B. 22*). The honey enquiry was restricted to London and Glasgow and has recently been issued (*The Demand for Honey, E.M.B. 50*).

Subsequent investigations have concerned canned vegetables, eggs and deciduous fruits, and reports on these surveys are now being compiled. The survey of deciduous fruits has been undertaken with the co-operation of the South African Co-operative Deciduous Fruit Exchange, at whose request the investigation was planned.

In general, the retail surveys have served to demonstrate a method of investigation which is capable of extension to a wide range of commodities and which can be developed in scope and application according to special conditions. Further developments in this field are under consideration.

### TRADE AND PRODUCTION IN EMPIRE COUNTRIES.

In view of the increasing number of applications received by the Board from teachers, students and the general public for statistical information relating to production and trade in the various countries of the British Empire, the preparation of a series of statistical memoranda was begun in the second half of 1930. The statistics include area and population, production and external trade, and the tables are so arranged as to indicate for the main commodities the chief sources of imports and destinations of exports. The series has recently been completed and has proved to be very popular. It is hoped to revise the pamphlets, incorporating the latest information during the course of 1932—33.

### COMMODITY STATISTICAL PAMPHLETS.

A new series of statistical memoranda somewhat on the lines of the Trade and Production series mentioned above has recently been begun. The series treats of various groups of selected agricultural commodities from the Empire standpoint, bringing together the available statistics, for the principal world and Empire countries concerned, as to production, international trade and distribution of exports. The pamphlets are intended to form a series of concise reference tables, and when completed will cover over 50 of the important agricultural products of the Empire. The first of the series, dealing with dairy products (butter, cheese, condensed milk, milk powder, eggs and egg products) has already been issued.

### WASTAGE IN IMPORTED FRUIT.

The rapid expansion of the fruit trade within comparatively recent years is to a large extent directly attributable to the use of refrigeration, which has extended the storage life of fruit and made possible its shipment over long distances. On account of the perishable nature of the product, however, considerable losses from wastage are still incurred, and intensive research into preventive measures has for some time been in progress at experimental stations in the main producing countries. The work already accomplished has revealed the complexity of the underlying problems, and it is evident that cultural, harvesting, storage and marketing procedure must all be adjusted to a narrow range of conditions if fruit of satisfactory quality is to be produced and delivered to the consumer with a minimum of loss.

The Board have given grants to assist these basic investigations both at home and overseas. As a supplement to this work, a systematic survey was begun early in 1927 with the object of ascertaining the nature, extent and incidence of wastage in imported Empire fruit. Exact quantitative data as to existing conditions have in this way been secured and fields for future research defined. Special attention was directed towards methods of control of wastage under commercial conditions, and in certain cases experimental shipments to test specific methods were arranged in co-operation with scientific departments overseas. Throughout the survey, close contact was maintained with the officers of the Cambridge Low Temperature Research Station of the Food Investigation Board.

In the course of the survey, cargoes of fruit were examined at all the principal ports, but the greater part of the work was concentrated at London and Liverpool. Information was also obtained on the post-shipment development of wastage by the re-examination of selected samples, and, more recently, the experiment has been tried of inserting cards in boxes of fruit for return by retailers with particulars of the wastage found.

A report on Canadian Apples (E.M.B. 30) was published in June, 1930, and a further report on Australian and New Zealand Apples (E.M.B. 46) has been issued during the past year. Each of these reports dealt with the results of investigations carried out over a period of three years, and the findings of the Board's botanical staff have been extensively quoted in the scientific and lay press throughout the Empire. Interim reports were prepared from time to time during the course of the survey for the use of the Dominion Governments concerned.

Similar work was also carried out on Palestine Oranges and a report on these investigations will shortly be issued.

Work in this field could not have been efficiently conducted without the active co-operation of Oversea Dominion representatives in the United Kingdom, of the Departments of Agriculture concerned and of the port authorities, shipping companies and members of the fruit trades.

The insertion of cards in boxes of fruit for return by retailers, with particulars of the amount of wastage found upon opening, has been extended during the past season to South African deciduous fruit, and arrangements have been made for similar action to be taken

next season in connection with British Columbian apples, but in this case the cards will be inserted at the port of export instead of the port of arrival.

#### EXPERIMENTAL CONSIGNMENTS AND MARKET ENQUIRIES.

Mention has been made in earlier reports of the Board's cooperation with oversea Governments in arranging experimental consignments. These experiments are designed to test the possibility of developing a trade in commodities not previously exported and have covered a wide range of foodstuffs. Many have been concerned with highly perishable articles, such as fruit, and experiments extending over several seasons have in some instances been necessary in order to compare different methods of harvesting, packing and transport. On arrival, the consignments are examined by the Board's officers and observations are taken on such points as condition, method of packing, and grading. Selected samples are retained under observation in the laboratory. Other samples are submitted to members of the wholesale and retail trades for technical opinion. Reports on the consignments include particulars of competitive supplies, while suggestions have frequently been made for further experiments to test specific factors. A number of reports of more general interest have been published in a special series and have been reprinted in various oversea journals.

Commodities which have been tested by these methods during the past year include pineapples, grapefruit and oranges from Nigeria; oranges from Australia; tomatoes from British West Indies and Palestine; eggs from India and Palestine; potatoes from Palestine; Indian and West Indian mangoes; almonds from Cyprus; and avocado pears from the West Indies. These products do not all promise to be immediately successful, but there are favourable prospects eventually for all of them and some are likely to be seen on the United Kingdom market in commercial quantities within a short time.

A large number of enquiries into the market prospects for various commodities have again been made at the request of oversea Governments and producers. The reports furnished in response to these enquiries have included information on market requirements in regard to quality, grading and packing, wholesale and retail prices and the extent and nature of competitive supplies. Recent enquiries of this

type have covered guava pulp, sour oranges, cashew nuts, tamarinds in syrup, fruit juices, fruit peel, canned beans and peas, limes, mangoes, tomatoes, oranges, mangosteens and pecan nuts.

#### FARM ECONOMICS AND AGRICULTURAL COSTINGS.

The Board's Agricultural Economics Committee appointed in February of last year a Sub-Committee to deal particularly with questions of agricultural costings and farm management. The Sub-Committee have studied a number of published reports of enquiries into farm management conducted by academic and other institutions, as well as by Departments of Agriculture, in different parts of the Empire. They are impressed with the fact that enquiries of this kind would have a wider value if they could in some way be linked, and could be conducted to some extent on agreed principles. The Committee hope to be able to make some suggestions to this end.

#### CHAIR OF IMPERIAL ECONOMIC RELATIONS.

The Chair of Imperial Economic Relations, established at the London School of Economics and Political Science by means of a grant from the Board and held by Professor J. Coatman, has been in existence for two years.

It is a research chair devoted to the study of the economic activities of the countries comprising the British Commonwealth. Such study aims at elucidating fundamental principles and conditions under which economic activities within the Empire are carried on, of assembling a body of knowledge, and of tracing developments and trends, all with the ultimate object of assisting the process of economic co-operation between the various Empire countries. One of the duties of the Professor is to expound the results of his work so that the general public may understand them and so that they shall be available to Empire statesmen, business men and others actively engaged in the practical day to day work of the Empire's economic life for such use as they may see fit to make of them.

The work of the Chair may be divided into two main sections, one of which may be called its intra-mural part and the other its extra-mural part. The intra-mural section is that part which is carried on within the confines of the University itself, such as lecturing, teaching and direction of research. The Professor's contacts with teachers in other Empire Universities and in foreign Universities



come within this part of his work. An extended series of lectures is given on the general economic problems of the Empire to a post-graduate class which hitherto has contained, in addition to English students, visitors from various British Dominions and foreign countries. Next term, a course of lectures will be given on Empire problems in a series devoted to explaining the chief aspects of the life of Contemporary Britain.

In addition to lecturing, research for Higher Degrees—Ph.D., D.Sc., and M.Sc.—is directed. The intention is to collect a band of researchers from all over the Empire whose work the Professor will co-ordinate so as to cause each individual to do one part or aspect of a complete enquiry into Empire economics. Already researchers from Canada, Australia, New Zealand and India are being so trained and arrangements for getting one or two South African workers are in hand. Enquiries into the economic aspects of the growth of population in Canada and Australia and into marketing problems in Australia, New Zealand and India are now under way.

The extra-mural work consists of lectures, writings, broadcasting, and the reading of papers to various bodies and societies. A course of lectures on Empire Economic Relations was given at a summer school at Cambridge to a large audience composed of students from the oversea Dominions as well as from foreign countries; Chambers of Commerce have been addressed; and an address on behalf of the British Empire was prepared and read by the Professor at the last meeting of the International Colonial Institute at Paris in May, 1931. A paper will be read at this year's meeting of the British Association. Contributions have been made to home and oversea newspapers on topics connected with the work of the Chair and a connected series of nine lectures on the Empire and Ourselves have been broadcast.

The London University are proposing to found a school of studies, at the London School of Economics, connected with Colonial development and administration in all its aspects, and the Professor of Imperial Economic Relations will be put in charge of this group of studies. This will enable him to get into touch with the men actually engaged in Colonial administration and so will make his work effective on the Colonial side of Empire economic study as well as on the side of the Dominions. It will also give him the opportunity of exploring the hitherto almost unmapped field of comparative colonial administration.

### III. PUBLICITY.

Provision was made in the printed estimates for 1931-32 for an expenditure on publicity of £105,000. This was subsequently reduced to £80,000 as a result of the financial crisis, but was at a later stage increased to a final figure of £92,000 to allow for the "Buy British" campaign.

#### A.—GENERAL.

##### 1. NEWSPAPER ADVERTISEMENTS.

Advertisements were inserted in the local press in support of Empire Shopping Weeks in which the Board assisted all over the country, and also in trade and local papers in connection with the Board's own shops, and with exhibitions in which the Board have participated.

##### 2. POSTERS.

(a) *Displays on the Board's own Poster Frames.*—Thirteen sets of posters were displayed by the Board during the year on their 1,700 special poster frames in some 475 towns in the United Kingdom. In addition, three sets of posters on the "National Mark" were displayed on the Board's frames by the Ministry of Agriculture and Fisheries in England and Wales and by the Department of Agriculture for Scotland in Scotland.

The Board's own poster sets were on the following subjects :—

- (1) Malaya, Borneo, Ceylon, Fiji, Mauritius.
- (2) Empire Tobacco (Letterpress).
- (3) Empire Summer Fruits.
- (4) Empire Butter.
- (5) Irish Free State Dairy Produce.
- (6) Home Fish.
- (7) "Buy British" (Letterpress).
- (8) "Buy British" (Letterpress).
- (9) "Buy British" (Letterpress).
- (10) Badges of Empire.
- (11) British Industries Fair (Letterpress. In co-operation with the Department of Overseas Trade).
- (12) New Zealand.
- (13) Empire Trade (Letterpress).

(b) *Displays on the Commercial Hoardings.*—A special hoarding display was made in Blackpool in support of the Board's Empire Shop.

(c) *Poster Reproductions for Schools.*—There are now 25,700 schools in the United Kingdom on the Board's standing list in receipt of poster reproductions and leaflets. Reproductions of two of the Board's map posters and a special map frieze showing the Empire's air, cable and wireless communications were issued during the year.

(d) *Shop Display Material.*—Twenty-three new bills, cards and window strips were designed and issued for display in shops to advertise Empire products. Reprints of many earlier designs were also issued.

(e) *"Contract" Posters.*—Contract posters and reproductions have continued to be supplied to numerous firms in the United Kingdom in receipt of orders from the Empire overseas.

(f) *"Contract" Labels.*—As an extension of the contract poster scheme, special labels have been designed for affixing to goods manufactured in the United Kingdom to meet oversea Empire orders. These labels, in bright colours, have two messages, "Made in Great Britain for Canada" (or whichever Dominion is in question) and "Canada Sent us this Order, Buy Canadian Produce." Some quarter million of these labels have been issued to firms in the United Kingdom.

### 3. LEAFLETS.

New leaflets were issued on the subject of:—

A List of Empire Products.

Home Apples.

Home Plums.

Empire Tea.

Empire Hardwoods from the point of view of Turnery.

Reprints were issued of the leaflets on:—

Canadian Apples.

Australian Dried Fruits.

South African Oranges.

East African Coffee.

New leaflets to accompany school reproductions of posters were issued on the following subjects:—

Canada—The Empire's First Dominion.

Australia—The Empire's Island Continent.

Speed within the Empire.

In all, approximately a million leaflets were distributed in the year.

#### 4. LECTURES.

Lecturing work was continued throughout 1931-32 on the same lines as in the previous year, 841 lectures being given during the year, mainly to Women's Organisations. Of these, 157 were arranged on behalf of, and at the charge of, the Ministry of Agriculture and Fisheries and dealt with the National Mark. The remaining 684 dealt with Empire marketing and the products of different Empire countries. The total audiences numbered over 60,000.

#### 5. BROADCASTING.

The series of Tuesday morning talks to housewives, noted in the Board's last Report as having begun in January, 1931, continued until the end of December, when its place was taken by a weekly bulletin of Housewives' News broadcast at 2 o'clock every Monday afternoon. These bulletins, which are based on material supplied jointly by the Board and the Ministry of Agriculture and Fisheries, contain information regarding Empire foods in season and other items of topical interest to housewives.

Pending the establishment of their proposed new Empire Broadcasting Station, the B.B.C. began, in January, 1932, an Empire service of News Bulletins and other information from the existing experimental station at Chelmsford. Arrangements have been made for the inclusion in these bulletins of material suggested by the Board.

#### 6. EXHIBITIONS AND EMPIRE SHOPPING WEEKS.

A.—The Board participated in the following Exhibitions :—

1931.

29th May-13th June .. Glasgow Civic and Empire Week  
and Empire Exhibition.  
5th Sept.-11th Sept. .. Bakers and Confectioners Exhibition.  
19th Sept.-25th Sept. .. International Grocers Exhibition.  
30th Oct.-7th Nov. .. Imperial Fruit Show.

1932.

22nd Feb.-3rd March .. British Industries Fair.

B.—The Board acquired the lease of premises in Birmingham, Blackpool and Liverpool during the undermentioned periods and organised them as Empire Shops, which were placed at the disposal of the various Empire countries in turn for a fortnight each, to make displays and sell samples of their products.

1931-32.

24th Jan.-13th June .. Birmingham.  
20th July-24th Oct. .. Blackpool.  
16th Nov.-19th March .. Liverpool.

C.—The Board assisted in Empire Shopping Weeks in the following centres :—

Ashtead.	Eastbourne.	Newhaven.
Abertillery.	East Grinstead.	Ossett.
Arbroath.	Epsom.	Rochester.
Bexhill.	Glasgow.	Southgate.
Battle.	Heathfield.	Southend and
Bridgend.	Hitchin.	Westcliff-on-Sea.
Bradford.	Kings Lynn.	Seaford.
Bicester.	Lewes.	Staines.
Belfast.	Leigh (Lancs.).	Southall.
Bromley.	Long Eaton.	Thrapston.
Biggleswade.	Maidenhead.	Thorne.
Chingford.	Manchester	Twickenham.
Clacton-on-Sea.	(Stretford Road).	Tonbridge.
Clapham.	Merthyr Tydfil.	Uckfield.
Darlington.	Northampton.	West Wickham.

#### 7. TRADE MEETINGS.

Members of the Marketing Branch addressed meetings of Chambers of Commerce and Trade, Businessmen, Distributive Traders and Producers at the undermentioned places during the last twelve months :—

Ayr.	Cardiff.	Manchester.
Aldershot.	Croydon.	Maidstone.
Arbroath.	Darlington.	Newport.
Aylesbury.	Eastbourne.	Rochester.
Ashford.	Eltham.	Southend.
Barnes.	East Molesey.	Southgate.
Blackpool.	Grays Thurrock.	Scunthorpe.
Bristol.	Hitchin.	Tunbridge Wells.
Berkhamstead.	Hendon.	Twickenham.
Biggleswade.	Islington.	Worcester.
Chingford.	Kensington.	Westminster.
Chiswick.	Lewisham.	Watford.
	Luton.	

## 8. HORTICULTURAL DISPLAYS.

For the fifth year in succession the Board arranged in conjunction with the Office of Works a display of 200,000 British grown tulips in the Royal Parks. Last year the display was supplemented by a small show of some of the newer and rarer varieties of British daffodils. Later in the summer there was a small display in Hyde Park of Bermuda lilies grown from bulbs which were the gift of the Bermudan Department of Agriculture.

A shop window bill and shop window strip advertising Home grown Narcissi and Daffodils from Cornwall, Scilly and the Channel Islands was issued to retail florists in time for the spring season.

In response to the request of the Horticultural Trades' Association and the British Rose Growers' Association for assistance in advertising British grown rose trees, of which large stocks were awaiting disposal, the Board approached H.M. Office of Works as to the possibility of securing space in the Royal Parks for a National Rose Garden which should be a permanent advertisement of the qualities of British grown roses. A suitable site being available in the Royal Botanic Gardens, English, Scottish and Irish rose growers made through the Board a gift of 10,000 rose trees to the Office of Works. The trees have now been planted in a specially designed garden which will be opened to the public in the course of the summer.

## 9. CINEMA.

### (a)—*Film Production.*

The Board have continued to maintain a small film producing and editing unit which has prepared the following films, either from material produced directly by themselves or by re-editing existing material.

#### (i) *Theatrical Films on the following Subjects —*

- Canadian Lumbering.
- Home Milk Production and the English Countryside.
- Salmon Fishing.
- British Industry.
- Pasture Improvement in Wales (entitled "Shadow on the Mountain").

*Note.*—All the above films have been completed to the silent stage and are about to be synchronised.

(ii) *Films for the Education of Agricultural Producers, etc.*

The last Imperial Conference adopted the following resolution :—

“The Conference, being impressed with the potentialities of the cinema as a means of disseminating the results of scientific research, for example, among agricultural producers, recommends that steps should be taken to stimulate the production of instructional films having a common interest to more than one part of the Empire, and to secure closer co-operation and exchange of information between the authorities producing such films, and that this proposal should be referred for the consideration of the Empire Marketing Board.”

The Board have now produced a film illustrating experiments which are being carried out at the Welsh Plant Breeding Station at Aberystwyth which have as their objective the eventual production of strong and persistent grasses which will enable more and more sheep to be pastured on the Welsh hills during the winter months. Two versions of this film have been made, one in popular form for theatrical distribution and the other on more scientific lines for exhibition to research workers and agriculturists.

(iii) *Non-Theatrical Films for Schools, etc.*

Birds and Beasts of Canada.	Corn on the Cob (Maize).
Gobblers (Turkey rearing and Marketing in Western Canada).	Home Plums.
Pathways of the Rockies.	Tearing Wealth from the Earth (Mining).
People of the Sea (Fish)	Sugar Harvests (Trinidad).
Birds of the Sea.	Chocolate Artists.
Meat for Millions.	Hot from the Press.
Tea Leaves.	Rubber for the Road.
Isle of Tea.	Rope from Leaves.
Burma Cheroots.	Pavement Workshops (Cyprus).
Land of Good Hope.	Candy from Trees (Maple Sugar).
Salmon.	Across 4,000 Miles (Cotton Spinning).
Clothes of the Empire.	Melting Sand (Glass-making).
Seasons of Canada.	Vitamines on Parade (Oranges).
Milky Way.	On the Hoof in South Africa (Cattle).
Beasts of the Field.	Secrets of Light (Electric lamps).
National Mark Apples.	Salt of the Earth.
Winged Metal (Aeroplane engines).	
People and Products of India.	

Homes of the Empire.	Fruit of the Forest (Bananas).
Climatic Regions of the Empire.	Fire Fighters of the Canadian Forests.
Seaports of the Empire.	Oil (Scottish Shale).
British New Guinea.	Ducks and Downs (Eiderdown).
Daylight and Night.	Smoke (Cigarettes).
Canada (school film).	Fifty Miles of Blankets.
Fruit Canning.	Food for Industry (Coal).
Netting Millions (Fish).	Furry Folk (Beavers).
Water Volcanoes of New Zealand.	African Trails.
Harvest of the Swamp (Rice).	Cups and Saucers (Pottery).
Machine with a Hundred Hands.	Fisherman's Larders (Fish Hatcheries).
Winter in Canada.	A Matinee for Winged Folk (Birds.)
Axes and Elephants (Timber).	
Goloshes from Trees (Rubber).	
The White Parade (Milk).	

(iv) *Short 2-300 ft. Advertising Films.*

Australian Butter.  
 Australian Dried Fruits.  
 Canadian Wheat.  
 Canadian Lumbering.  
 Empire Timber (Abstract).  
 Empire Grown Tea (Abstract).  
 Progress of the National Mark (Abstract).

(b)—*Film Library.*

The Board have devoted a good deal of attention during the year to the preparation of a library of films for schools and other non-theatrical organisations. The catalogue of this Library was issued in November, 1931, to schools and certain other suitable bodies known to possess projectors. The eager demand for films from this library, together with the appreciative comments on the type of films it contains, made by Education Authorities and other users, has proved that this service is meeting a definite and important need.

During the first 3 months distribution period and with a library of under 200 prints of 105 subjects available, 947 bookings were made, representing 2,156 films and an estimated total audience of 300,000 people.

The Library has been compiled mainly from the Board's own films and from films belonging to various Empire Governments, together with material kindly placed at their disposal by various industrial and film companies. The Board are specially indebted to the Canadian Government Motion Picture Bureau, Messrs. Ideal Films Ltd., and British Movietone News.



(c)—*Special Film Displays to the Public and to Schools.*

(i) *Automatic Daylight Cinemas.*—The Board have continued to make use of automatic daylight cinema projectors as central features of their publicity displays. Specially designed short advertising films have been prepared by the Board's Film Unit for such exhibition.

(ii) *Film displays to mass gatherings of schoolchildren.*—In addition to their service of films to individual schools, the Board have continued to encourage displays of films to mass gatherings of schoolchildren arranged by Education Authorities and other bodies. In conjunction with the Local Education Authority concerned and the Cinematograph Exhibitors' Association, the Board arranged displays to some 40,000 schoolchildren in Birmingham during the period of their special publicity drive in that area.

(iii) *The Empire Marketing Board Cinema at the Imperial Institute.*—The Board have continued the grant to the Imperial Institute for the maintenance of a cinema in which Empire films are shown daily. During the year 320,000 persons visited the cinema including 65,000 schoolchildren in organised parties. The total attendance since the opening of this cinema in 1927 has been over 1,797,000 persons.

#### B.—SPECIAL "BUY BRITISH" CAMPAIGN.

The Board's "Buy British" campaign was launched by H.R.H. The Prince of Wales in a broadcast speech on November 16th, 1931. Its main features were as follows:—

##### 1. *Posters.*

Over 4,000,000 copies of two special posters were issued in various forms and sizes. These were displayed through the following media:—

- (a) On approximately 17,000 "16 sheet" positions on the commercial hoardings.
- (b) In windows of shops throughout the country.
- (c) In Government Departments, Crown post offices, banks, theatres, schools, etc.
- (d) On tubes, buses and trams throughout London and the Provinces.
- (e) On the premises of all the main line railway companies throughout the United Kingdom.
- (f) On private motor cars and aircraft, commercial vehicles and taxis.
- (g) On the premises of factories, aerodromes, piers and harbours, football clubs, race courses.
- (h) On the Board's own special poster frames.

## 2. *Newspapers.*

(a) The campaign received the most generous support from the press throughout the country in their editorial and news columns and picture pages.

(b) Over 15,000 insertions of a special series of advertisements appeared in the advertising columns of all classes of newspapers, in theatre programmes and in a variety of other special publications.

(c) The theme of "Buy British" was widely incorporated by private advertisers in their own advertisements.

## 3. *Broadcasting.*

On the evening of November 16th, the B.B.C. gave a half-hour special programme, consisting of the inaugural address by H.R.H. The Prince of Wales, followed by a speech by Mr. J. H. Thomas and a reproduction of the message that Mr. Scullin, the Prime Minister of Australia, had telephoned from Australia to an Exhibition at Australia House earlier in the day. The B.B.C. also broadcast a speech by Lady Snowden at Australia House and gave generous prominence to the campaign in their news programmes both before and after November 16th.

## 4. *Cinema.*

(a) The leading news reels and magazines included in their programmes a number of items dealing with the campaign.

(b) A special film of a national appeal by the Prime Minister and Mr. Lansbury was prepared in co-operation with the Cinematograph Exhibition Association and the News Reel Companies, and was shown in over 1,000 theatres to a total audience of some 12 million people.

## 5. *Leaflets.*

A special leaflet on "Why every woman should Buy British" was issued and widely distributed, together with the Board's list of Empire products and other of their general leaflets.

## 6. *Miscellaneous.*

(a) The great wall overlooking the site of the new Africa South House in Trafalgar Square, carried an illuminated "Buy British" sign with letters 15 feet high.

(b) The "Cornish Riviera" express was specially decorated by the Great Western Railway as a "Buy British" train on November 25th.

(c) Many other special publicity activities were arranged to reinforce the campaign.

## APPENDIX I.

### (1) THE EMPIRE MARKETING BOARD.

- The Secretary of State for Dominion Affairs.  
(The Rt. Hon. J. H. THOMAS, M.P.) (*Chairman*).
- The Parliamentary Under-Secretary of State for Dominion Affairs.  
(Mr. MALCOLM MACDONALD, M.P.) (*Vice-Chairman*).
- The Financial Secretary to the Treasury.  
(Major The Rt. Hon. WALTER E. ELLIOT, M.C., M.P., M.B., D.Sc.)
- The Parliamentary Secretary to the Ministry of Agriculture and Fisheries.  
(The Rt. Hon. the EARL DE LA WARR.)
- The Parliamentary Under-Secretary of State for Scotland.  
(Mr. A. N. SKELTON, M.P.)
- The Parliamentary Under-Secretary of State for the Colonies.  
(Sir ROBERT HAMILTON, M.P.)
- The Rt. Hon. L. S. AMERY, M.P.
- Mr. W. LUNN, M.P.
- Major GWILYM LLOYD GEORGE, M.P.
- Sir EDWARD CROWE, K.C.M.G.  
(Comptroller-General of the Department of Overseas Trade).
- Sir THOMAS ALLEN (United Kingdom).
- Sir WILLIAM CRAWFORD, K.B.E. (United Kingdom).
- Mr. W. A. WILSON (Canada).
- Mr. F. L. MCDUGALL, C.M.G. (Australia).
- Mr. R. S. FORSYTH (New Zealand).
- Mr. J. DIMOND (Union of South Africa).
- Mr. J. W. DULANTY, C.B., C.B.E. (Irish Free State).
- Mr. H. A. F. LINDSAY, C.I.E., C.B.E., I.C.S. (India).
- Hon. J. W. DOWNIE, C.M.G. (Southern Rhodesia).
- Sir EDWARD DAVSON, Bart. (Colonies and Protectorates).
- 
- Sir STEPHEN TALLENTS, K.C.M.G., C.B., C.B.E. (*Secretary*).
- Mr. E. M. H. LLOYD (*Assistant Secretary*).

(2) THE RESEARCH GRANTS COMMITTEE.

Sir ROBERT HAMILTON, M.P.  
(Parliamentary Under-Secretary of State for the Colonies) (*Chairman*).  
Mr. MALCOLM MACDONALD, M.P.  
(Parliamentary Under-Secretary of State for Dominion Affairs).  
The Rt. Hon. the EARL DE LA WARR.  
(Parliamentary Secretary to the Ministry of Agriculture and Fisheries.)  
Major The Rt. Hon. WALTER E. ELLIOT, M.C., M.P., M.B., D.Sc.  
(Financial Secretary to the Treasury.)  
Mr. W. A. WILSON.  
Mr. F. L. MCDUGALL, C.M.G.  
Mr. H. A. F. LINDSAY, C.I.E., C.B.E., I.C.S.  
Sir EDWARD DAVSON, Bart.  
Sir BASIL P. BLACKETT, K.C.B., K.C.S.I.  
(Chairman of the Colonial Development Advisory Committee.)  
Dr. T. DRUMMOND SHIELS, M.C.  
Mr. C. L. STOCKS. (H.M. Treasury).  
Mrs. MAY MELLANBY.  
Mr. E. M. H. LLOYD (*Secretary*).

(3) THE PUBLICITY COMMITTEE.

Mr. MALCOLM MACDONALD, M.P.  
(Parliamentary Under-Secretary of State for Dominion Affairs) (*Chairman*).  
Sir WILLIAM CRAWFORD, K.B.E.  
(Governing Director of Messrs. W. S. Crawford, Ltd.) (*Vice-Chairman*).  
The Rt. Hon. the EARL DE LA WARR.  
(Parliamentary Secretary to the Ministry of Agriculture and Fisheries.)  
Sir THOMAS ALLEN.  
(Director, Co-operative Wholesale Society.)  
Sir WOODMAN BURBIDGE, Bart., C.B.E.  
(Chairman and Managing Director of Messrs. Harrods, Ltd.)  
The Viscount BURNHAM, G.C.M.G., C.H.  
Mr. E. R. EDDISON, C.B., C.M.G.  
(Deputy Comptroller-General of the Department of Overseas Trade.)  
Major The Rt. Hon. WALTER E. ELLIOT, M.C., M.P., M.B., D.Sc.  
(Financial Secretary to the Treasury.)  
Mrs. COTTRELL.  
(Director of the Co-operative Wholesale Society, Ltd.)  
Mr. J. W. DULANTY, C.B., C.B.E.  
Lieut.-Gen. Sir WILLIAM FURSE, K.C.B., D.S.O.  
(Director of the Imperial Institute.)  
Mr. D. G. GERAHTY.  
(Director of Publicity for Canada in the United Kingdom.)  
Mr. H. A. F. LINDSAY, C.I.E., C.B.E., I.C.S.  
Mr. W. LUNN, M.P.  
Mr. F. L. MCDUGALL, C.M.G.  
Mr. A. P. RYAN.  
(Publicity Manager, Gas Light & Coke Co.)  
Lieut.-Col. N. G. SCORGIE, C.B.E., M.V.O.  
(Deputy Controller of H.M. Stationery Office.)  
Mr. J. C. STOBART.  
(Director of Education of the British Broadcasting Corporation).  
Mr. G. HUXLEY, M.C. (*Secretary*).

(4) THE MARKETING COMMITTEE.

- Mr. A. N. SKELTON, M.P.  
(Parliamentary Under Secretary of State for Scotland) (*Chairman*).
- Mr. R. S. FORSYTH  
(London Manager, New Zealand Meat Producers' Board) (*Vice-Chairman*).
- Sir THOMAS ALLEN  
(Director, Co-operative Wholesale Society, Ltd.).
- Mr. A. T. BRENNAN  
(Assistant Trade Commissioner, Union of South Africa.)
- Sir THOMAS CLEMENT, K.B.E.  
(Chairman and Joint Managing Director, Messrs. Andrew Clement & Sons, Ltd.)
- Sir WILLIAM CRAWFORD, K.B.E.  
(Governing Director, Messrs. W. S. Crawford, Ltd.)
- Mr. RHYS J. DAVIES, M.P.  
The Rt. Hon. the EARL DE LA WARR  
(Parliamentary Secretary to the Ministry of Agriculture and Fisheries.)
- Mr. J. W. DULANTY, C.B., C.B.E.  
(High Commissioner for the Irish Free State).
- Mr. T. W. KING, C.B.E.  
(Director and General Manager, Civil Service Supply Association, Ltd.)
- Mr. F. W. MACINNEY, C.B.E.  
(Chief Officer of Supplies, London County Council.)
- Mrs. MURIEL E. W. NICHOL.
- Mr. I. M. SIEFF  
(Vice-Chairman and Joint Assistant Managing Director, Messrs. Marks and Spencer, Ltd.)
- Mr. W. NORMAN VERNON  
(Director, Messrs. Spillers, Ltd.)
- Mr. W. A. WILSON  
(Agricultural Representative for Canada.)
- Mr. LACHLAN MACLEAN, O.B.E. (*Secretary*).

(5) FILM COMMITTEE.

- Mr. MALCOLM MACDONALD, M.P. (*Chairman*.)
- Mr. P. W. L. ASHLEY, C.B.
- Mr. L. BROWETT, C.B.E. (Board of Trade).
- Sir WILLIAM CRAWFORD, K.B.E.
- Major The Right Hon. WALTER E. ELLIOT, M.C., M.P. (Financial Secretary to the Treasury.)
- Lieut.-Gen. Sir WILLIAM FURSE, K.C.B., D.S.O. (Director of the Imperial Institute.)
- Mr. L. HORE-BELISHA, M.P.
- Mr. H. A. F. LINDSAY, C.I.E., C.B.E., I.C.S.
- Mr. W. LUNN, M.P.
- The Hon. Mrs. ALFRED LYTTLETON, G.B.E.
- Mr. F. L. MCDUGALL, C.M.G.
- Mr. H. VISCHER, C.B.E. (Colonial Office.)
- Mr. HARRISON WATSON (Chief Canadian Government Trade Commissioner in the United Kingdom.)
- Mr. G. HUXLEY, M.C. (*Secretary*).

(6) AGRICULTURAL ECONOMICS COMMITTEE.

Mr. F. L. McDOUGALL, C.M.G. (*Chairman*.)  
Sir DAVID CHADWICK, C.S.I., C.I.E. (Secretary, Imperial Economic Committee.)  
Mr. HENRY CLAY.  
Mr. H. M. CONACHER (Department of Agriculture for Scotland.)  
Mr. R. R. ENFIELD (Ministry of Agriculture and Fisheries).  
Professor R. B. FORRESTER (University College of Wales, Aberystwyth.)  
Mr. H. D. HENDERSON (Economic Advisory Council.)  
Mr. H. A. F. LINDSAY, C.I.E., C.B.E.  
Mr. E. M. H. LLOYD.  
Mr. J. P. MAXTON (Agricultural Economics Research Institute, Oxford.)  
Mr. C. S. ORWIN (Director, Agricultural Economics Research Institute, Oxford.)  
Dr. J. A. VENN (President of Queen's College, University of Cambridge.)  
Mr. K. WALTER (Horace Plunkett Foundation).

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Mr. F. GRANT (*Secretary*.)

(7) FOOD PRODUCTS COMMITTEE.

Mr. A. N. Skelton, M.P. (Parliamentary Under-Secretary of State for Scotland) (*Chairman*); Sir Thomas Clement, K.B.E. (Chairman and Joint Managing Director, Messrs. Andrew Clement & Sons, Ltd.) (*Vice-Chairman*); Mr. C. L. T. Beeching, O.B.E., F.G.I. (Secretary, The Institute of Certificated Grocers); The Hon. Algernon Borthwick (Director, Messrs. Thomas Borthwick & Sons, Ltd. ; Mr. E. T. Dottridge, C.B.E. (Chairman, Messrs. Joseph Travers & Sons, Ltd.); Mr. R. S. Forsyth (London Manager, New Zealand Meat Producers' Board); Mr. M. W. Gordon, J.P., F.G.I. (Chairman and Managing Director, Messrs. Gordon, McDonald & Co., Ltd.), Mr. A. Greig (Managing Director, Allied Suppliers, Ltd., etc.) ; Mr. T. H. Harvey, O.B.E. (Managing Director, The United Yeast Co., Ltd.); Mr. H. A. Hughes (Director, Messrs. Alfred Hughes & Sons, Ltd., etc.); Mr. V. Josephs (Messrs J. Lyons & Co., Ltd.); Mr. J. W. Justham (The Co-operative Wholesale Society, Ltd.); Mr. T. W. King, C.B.E. (Director and General Manager, Civil Service Supply Association, Ltd.); Mr. E. M. H. Lloyd ; Mr. P. Machin (Director, Messrs. Samuel Hanson & Son) ; Mr. L. Maclean, O.B.E. ; Major E. G. Monro, O.B.E., T.D. (Governing Director, Messrs. George Monro, Ltd.); Major J. G. Stokes (Managing Director, Messrs. Salter & Stokes, Ltd., etc.) ; Mr. H. L. Webb (Director, The Webb Grain Co., Ltd.) ; Mr. T. F. Skilton (*Secretary*).

(8) FRUITS COMMITTEE.

Mr. W. A. Wilson (*Chairman*); Sir E. Davson, Bart.; Mr. J. Dimond; Mr. F. C. Faraker (Australian Government Commercial Representative); Mr. A. E. Gough, O.B.E. (Overseas Farmers' Co-operative Federations, Ltd.); Mr. M. M. S. Gubbay, C.S.I., C.I.E.; Mr. B. W. Harlow (South African Co-operative Citrus Exchange, Ltd.); Mr. C. H. Lewis, O.B.E. (Mil.) (Representative of the National Federation of Fruit and Potato Trades Associations (Incorporated), Ltd.); Mr. E. M. H. Lloyd; Mr. L. Maclean, O.B.E.; Major E. G. Monro, O.B.E., T.D.; Mr. F. W. J. Moore, O.B.E. (Representative of the National Federation of Fruit and Potato Trades Associations (Incorporated), Ltd.); Mr. J. Forsyth Smith (Canadian Government Fruit Trade Commissioner); Mr. H. V. Taylor, O.B.E. (Ministry of Agriculture and Fisheries); Dr. C. West (Cambridge Low Temperature Research Station, Department of Scientific and Industrial Research); Mr. J. W. White, O.B.E. (Representative of the Fruit Brokers' Federation of Great Britain); Mr. N. L. Wright (Scientific Liaison Officer, New Zealand); Sir William Hardy F.R.S. (Director of Food Investigation, Department of Scientific and Industrial Research) (Assessor); Mr. W. E. Knox (*Secretary*).

(9) DAIRY RESEARCH COMMITTEE.

Chairmanship vacant\*; Mr. J. F. Blackshaw, O.B.E. (Ministry of Agriculture and Fisheries); Mr. R. E. Montgomery, M.R.C.V.S. (Colonial Office); Professor R. H. Leitch, M.A., B.Sc., N.D.A., N.D.D. (West of Scotland Agricultural College and Department of Agriculture for Scotland); Mr. N. C. Wright, M.A., Ph.D. (Hannah Dairy Research Institute, Scotland); Mr. R. H. Wilkinson (Ministry of Agriculture, Northern Ireland); Mr. W. A. Wilson; Mr. W. Wright (Inspector of New Zealand Dairy Products); Mr. J. Dimond; Mr. A. Poole-Wilson, M.B.E. (Department of Agriculture, Irish Free State); Mr. E. M. H. Lloyd; Mr. A. More, A.R.C.S., F.I.C. (Government Chemists' Department); Mr. V. Stott, B.A., F.Inst.P. (National Physical Laboratory); Mr. A. J. Smith, Ph.D. (Cambridge Low Temperature Research Station); Mr. H. J. Denham, M.A., D.Sc. (Institute of Agricultural Engineering, Oxford); Professor G. S. Wilson (London School of Hygiene and Tropical Medicine—nominated by the Medical Research Council); Mr. R. F. Jenkins (*Secretary*).

(10) SUB-COMMITTEE ON THE STANDARDISATION OF VOLUMETRIC GLASSWARE

(OF THE DAIRY RESEARCH COMMITTEE).

Mr. V. Stott, B.A., F.Inst.P. (National Physical Laboratory) (*Chairman*); Captain J. Golding, D.S.O., F.I.C. (National Institute for Research in Dairying, University of Reading); Mr. J. Davies (representing the Joint Committee for the Standardisation of Scientific Glassware); Mr. J. D. Roberts, B.Sc. (representing the Society of Public Analysts); Mr. J. Tavroges, B.Sc., F.I.C. (Messrs. Cow & Gate, Ltd.); Mr. W. Wright (Inspector of New Zealand Dairy Products); Mr. R. F. Jenkins (*Secretary*).

\* The late Professor R. Stenhouse Williams acted as Chairman of the Committee until his death in February, 1932. Dr. A. T. R. Mattick was appointed to represent the National Institute for Research in Dairying on the Committee pending the appointment of a successor to Professor Stenhouse Williams as Director of the Institute.

(11) INFESTATION OF STORED PRODUCTS COMMITTEE.

Mr. E. M. H. Lloyd (*Chairman*); Professor V. H. Blackman, Sc.D., F.R.S. (Imperial College of Science); Mr. H. Brown, O.B.E. (Imperial Institute); Dr. E. J. Butler, C.I.E., F.R.S. (Imperial Mycological Institute); Dr. W. R. Thompson (Imperial Institute of Entomology); Dr. P. A. Buxton (London School of Hygiene and Tropical Medicine); Mr. J. C. F. Fryer, O.B.E. (Ministry of Agriculture and Fisheries); Mr. F. Laing (Natural History Department, British Museum); Mr. T. W. Macara (British Association of Research for the Cocoa, Chocolate, Sugar, Confectionery and Jam Trades); Mr. H. C. Sampson, C.I.E. (Royal Botanic Gardens, Kew); Professor J. W. Munro, M.A., D.Sc. (Imperial College of Science); Mr. C. H. Wake (*Secretary*).

(12) RETAIL GROCERS' ADVISORY SUB-COMMITTEE  
(OF THE MARKETING COMMITTEE).

Mr. Lachlan Maclean, O.B.E. (*Chairman*); Mr. A. E. Baxter, Hon. F.G.I. (Secretary, Greater London Council of Grocers' Associations); Councillor J. E. Bennett, (Sheffield); Mr. Felix J. Blakemore, O.B.E., J.P. (The National Chamber of Trade); Mr. G. Bolton (Birmingham); Mr. C. O. Burrows, F.G.I. (Kingston-on-Thames); Mr. Duncan Cameron, J.P. (Director, Scottish Co-operative Wholesale Society, Ltd.); Councillor J. T. Clark, F.G.I. (Darwen); Mr. A. H. Clarke; Mr. J. H. Finlay (Belfast); Mr. J. W. Fletcher (Birmingham Co-operative Society, Ltd.); Mr. W. J. Guilford (Messrs. Selfridge & Co., Ltd.); Mr. C. W. Hewitt (Ipswich); Mr. A. E. James (Cardiff); Mr. R. C. D. Jenkins (Messrs. Nicholl's Stores, Kensington); Mr. W. H. Kent (Secretary, Federation of Grocers' Associations of the United Kingdom); Mr. John Thomson, F.G.I. (President, Scottish Federation of Grocers' and Provision Merchants' Associations); Mr. W. W. Waite, F.G.I. (Institute of Certificated Grocers); Mr. W. J. Whitney (Parliamentary Committee of the Co-operative Congress); Mr. Thomas Wilkie, J.P. (Glasgow); Mr. T. F. Skilton (*Secretary*).

(13) RETAIL FRUITERERS' ADVISORY SUB-COMMITTEE  
(OF THE MARKETING COMMITTEE).

Mr. Lachlan Maclean, O.B.E. (*Chairman*); Mr. R. C. Bignall (Nottingham); Mr. G. E. Bousfield (Liverpool); Mr. P. Breen (The Co-operative Wholesale Society); Mr. A. H. Clarke; Mr. R. Martin Cowley, O.B.E. (The National Federation of Retail Fruiterers, Florists and Fishmongers, Ltd.); Councillor G. Hall (Manchester); Mr. R. Hayward (The Retail Fruiterers' & Florists' Association, Ltd.); Mr. Victor Josephs (Messrs. J. Lyons & Co., Ltd.); Mr. J. S. Metcalf (The National Federation of Retail Fruiterers, Florists and Fishmongers, Ltd.); Mr. H. Payne (Maidstone); Mr. G. W. Ritchie (Newcastle-on-Tyne); Mr. W. B. Shearn (London); Mr. J. J. Slater (Sheffield); Sir William Turner (Belfast); Mr. T. Ward (London); Mr. W. J. Whittle (Weymouth); Mr. James K. Wilson (Glasgow); Mr. W. J. Yeoman (The Retail Fruiterers' and Florists' Association, Ltd.); Mr. C. H. Young (York); Mr. T. F. Skilton (*Secretary*).



(14) RETAIL BAKERS' AND CONFECTIONERS' ADVISORY SUB-COMMITTEE  
(OF THE MARKETING COMMITTEE).

Mr. Lachlan Maclean, O.B.E. (*Chairman*); Mr. H. Bamford (London Master Bakers' and Confectioners' Protection Society); Mr. W. Banfield, J.P. (Amalgamated Union of Operative Bakers, Confectioners and Allied Workers); Mr. J. Clarke, O.B.E., J.P. (Sale, Cheshire); Provost D. Fisher, M.B.E., J.P. (Hawick, N.B.); Mr. J. W. Gilmour (Belfast Master Bakers' Association); Mr. T. H. Harvey, O.B.E. (Managing Director, The United Yeast Co., Ltd.); Mr. Howard A. Hughes (Director, Messrs. Alfred Hughes & Sons, Ltd., etc.); Mr. A. B. Hutchison, J.P. (Scottish Association of Master Bakers); Mr. F. James (Incorporated Society of Principal Wholesale and Retail Bakers, Ltd.); Mr. A. Joyce (Kettering Industrial Co-operative Society, Ltd.); Mr. J. H. Merrett (National Association of Master Bakers, Confectioners and Caterers); Mr. E. F. Mitchell (National Federation of Bakery Students' Societies); Mr. F. Newens (British Confectioners' Association); Sir Robert Stewart (Scottish Co-operative Wholesale Society, Ltd.); Mr. A. Valentine (Northampton); Mr. T. F. Skilton (*Secretary*).

(15) EDUCATION SUB-COMMITTEE  
(OF THE PUBLICITY COMMITTEE).

Lieut.-Gen. Sir William Furse, K.C.B., D.S.O. (*Chairman*); Mr. H. A. F. Lindsay, C.I.E., C.B.E.; Mr. J. W. Peck, C.B. (Scottish Education Department); Mr. J. C. Stobart (The Education Director, British Broadcasting Corporation); Mr. S. H. Wood, M.C. (Board of Education); Mr. J. Wilkie (*Secretary*).

(16) DAIRY PRODUCE INTELLIGENCE SUB-COMMITTEE  
(OF THE AGRICULTURAL ECONOMICS COMMITTEE).

Mr. E. M. H. Lloyd (*Chairman*); Mr. K. H. Bond, M.C. (Ministry of Agriculture and Fisheries); Sir Thomas Clement, K.B.E.; Mr. H. E. Davis (New Zealand Dairy Produce Board); Mr. F. Grant; Mr. F. Killick (Secretary, London Provision Exchange); Mr. A. Lovell (Chairman, London Provision Exchange); Mr. W. A. Wilson; Mr. G. S. Dunnnett (*Secretary*).

(17) CANNED FRUIT INTELLIGENCE SUB-COMMITTEE  
(OF THE AGRICULTURAL ECONOMICS COMMITTEE).

Mr. E. M. H. Lloyd (*Chairman*); Mr. W. B. Cooper (Secretary, Australian Canned Fruits Board); Mr. J. H. Dimond; Mr. F. C. Faraker (Commercial Officer, Commonwealth of Australia); Mr. J. H. Gorvin, C.B.E. (Ministry of Agriculture and Fisheries); Mr. F. Grant; Mr. J. F. Owen (Deputy Agent, Malayan Information Agency); Mr. H. W. Packer (Secretary, National Food Canning Council); Mr. F. Travers (Messrs. Joseph Travers & Sons, Ltd.); Mr. L. Wharton (Messrs. J. C. Houghton & Co.); Mr. W. A. Wilson; Mr. W. E. Knox (*Secretary*).

(18) WOOL STATISTICS SUB-COMMITTEE  
(OF THE AGRICULTURAL ECONOMICS COMMITTEE).

Mr. E. M. H. Lloyd (*Chairman*); Mr. S. E. J. Brady, M.B.E. (Board of Trade); Mr. L. Browett, C.B.E. (Board of Trade); Sir David Chadwick, C.S.I., C.I.E.; Mr. Harry Dawson, J.P. (Messrs. H. Dawson, Sons & Co., Ltd.); Mr. W. P. Devereux (Australian Wool Growers' Council); Mr. Arnold Frobisher (Wool Industries Research Association); Mr. F. Grant; Mr. I. Graul; Mr. F. D. Haggard (Messrs. Dalgety & Co., Ltd.); Mr. W. Harrison (British Wool Federation); Mr. E. J. Martin (National Wool (and Allied) Textile Employers' Council); Mr. C. Nathan (Ministry of Agriculture and Fisheries); Mr. G. H. Wood (Woolen and Worsted Trades' Federation); Mr. R. A. Dunn (*Secretary*).

## APPENDIX II.

GRANTS OUTSTANDING AS AT MAY, 1932, FOR RESEARCH AND OTHER SCHEMES APPROVED BY THE SECRETARY OF STATE ON THE ADVICE OF THE EMPIRE MARKETING BOARD.

GRANTS APPROVED FROM JUNE, 1931, TO MAY, 1932, ARE SHOWN IN ITALICS.

Object of Grant.	Department or Body to whom Grant made.	Expenditure from the Empire Marketing Fund Approved by the Board.*	Contributions by other Bodies on which Grants from the Empire Marketing Fund have been made conditional.
<b>BIOLOGICAL AND AGRICULTURAL SCIENCES.</b> Development of Biological and Agricultural Departments of the University of Cambridge.	University of Cambridge	£10,000 p.a. for 5 years..	£700,000 from International Education Board; £50,000 from Exchequer; £379,000 from other sources.
<b>FOOD PRESERVATION AND LOW TEMPERATURE RESEARCH.</b> <i>Continuation during 1932-33 of food preservation and low temperature research at Cambridge, Dilton and Torry.</i>	<i>Department of Scientific and Industrial Research.</i>	£30,133.	
<b>ANIMAL HUSBANDRY.</b> Research on the mineral content of natural pastures, with special reference to certain deficiencies in the soil and their effect on the growth and strength of livestock.	<i>(a) Rowell Research Institute, Aberdeen.</i>	£1,421.	

Do.	do.	(b) Commonwealth Council for Scientific and Industrial Research.	£3,000 capital; £1,875 p.a. for 5 years.	£3,000 capital; £1,875 p.a. for 5 years, half from Commonwealth Council for Scientific and Industrial Research and half from the University of Adelaide.
Do.	do.	(c) New Zealand Government.	£2,000 p.a. for 5 years ..	Similar sum provided in equal amounts by New Zealand Government and Cawthron Institute, New Zealand.
Do.	do.	(d) Government of Southern Rhodesia.	£2,500 capital; £2,500 p.a. for 3 years. £200.	Similar sums from Government of Southern Rhodesia.
Erection of silo at School of Agriculture, Cambridge, for trials of the economic value of silage made from grass.		School of Agriculture, Cambridge.		
Grants in aid of work at Cambridge University on the physiology and growth of farm animals, etc.		University of Cambridge	£5,000 capital; £400 p.a. for 5 years; £500 guarantee.	£11,000 capital.
<b>ANIMAL HEALTH.</b>				
Extension of the activities of the Onderstepoort Veterinary Research Station. Research on Animal Health problems in Australia.		Government of the Union of South Africa.	£10,000 capital; £11,000 p.a. for 5 years.	
		Commonwealth Council for Scientific and Industrial Research.	£8,000 p.a. for 5 years ..	Similar sum from Australian sources.
Establishment of Institute of Helminthology at Macdonald College, McGill University, Montreal.		Macdonald College, McGill University, Montreal.	£5,200 spread over 3 years	Similar sum from National Research Council of Canada.
<b>WOOL.</b>				
Standardisation of wool quality ..		Wool Industries Research Association.	£7,800 capital; £15,200 spread over 5 years.	
Sheep breeding and biology of wool ..		Animal Breeding Research Department, University of Edinburgh.	£3,000 capital; £800 p.a. for 5 years.	
Supply of wool packs for trials in Australia, New Zealand and South Africa.		Wool Industries Research Association.	£475.	

\* The sums shown in this column are maxima approved by the Secretary of State. With the exception of the grants approved from June, 1931, to May, 1932 (which are shown in italics), reductions ranging from 10 to 30 per cent. have been called for and effected as a result of the financial crisis and the consequent reductions in the Board's resources.

Object of Grant.	Department or Body to whom Grant made.	Expenditure from the Empire Marketing Fund Approved by the Board.*	Contributions by other Bodies on which Grants from the Empire Marketing Fund have been made conditional.
<p><b>HIDES AND SKINS.</b> Research on processing of New Zealand pelts.</p>	New Zealand Department of Scientific and Industrial research.	£500 p.a. for 5 years ..	Similar sum provided in equal proportions from New Zealand Department of Scientific and Industrial Research and Freezing Companies.
<p><b>DAIRY RESEARCH.</b> Production of Dairy Research Journal..</p> <p>Investigation of tuberculous infection of milk.</p> <p>Investigation into the problem of "openness" in cheese.</p> <p>Investigation into the technique of milk examination.</p>	<p>Department of Health, Scotland.</p> <p>New Zealand Dairy Research Institute.</p> <p>London School of Hygiene and Tropical Medicine.</p>	<p>£1,500.</p> <p>£1,400 p.a. for 2 years.</p> <p>£500 Capital; £2,000 p.a. for 4 years.</p> <p>£600 p.a. for 2 years.</p>	
<p><b>POULTRY.</b> Research in poultry nutrition problems</p> <p>Research on the scientific feeding of poultry.</p> <p>Investigation into the production and marketing of table poultry, eggs, etc.</p> <p>Study of quality in eggs and the effect of dietary factors on the hatching capacity of eggs.</p>	<p>Rowett Research Institute, Aberdeen, and Hillsborough Experimental Station, Northern Ireland.</p> <p>Animal Nutrition Institute, University of Cambridge.</p> <p>Harper Adams Agricultural College.</p> <p>Ontario Agricultural College, Guelph.</p>	<p>£7,300 capital; £2,440 p.a. for 5 years.</p> <p>£890 capital; £1,870 spread over 5 years.</p> <p>£5,000 capital; £8,492 spread over 5 years.</p> <p>£350 capital; £670 p.a. for 5 years.</p>	Similar sums from Ontario Department of Agriculture.
<p><b>EXPORT OF PEDIGREE LIVE-STOCK.</b> Erection and maintenance of the London Quarantine Station.</p>	Royal Agricultural Society of England.	£7,750 capital; £3,250 p.a. for 5 years.	

ENTOMOLOGY.			
Establishment and maintenance of a laboratory for breeding beneficial parasites.	Imperial Institute of Entomology.	£15,000 capital; £34,000 spread over 6 years.	
Biological control of insect pests in the West Indies.	Imperial Institute of Entomology.	£7,450 spread over 4 years.	
Locust Campaign . . . . .	Imperial Institute of Entomology.	£2,720 for 1 year; £2,020 for second year.	Similar sums from certain overseas Governments.
Research on the digestion of meat by the larvae of flies and on the part played by micro-organisms in the nutrition of larvae.	London School of Hygiene and Tropical Medicine.	£1,500 spread over 3 years.	
Preliminary survey of problems of insect nutrition.	Hebrew University, Jerusalem.	£75 capital; £227 10s. p.a. for 3 years.	
Establishment and maintenance of Biological Field Station for research into the infestation of stored products.	Imperial College of Science and Technology	£10,775 capital, £18,936 spread over 6 years.	£300 towards research on tobacco problems from Southern Rhodesian tobacco interests.
Towards cost of campaign against the warble fly.	Leathersellers' Company	£1,000 . . . . .	Similar sum from various interests represented on the Warble Fly Committee of the Leathersellers' Company.
Establishment of an organisation to pursue entomological investigations in Australia.	Commonwealth Council for Scientific and Industrial Research.	£21,000 capital; £39,052 spread over 5 years.	£21,000 capital and £57,873 spread over 5 years from Commonwealth Government.
Research into entomological control of noxious weeds.	Cawthron Institute, New Zealand.	£1,898 capital; £2,000 p.a. for 5 years.	£200 capital and £1,000 p.a. for 5 years from Cawthron Institute and £637 capital and £1,000 p.a. for 5 years from the New Zealand Government.
MYCOLOGY AND PLANT PATHOLOGY.			
Research into virus diseases of plants . .	Rothamsted Experimental Station.	£2,085 capital; £12,550 spread over 5 years.	
Do. do.	Cheshunt Experimental and Research Station.	£1,040 capital; £6,350 spread over 5 years.	
Do. do.	Scottish Society for Research in Plant Breeding.	£4,450 capital; £8,000 spread over 5 years.	

\* See footnote on page 117.

Object of Grant.	Department or Body to whom Grant made.	Expenditure from the Empire Marketing Fund Approved by the Board.*	Contributions by other Bodies on which Grants from the Empire Marketing Fund have been made conditional.
<b>MYCOLOGY AND PLANT PATHOLOGY—contd.</b>			
Research into virus diseases of plants ..	University College, Dublin.	£3,250 capital; £5,500 spread over 5 years.	
Cotton disease research .. .. .	Rothamsted Experimental Station.	£800 capital; £200 p.a. for 4 years.	
<b>PLANT BREEDING.</b>			
Prosecution and co-ordination of research in grasses and clovers.	Welsh Plant Breeding Station, Aberystwyth.	£4,350 capital; £23,375 spread over 5 years.	
Appointment of Plant Breeding Expert for study of Empire grassland problems	Welsh Plant Breeding Station, Aberystwyth.	£3,850 spread over 2½ years.	
Establishment of a Plant Breeding and Seed Research Station at New Zealand Agricultural College, Palmerston North	New Zealand Department of Scientific and Industrial Research.	£2,500 capital; £2,500 p.a. for 5 years.	£2,500 capital and £2,500 p.a. for 5 years from New Zealand Government.
Experiments with plants of the tidal zone with special reference to <i>Spartina Townsendii</i> .	East Anglian Institute of Agriculture.	£1,220 spread over 4 years.	
Research into production of strong strawed varieties of oats and barley.	University College, Dublin.	£1,550 capital; £425 p.a. for 5 years.	
Towards the maintenance of the Division of Plant Industry.	Commonwealth Council for Scientific and Industrial Research.	£4,000 capital; £6,000 p.a. for 2 years.	£11,500 capital from Australian sources.
<b>HORTICULTURE.</b>			
Fruit research and standardisation of horticultural material.	East Malling Research Station, Kent.	£22,250 capital; £37,220 spread over 6 years.	
Investigations into the keeping qualities of fruit and its relation to the nutrition of the tree and soil conditions.	Long Ashton Horticultural Research Station, Bristol.	£7,025 capital; £13,776 spread over 6 years.	
Fruit Research investigations in New Zealand.	New Zealand Department of Scientific and Industrial Research.	£2,350 capital; £9,300 spread over 5 years.	Similar sums from the Government of New Zealand.
Establishment of an experimental fruit farm with the object of testing the economic cost of growing and shipping bananas and grape fruit.	Government of Sierra Leone.	£1,500 capital; £1,500 p.a. for 5 years.	Similar sums from Government of Sierra Leone.

<b>ECONOMIC BOTANY.</b>			
Visits of Economic Botanists to Dominions and Colonies and employment of botanical collectors for work overseas.	Royal Botanic Gardens, Kew.	£20,000 spread over 6 years.	
Classification of Herbarium specimens..	Royal Botanic Gardens, Kew.	£15,567 spread over 5 years.	
<b>DIETETICS.</b>			
Research into the vitamin content of fruits, vegetables and dairy products at the Lister Institute.	Medical Research Council	£24,000 spread over 6 years.	
<b>COLONIAL AGRICULTURAL AND VETERINARY SERVICES.</b>			
Towards the cost of Headquarters Organisation, including appointment of Advisers on Agriculture and Animal Health.	Colonial Office .. ..	Approx. £8,000 up to 31.3.31 and £7,000 p.a. for 5 years.	Similar sums from Colonial Governments.
<b>TROPICAL RESEARCH STATIONS.</b>			
Development of a training centre for the study of tropical agricultural problems.	Imperial College of Tropical Agriculture, Trinidad.	£21,000 capital; £71,000 spread over 5 years; £14,400 for sixth year.	£21,000 capital from Lancashire Cotton interests.
Towards cost of maintenance of Amani Station.	East African Agricultural Research Station, Amani.	£6,000 p.a. for 5 years; £8,000 p.a. for sixth year.	Contributions estimated at £12,000 per annum by the East African Governments.
<b>BANANA RESEARCH.</b>			
Prosecution of research into the production of a variety of banana immune from Panama disease and investigation into transport of bananas under cold storage conditions.	Imperial College of Tropical Agriculture, Trinidad.	£5,774 capital; £3,806 p.a. for 5 years.	

\* See footnote on page 117.

Object of Grant.	Department or Body to whom Grant made.	Expenditure from the Empire Marketing Fund Approved by the Board.*	Contributions by other Bodies on which Grants from the Empire Marketing Fund have been made conditional.
<p style="text-align: center;"><b>TEA.</b></p> <p>Towards the cost of establishment and development of a laboratory of plant physiology for the investigation of problems connected with the constitution and composition of the tea plant.</p>	Indian Tea Association..	£3,125 capital; £3,375 spread over 5 years.	Similar sums from the Indian Tea Association.
<p style="text-align: center;"><b>RICE.</b></p> <p>Development of rice research in Burma and Bengal.</p>	Indian Imperial Council of Agricultural Research.	£2,500 capital; £12,745 spread over 5 years.	Similar sums from Indian Imperial Council of Agricultural Research.
<p style="text-align: center;"><b>SUGAR.</b></p> <p>Development of sugar research in Mauritius.</p>	Government of Mauritius	£2,000 p.a. for 5 years ..	Similar sums from the Government of Mauritius.
<p style="text-align: center;"><b>TOBACCO.</b></p> <p>Towards cost of establishment of tobacco research station in Southern Rhodesia.</p>	Government of Southern Rhodesia.	£3,000 spread over 2 years	Approx. £5,680 from Southern Rhodesian Government.
<p style="text-align: center;"><b>TUNG OIL.</b></p> <p>Distribution of Tung Oil seeds for cultivation in various Empire countries and comparative study of the technical properties of Tung Oil from various sources.</p>	Royal Botanic Gardens, Kew, and Research Association of British Paint, Colour and Varnish Manufacturers.	£800. £750 p.a. for 5 years.	
<p style="text-align: center;"><b>COPRA.</b></p> <p>Research into the best methods of preparing copra of high quality for export.</p>	Government of the Federated Malay States.	£1,150 p.a. for 4 years.	Similar sum from the Government of the Federated Malay States.
<p style="text-align: center;"><b>LAC.</b></p> <p>Towards cost of marketing expert in England to supplement lac research being carried on in India.</p>	Government of Bihar and Orissa.	£500 p.a. for 5 years ..	Similar sum from the Government of Bihar and Orissa.



<b>SERICULTURE.</b>			
Towards the development of the silk industry in Jamaica.	Government of Jamaica	£1,900 spread over 3 years	Similar sum from the Government of Jamaica.
Towards the revival of the silk industry in Palestine.	Government of Palestine	£100 . . . . .	£800 from the Government of Palestine.
<b>FLAX.</b>			
Development of research into problems of flax industry.	Linen Industries Research Association, Northern Ireland.	£2,250 capital; £16,500 spread over 5 years.	£750 capital and £8,500 spread over 5 years from Government of Northern Ireland.
Flax development in Cyprus . . . .	Government of Cyprus..	£2,500 spread over 3 years	Similar sum from Government of Cyprus.
<b>PINEAPPLES.</b>			
<i>Import of pineapple crowns in connection with establishment of pineapple canning industry.</i>	<i>Government of Mauritius</i>	<i>£1,250 . . . . .</i>	<i>Similar sum from Government of Mauritius.</i>
<b>FORESTRY AND FOREST PRODUCTS.</b>			
Maintenance of the Imperial Forestry Institute.	Imperial Forestry Institute, Oxford.	£9,500 spread over 3 years.	
<i>Continuation during 1932-3 of assistance to the Forest Products Research Laboratory, Princes Risborough, for work on the utilisation of Empire timbers.</i>	<i>Department of Scientific and Industrial Research.</i>	<i>£7,000.</i>	
<b>MECHANICAL TRANSPORT.</b>			
Experimentation and development of Mechanical Transport suitable for use in undeveloped parts of the Empire.		£60,000 spread over 5 years.	Similar sum from Oversea Governments of the Empire over a period of 4 years.
<b>FISHERIES.</b>			
Fisheries Research in Newfoundland . .	Government of Newfoundland.	£5,000 capital; £5,000 p.a. for 5 years.	Similar sums from Government of Newfoundland.

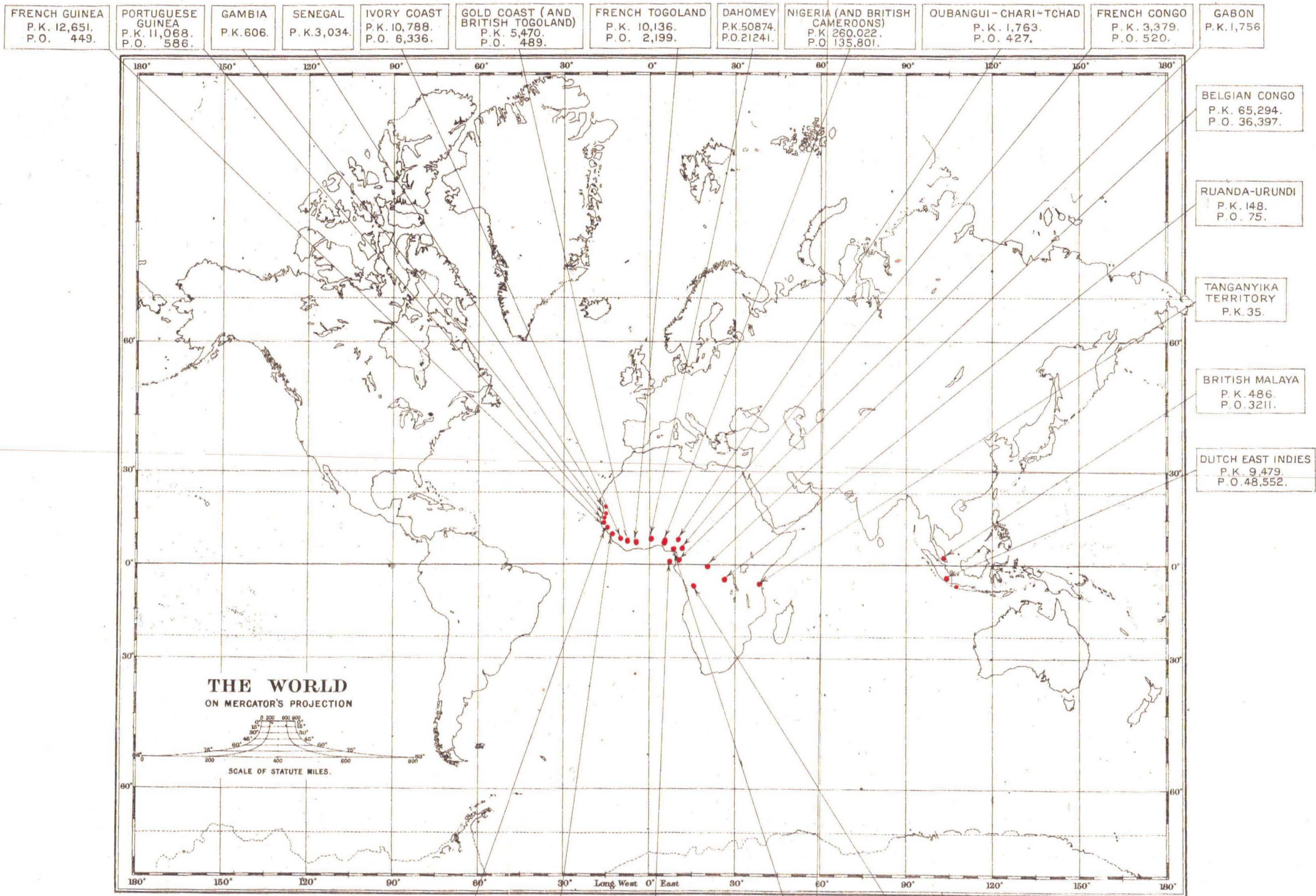
\* See footnote on page 117.

Object of Grant.	Department or Body to whom Grant made.	Expenditure from the Empire Marketing Fund Approved by the Board.*	Contributions by other Bodies on which Grants from the Empire Marketing Fund have been made conditional.
<b>ECONOMIC INVESTIGATION.</b>			
Establishment of a Chair of Imperial Economic Relations at the London School of Economics.	University of London ..	£2,000 p.a. for 5 years.	
<i>Continuation during 1932-3 of investigations into the marketing of home agricultural products with special reference to the improvement of the existing methods of distribution and preparation for markets.</i>	<i>Ministry of Agriculture and Fisheries.</i>	£36,500.	
Investigations into problems of marketing organisation.	Ministry of Agriculture and Fisheries.	£12,000 p.a. for 3 years.	
<i>Continuation during 1922-3 of investigations into the marketing of Scottish Agricultural produce.</i>	<i>Department of Agriculture for Scotland.</i>	£4,450.	
Improvement of Pork and Bacon production in Scotland.	Department of Agriculture for Scotland.	£3,750 capital; £407 p.a. for 5 years.	
Investigation into the marketing of Northern Ireland Agricultural produce.	Ministry of Agriculture, Northern Ireland.	£3,350 spread over 4 years.	
Investigation into the economics of small farms in Northern Ireland.	Government of Northern Ireland.	£1,800 spread over 5 years.	Similar sum from Government of Northern Ireland.
Collection and dissemination of data concerning the economics of agricultural production within the Empire, with special reference to the technique and results of cost accounting and survey methods.	Agricultural Economics Research Institute, Oxford.	£700 p.a. for 5 years.	
<b>MISCELLANEOUS.</b>			
Scheme of Economic Ornithology.	Departments of Zoology and Agriculture, University of Oxford.	£250 p.a. for 3 years ..	Similar sum from other sources.
Preliminary investigation into problems of the maturation of wine.		£1,250.	
Comparative study of methods of soil analysis.	University College of North Wales, Bangor.	£980.	

\* See footnote on page 117.

# OIL PALM PRODUCING COUNTRIES OF THE WORLD.

## (1930 EXPORTS OF PALM PRODUCTS IN TONS.)



P. K. = PALM KERNELS.  
P. O. = PALM OIL.

E.M.B. 54

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# SURVEY OF VEGETABLE OILSEEDS AND OILS

VOLUME I

## OIL PALM PRODUCTS

A SUMMARY OF PRODUCTION AND TRADE  
IN THE EMPIRE AND FOREIGN COUNTRIES  
PREPARED BY THE STATISTICS AND  
INTELLIGENCE BRANCH OF THE EMPIRE  
MARKETING BOARD



JUNE, 1932.

LONDON

PRINTED AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

To be purchased directly from H.M. STATIONERY OFFICE at the following addresses  
Adastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh  
York Street, Manchester; 1, St. Andrew's Crescent, Cardiff  
15, Donegall Square West, Belfast  
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Price 1s. 0d. Net

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X9(J58).1.N3t4

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## FOREWORD.

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THE Empire Marketing Board has from time to time received applications from a number of the Colonies for information upon the vegetable oil industry, particularly as regards its future and the extent of substitution between one vegetable oil and another and between vegetable oils and marine oils.

The Board's Agricultural Economics Committee accordingly suggested that the Statistics and Intelligence Branch of the Board should undertake a statistical survey of world production and consumption of oilseeds and nuts for the information of producers, traders and utilisers of these commodities. A preliminary survey entitled "Copra and Competitive Products," very brief and covering only the most easily accessible figures, was compiled early in the year 1931 and circulated among the Government Departments of the Empire Countries concerned, and it was intended to follow this by a more detailed analysis on the lines of the surveys already issued relating to Oranges (E.M.B. 15) and Cocoa (E.M.B. 27).

During the work of preparation, it soon became apparent that the subject was too wide to be confined to one volume, and it has been decided to issue a series of volumes, each dealing with a convenient group of these commodities.

The present volume covers the products of the oil palm—palm kernels, palm kernel oil and palm oil—and follows much the same lines as the previous surveys on oranges and cocoa referred to above. It is essentially a statistical record of the trade in these products in recent years with some indication of the general trend of production and consumption. Where possible, an attempt has been made to indicate the effect of the competition of substitutable oils, both vegetable and marine. In this connection, some difficulty has been experienced in estimating the degree of substitution that is being effected on account of the absence of comprehensive statistics of the constituent oils and fats utilised by the more important industries concerned, namely the soap, candle, margarine and tin-plate industries. But enquiries on this subject are being actively pursued and it is hoped to publish the results in a subsequent volume.

Certain minor difficulties have also been encountered in connection with the trade statistics, which in some few cases do not separately classify palm kernel oil and palm oil. Production statistics, except in the newer producing areas, are almost entirely absent.

STATISTICS AND INTELLIGENCE BRANCH,  
EMPIRE MARKETING BOARD.

June, 1932.

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## INTRODUCTION.

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The products of the Oil Palm fall into two distinct classes :—

- (a) The kernels of the palm fruit which provide palm kernel oil, and
- (b) The fleshy pericarp of the palm fruit which provides palm oil.

Chapter I is devoted to the production of and trade in palm kernels and palm kernel oil ; palm oil is dealt with in the succeeding chapter. It is impossible entirely to separate the two groups of products of the oil palm, since the factors affecting their production must necessarily be the same, and the two chapters should therefore be read in conjunction if a complete picture of the oil palm industry is to be obtained.

### **The Oil Palm.**

The oil palm is a tree, 60 to 100 feet high, native to West Africa, to which area its commercial exploitation was confined until comparatively recent times. In view of the increasing importance of vegetable oils in world industry, and particularly those utilisable for edible purposes, the cultivation of the oil palm has received much careful scientific investigation and has been introduced experimentally into Labuan, Seychelles, Queensland, Jamaica, British Malaya, the Dutch East Indies, and other tropical countries. In British Malaya and the Dutch East Indies, the industry is now past the experimental stage, and production is of growing importance.

No less than 18 varieties of the oil palm have been distinguished, but from a commercial point of view the varieties fall into two main groups :—

- (i) Those whose fruit has a comparatively thin pulp and thick shell and yields a relatively small amount of palm oil, and a large amount of kernels ; and

(ii) those whose fruit has a thick fleshy pericarp and moderately thick shell yielding a relatively large amount of palm oil, and a small amount of kernels.

There is a third type which has not yet passed the experimental stage. It has a thick fleshy pericarp and thin shell, yielding a relatively large amount of both palm oil and palm kernels (a).

The oil palms in West Africa largely consist of varieties which fall into the first class, and it is from these that the bulk of commercial supplies of palm kernels and palm kernel oil is obtained; the oil palms of the more recently developed areas consist for the most part of the second class and yield a higher proportion of palm oil. Some indication of the composition of the oil palm fruit of characteristic types of the two main varieties of oil palm is obtained from the following table and diagram which summarise the analysis of the fruit produced in Nigeria and British Malaya.

TABLE I.—*Analysis of Characteristic Types of Oil Palm Fruit.*  
(In per cent.)

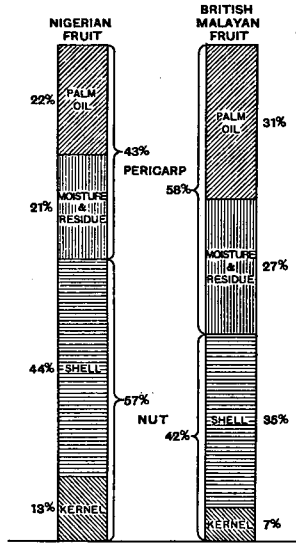
Constituents.	Nigerian Fruit (b).	British Malayan Fruit (c).
Pericarp .. .. .	43	57-60
Nut .. .. .	57	43-40
Total .. .. .	100	100
Palm oil (from pericarp) .. .. .	22	29-32
Palm kernel (from nut) .. .. .	13	6.5-8.5

(a) See Paper entitled "The Oil Palm Industry," by F. M. Dykes, contributed to the 6th International Congress of Tropical Agriculture, Paris, 1931.

(b) Source—"Tropical Agriculture," Vol. VII, August, 1930. Article entitled "The Oil Palm Industry," by S. M. Gilbert.

(c) Source—"The Oil Palm in Malaya." F.M.S. Department of Agriculture, \* Bulletin, No. 39.

DIAGRAM—ANALYSIS OF CHARACTERISTIC TYPES OF OIL PALM FRUIT.



The pericarp contains a fairly high though variable oil content, which is extracted as near as possible to the area of production, owing to difficulty in handling the pericarp consequent upon its perishable nature. It does not, therefore, enter into world trade and the product of this part of the oil palm fruit is always exported in the form of palm oil. The kernels, on the other hand, which have an oil yield of 45-50 per cent. are capable of sustaining long periods of transport and are for the most part exported in bulk to oil crushing countries, where the oil known as Palm Kernel Oil is expressed, the residual cake being utilised as a feed for stock. The utilisation of palm kernel cake and meal has extended rapidly, particularly in Germany, Denmark and the Netherlands, and the existence of a ready market for this residual product has been an important factor in the development of the crushing of kernels in those countries.

The Oil Palm commences to bear fruit in about the third year after planting, but regular harvesting is not advisable until about the end of the fourth year. Palms grown in natural palm groves will often not produce marketable fruit until the sixth year. The bunches of fruit ripen and are usually ready for harvesting within a varying period, ranging from 4 to 6 months from the date of pollination, but if a dry spell supervenes, this period may be extended for another month. The fruit ripens throughout the year, the yield south of the Equator being greatest during the months of August and September, when monthly production may be from 3 to 4 times that of the lowest yielding months—January and February. North of the Equator the greatest yields are obtained in the earlier months of the year. The palms usually reach a maximum production at about their 10th or 11th year.

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GOLD COAST.

Heads of palm fruit and separated fruit.

*Reproduced by courtesy of the Imperial Institute, South Kensington.*

## CHAPTER I.

### PALM KERNELS AND PALM KERNEL OIL.

Statistics of production of Palm Kernels are not available for the more important producing areas, and accordingly statistics of external trade must generally serve as an indication of development. Owing to the fact that local consumption absorbs an appreciable part of the produce and that during periods of falling or stagnant prices the proportion of the crop consumed locally, held over, or not harvested may be considerable, it should be borne in mind that the movement of the trade figures may not accurately reflect the trend of production.

The palm kernels are utilised to obtain palm kernel oil either by treatment in hydraulic presses or by solvents, the residual cake or meal being utilised in the manufacture of feeding stuffs for livestock. The kernels are easily transported and the oil-cake finds a ready demand in Europe, which is practically the sole market for the kernels. Accurate statistics as regards this oil are not always available, as some countries do not distinguish between palm kernel oil and palm oil in their trade returns but it is known that there is very little export of palm kernel oil from oil palm producing countries, the export trade being almost entirely confined to palm kernel importing countries.

Palm kernel oil resembles coconut oil in its qualities, and high-grade oil is similarly used in the manufacture of margarine and edible vegetable fats, so called "chocolate fat," and to a limited extent for pharmaceutical and toilet preparations. Moreover the crude oils are both largely used in the soap industry, since they possess a high saponification index and make very hard soaps.

In the period 1924 to 1930 an average of about 545,000 tons of palm kernels were exported annually from producing areas, and of this amount the British Empire contributed about 325,000 tons or 60 per cent. The present level of world supply of this commodity is about 75 per cent. above that of the pre-war quinquennium but no marked development has been observable since 1924.

In the following paragraphs will be indicated the recent development of the exports of palm kernels from the principal producing areas, and the distribution of both palm kernels and palm kernel oil to the principal consuming countries.

Precise agreement between the different tables is not to be expected owing to the variation in the method of classification of exports and imports and particularly owing to the different ways of recording their origin and destination. The unit used throughout the Survey is the long ton of 2,240 lbs.

## PRODUCTION AND EXPORT.

### I.—BRITISH EMPIRE COUNTRIES.

#### British West Africa.

The oil palm flourishes in its native state throughout the British West African colonies, particularly in Nigeria where the production of the oil palm is the staple native industry, oil palm products in 1931 accounting for about 45 per cent. of the value of the total domestic exports. Nigeria, Sierra Leone, the Gold Coast and Gambia between them furnish about three-fifths of the world's supply of palm kernels and their share has not appreciably varied since 1925 although it is less than in the pre-war quinquennium when it amounted to 69 per cent. of the world's trade in this commodity.

Exports from the British West African Colonies since 1924 are shown in the following table in which the pre-war average is given for purposes of comparison.

TABLE II.—*Exports of Palm Kernels from British West Africa.*  
(In tons.)

Colony.	1909/13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931. (c)
Nigeria (a) ..	171,792	252,847	272,925	249,103	257,206	246,638	251,477	260,022	254,455
Sierra Leone ..	45,754	61,117	63,231	65,000	65,436	67,105	60,205	56,641	54,462
Gold Coast (b) ..	633	6,592	6,569	7,659	6,545	6,214	6,569	5,470	(d) 3,719
Gambia ..	545	678	692	676	719	615	735	606	828
<b>Total ..</b>	<b>218,724</b>	<b>321,234</b>	<b>343,417</b>	<b>322,438</b>	<b>329,906</b>	<b>320,572</b>	<b>318,986</b>	<b>322,739</b>	<b>313,464</b> (d)

(a) Includes exports from British Mandated Territory of the Cameroons from 1924.

(b) Includes exports from British Mandated Territory of Togoland from 1924 to 1930.

(c) Preliminary figures.

(d) Excluding exports from Togoland (British).

#### NIGERIA.

Nigeria is not only responsible for the bulk of the exports from British West Africa, but is also the largest exporter of palm kernels in the world. Practically the whole of the industry is in the hands of the natives and up to the present, no attempt has been made to organise production on European lines. Palm oil is largely used by the natives for cooking purposes and as an illuminant, and the kernels are regarded by them as a bank to be drawn upon in times of need. Hence a period of low prices will result in a material decrease in output both of kernels and of palm oil, owing to the lack of sufficient inducement to undertake the labour of harvesting and preparing larger supplies than are needed for home consumption; at such times only part of the crop is harvested, the rest being left to rot on the trees.

Attempts are now being made to encourage the native to improve the cultivation of the oil palm on the lines of the recommendations of a Committee appointed by the Secretary of State for the Colonies in September, 1923, of which the following is a brief summary.(a)

- (i) That steps be taken to teach the African to improve the condition of existing trees and to demonstrate by experimental plantations the value of remedial methods.
- (ii) That the African be encouraged to plant blocks of trees on bare areas, where palm trees are scattered, and that communal plantations be attempted where conditions are suitable.
- (iii) That the destruction of the palms by tapping for "palm wine" be restricted.

This educational method of increasing production and improving the quality of the output is necessarily slow, but it alone can be relied upon to ameliorate production, as there is not sufficient inducement offered to the European capitalist to interest himself in the industry. The recommendations, particularly those regarding the improvement of existing trees and the creation of experimental plantations, have been adopted in Nigeria with some success.

The opening up of competitive areas on modern lines in the Dutch East Indies and British Malaya, and the rapid development of the

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(a) Colonial No. 10/1925 and C.L.F. 2586/351/1925 (Sierra Leone).



industry in the Belgian Congo bestow a special importance upon this question of improving and extending the cultivation of the oil palm in Nigeria. According to a more recent report (a) much interest is being shown by the native farmer in the cultivation of the forest palms, and the more remote areas are being opened up by motor roads. The rapid development of production which took place in the years immediately following the war could not be expected to continue indefinitely at the same rate and there has been a cessation of the upward movement since 1926; but the present output of kernels is held to be satisfactory and capable of withstanding competition from the other producing areas. It is in regard to the production of palm oil that the British West African native methods are considered wasteful and productive of an inferior article and this aspect of the problem will be examined in the following chapter.

Exports of palm kernels from Nigeria which averaged about 172,000 tons per annum in the pre-war quinquennium rose rapidly during the War and by 1925 amounted to 273,000 tons, an increase of nearly 60 per cent. There has been a slight decline since then, and the average annual exports during the succeeding quinquennium were about 250,000 tons. An improvement was recorded in 1930 which was coincident with a marked decrease in the exports from the Belgian Congo. In 1931, a very slight fall occurred in the Nigerian exports, while the Congo exports again fell heavily. It is perhaps too early to attach any significance to this development but it is certainly noteworthy.

#### SIERRA LEONE.

Exports of palm kernels from Sierra Leone showed a more sustained upward movement than Nigerian exports up to 1928, but since then a serious decline has occurred, due probably to the fall in prices and to the lack of organised effort to increase and maintain a regular output. Much valuable research has been undertaken by the Department of Agriculture of this Colony supported by contributions from the Empire Marketing Board, and attempts are being made, as

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(a) Report on the Oil Palm Industry in British West Africa, by F. M. Dyke, Technical Officer of the Niger Company, Ltd., and Associated Companies, 1927.

exemplified in the Reports of the West African Agricultural Conference held in 1929, to encourage the establishment of the plantation method of cultivation, and the extension of the planting of Nigerian oil palms, in preference to the inferior local variety.

Exports of palm kernels increased considerably during the war and in 1924 amounted to about 61,000 tons as compared with an annual average of about 46,000 tons in the pre-war quinquennium. From 1924 to 1928 further progress was made and in the latter year exports exceeded 67,000 tons. A decline commenced in 1929 and continued to 1931, the total fall between 1928 and 1931 representing nearly 20 per cent. of the level of exports in the peak year of 1928.

#### GOLD COAST.

The oil palm industry has not flourished in this Colony to the same extent as in Nigeria and Sierra Leone. Oil palm cultivation is suited to that area which lies between the main mountain chain and the sea, where the rainfall is relatively high, and a well-defined oil palm belt extends close to the coastal line where cacao does not do well. The efforts of the farming population available for the production of an export crop have been concentrated almost entirely upon cacao cultivation which has been more remunerative than the production of the oil palm. The needs of the cacao industry, and to a lesser extent that of mining, seriously restrict the amount of labour available for the production and marketing of oil palm products. Prior to the War, the bulk of the production was consumed locally and exports of palm kernels were almost negligible, averaging only 633 tons for the years 1909-13. A rapid extension of production occurred during the War and by 1924 exports had increased to over 6,000 tons, or more than ten times the pre-war volume. Since then there has been little variation in the quantity of kernels exported.

#### GAMBIA.

The cultivation of the oil palm is a minor industry in the Gambia, far more attention being devoted to the production of ground nuts, which attracts the great bulk of the available labour. Nevertheless,

there is in the Colony a natural oil-palm belt and attempts are being made to improve production by means of a plantation in the Kombo district. The palms are regarded by the native chiefly as a source of food and are often injured by tapping for palm wine.

Exports of palm kernels are still very small and show only a slight increase as compared with the pre-war period.

#### BRITISH CAMEROONS AND BRITISH TOGOLAND.

Those areas of the Cameroons and Togoland which have been placed under British mandate in West Africa, comprise only a small part of the former German Colonies and their production has not substantially added to the volume of palm kernels exported from British West Africa.

The following table shows the annual exports of palm kernels from these territories since 1924. The substantial rise in the exports from the British Cameroons, which increased by about 470 per cent. between 1924 and 1930, stands in marked contrast to the relatively stable level of the exports from British Togoland during that period. The figures given below are already included in those given in Table II.

TABLE III.—*Exports of Palm Kernels from the British Cameroons and British Togoland.*(a).

(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.
British Cameroons ..	232	366	788	1,164	1,488	1,432	1,325
British Togoland (b) ..	545	410	396	431	570	583	474
Total .. ..	777	776	1,184	1,595	2,058	2,015	1,799

(a) Comparable figures for the pre-war quinquennium are not available.

(b) Exports passing over Anglo-French frontiers only; exports to Gold Coast not included. (See Colonial No. 63/1931.)

The distribution of the exports of palm kernels from British West Africa is shown in the following table (\*). It will be seen that the channels of trade in this commodity have undergone a substantial modification not only as compared with the pre-war quinquennium but also as compared with the early post-war period.

TABLE IV.—*Distribution of Exports of Palm Kernels from British West Africa.*

(In tons.)

COUNTRIES.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Germany .. ..	177,748	71,996	114,112	131,816	160,584	161,867	143,189	170,089	} (a)
United Kingdom..	31,015	234,663	217,069	180,154	154,655	137,242	135,694	117,035	
Netherlands ..	9,355	11,311	6,616	5,748	5,067	5,001	28,813	17,478	
Denmark .. ..	—	—	—	—	2,665	5,429	5,786	10,712	
France .. ..	513	1,415	4,331	3,872	5,112	6,971	2,451	1,530	
Italy .. ..	—	1,508	510	28	1,154	1,701	1,411	1,239	
United States of America .. ..	—	339	662	732	591	1,059	566	3,950	
Sweden .. ..	—	—	—	—	—	—	239	—	
Belgium .. ..	—	—	—	—	—	1,169	—	—	
Other countries ..	93	2	117	88	78	133	827	706	
Total .. ..	218,724	321,234	343,417	322,438	329,906	320,572	318,986	322,739	

(a) Details not yet available.  
(b) Preliminary figure.

Before the War over 80 per cent. of the palm kernels exported from British West Africa were shipped to Germany, which was then the largest producer of palm kernel oil. During the War the oil-crushing industry in the United Kingdom developed considerably, and that country became, and remained for some time, the chief market for West African palm kernels. In recent years, Germany has rapidly recovered her standing in the world's oil crushing industry, and though her imports of palm kernels have not yet fully attained their pre-war level, she now again imports a greater share of British

(\*) There are no essential differences in the distribution of the exports of palm kernels from the various West African colonies and the individual figures are, therefore, without interest.

West African kernels than the United Kingdom. Germany and the United Kingdom together have taken over 90 per cent. of the total exports of this commodity from British West Africa during the pre-war and post-war periods under review, but the amount taken by other countries although small has shown a marked upward tendency in recent years, largely as a result of increased consignments to the Netherlands and Denmark. This development does not necessarily indicate an increased consumption of British West African palm kernels by these countries but rather a change in the method of purchase, the tendency being for an increasing degree of direct purchase from the producing area, instead of by re-export from the United Kingdom and Germany.

#### **British Malaya.**

Although the oil palm was introduced into British Malaya as an ornamental palm as early as 1875, its cultivation for industrial purposes was not undertaken until 1917 when an area of land in the district of Kuala Selangor, previously alienated for coconuts, was planted with oil palms. Thus British Malaya is one of the new producing areas which came into existence as a result of the war-time demand for vegetable oils. Further stimulation to the industry was given by the heavy slump in the price of rubber in 1920, which caused attention to be devoted to alternative crops, but up to 1924, with the exception of a small area in Perak and Johore, planting was confined to Selangor. In 1925, nearly 1,000 acres were planted with oil palms in Johore, in 1926 appreciable areas were planted in Perak and Negri Sembilan, and in 1928 the industry spread to Pahang. The rapid progress which has taken place in the British Malayan oil palm industry in recent years is largely due to this later extension, particularly in Perak and Johore, and this may be attributed to the recent depression in the rubber industry which may still further encourage the development.

The introduction of the oil palm industry has been accompanied by careful and exhaustive research and experiment as to the best varieties of seed and the best methods of cultivation. These experiments are carried out at the Government Experimental Plantation, Serdang, and the importation of seed into the country is strictly supervised to ensure the introduction of only the most suitable varieties.

The following table indicates the rapid increase in the area planted since 1917, and the relative importance of the various States.

TABLE V.—*Area Planted with Oil Palms in British Malaya (a).*

(In acres.)

Year.	Selangor.	Perak.	Negri Sembilan.	Pahang.	Johore.	Kedah.	Total in Year.	Cumulative Total.
Before 1917	14	—	—	—	—	—	14	14
1917 ..	100	—	—	—	—	—	100	114
1918 ..	253	—	—	—	—	—	253	367
1919 ..	270	—	—	—	—	—	270	637
1920 ..	470	—	—	—	—	—	470	1,107
1921 ..	821	—	—	—	—	—	821	1,928
1922 ..	394	—	—	—	30	—	424	2,352
1923 ..	1,877	—	—	—	—	—	1,877	4,229
1924 ..	1,848	220	—	—	10	—	2,078	6,307
1925 ..	1,309	—	—	—	962	—	2,271	8,578
1926 ..	1,911	478	100	—	1,289	—	3,778	12,356
1927 ..	2,026	1,818	500	—	2,831	—	7,175	19,531
1928 ..	476	2,763	—	592	1,005	—	4,836	24,367
1929 ..	905	3,017	302	94	2,984	20	7,322	31,689
	12,674	8,296	902	686	9,111	20	31,689	31,689

(a) Source : "Malayan Agricultural Journal," July, 1930.

According to the Annual Report of the Department of Agriculture for 1930, the development shewn in the foregoing table has been continued in 1930. The area planted in Selangor increased during that year from 12,674 acres to 12,961 acres, that of Perak increased from 8,296 acres to 17,165 acres, that of Johore from 9,111 acres to 17,767 acres, and that of Pahang from 686 acres to 788 acres. On the other hand, in the case of Negri Sembilan and Kedah the aggregate area planted by the end of 1930 appears to have decreased, but the

apparent reduction may be due to an adjustment of the previously notified acreage. The following table shows the aggregate area planted with oil palms at the end of 1930, and also the acreage of mature and immature palms which indicates the rapid development in production of palm kernels that may be anticipated in the next few years.

TABLE VI.—*Acreage under Oil Palms in British Malaya, 1930(a).*

State.	Mature.	Immature.	Total.
Johore .. ..	5,064	12,703	17,767
Perak .. ..	2,144	15,021	17,165
Selangor .. ..	10,446	2,515	12,961
Pahang .. ..	—	788	788
Negri Sembilan .. ..	504	270	774
Total .. ..	18,158	31,297	49,455

(a) Source : "Malayan Agricultural Journal," January, 1932.

According to a later report published in the "Malayan Agricultural Journal," April, 1932, the acreage under oil palms increased in 1931 to about 57,000 acres. Johore accounted for almost the whole of the expansion, the acreage during the year having increased in that State from 17,767 to 24,395 acres. Reserve land for further cultivation is held by nearly all estates, and an aggregate of about 120,000 acres have been alienated for oil palm cultivation, while further areas have been earmarked for investigation as to their suitability. The oil palm in British Malaya may now be definitely regarded as a crop of major importance, although as yet production is not great, as most of the plantations have not come into full bearing. But each year larger areas will be harvested, and a definite and steady increase of production may be expected.

The annual production of palm kernels in British Malaya, is indicated in the following table which gives the figures from 1923, the first year in which the oil palm fruit was harvested.

TABLE VII.—*Production of Palm Kernels in British Malaya*(a).  
(In tons.)

Year.	Amount.
1923 .. .. .	50
1924 .. .. .	81
1925 .. .. .	110
1926 .. .. .	168
1927 .. .. .	185
1928 .. .. .	286
1929 .. .. .	311
1930 .. .. .	486 (b)
1931 .. .. .	773 (c)

(a) Compiled from returns supplied by Estates, published in "Malayan Agricultural Journal," July, 1930.

(b) Source: Supplement to the "F.M.S. Government Gazette," July 17, 1931.

(c) Source: "Malayan Agricultural Journal," April, 1932.

Exports of palm kernels from British Malaya have not as yet assumed considerable proportions, although a marked development is observable. The following table shows the exports since 1927, the first year for which figures are indicated in the official trade returns. The United Kingdom imported almost the whole of the Malayan shipments until 1929, and although her share has since decreased she is still the principal market.

TABLE VIII.—*Exports of Palm Kernels from British Malaya.*  
(In tons.)

COUNTRIES.	1927.	1928.	1929.	1930.	1931.
United Kingdom .. .. .	158	260	264	232	} 526
Netherlands .. .. .	16	—	9	174	
Belgium .. .. .	—	—	10	45	
Germany .. .. .	—	—	—	35	
Other countries .. .. .	5	—	—	—	
Total .. .. .	179	260	283	486	726



### Tanganyika.

The British mandated territory of Tanganyika exports appreciable quantities of palm kernels, but very little of this is Tanganyika produce, the bulk being kernels in transit from neighbouring countries. The transit trade declined considerably after 1929. Information as to the origin of the imports of palm kernels is incomplete, but it is known that about one-half comes from the Belgian Congo.

The following table shows the distribution of the exports since 1924 and indicates their origin, classified between Tanganyika and foreign produce. It will be seen that for the greater part of the period under review, Germany was the principal market for these exports.

TABLE IX.—*Source and Distribution of the Exports of Palm Kernels from Tanganyika.*  
(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Source of exports—								
Tanganyika produce..	32	43	53	348	80	84	35	113
Foreign produce ..	1,625	1,735	1,206	1,461	1,987	1,978	671	39
Total .. ..	1,657	1,778	1,259	1,809	2,067	2,062	706	152
Exported to—								
France .. ..	1,219	710	91	345	—	162	435	—
Belgium .. ..	175	97	—	—	471	1,071	231	—
Germany .. ..	66	843	922	1,407	1,585	790	40	84
Netherlands ..	—	36	186	—	—	—	—	—
United Kingdom ..	—	59	60	47	—	39	—	68
Union of South Africa	—	—	—	1	11	—	—	—
Italy .. ..	197	31	—	—	—	—	—	—
Zanzibar .. ..	—	2	—	9	—	—	—	—
Total .. ..	1,657	1,778	1,259	1,809	2,067	2,062	706	152

### British Guiana.

Appreciable quantities of oil palm seed were imported into British Guiana from West Africa, and young plants were distributed for cultivation at various Government experimental stations and farms as early as 1914, but no industry has yet been established in the Colony.

**Seychelles.**

Conditions in the Seychelles are particularly favourable to the growth of the oil palm, and encouraging experiments in its cultivation have been made with the result that the Department of Agriculture of the Seychelles has recommended that plantations of the oil palm should be undertaken. Up to the present there is no recorded production or export of oil palm products.

**Ceylon.**

Isolated attempts to plant oil palms have met with satisfactory results, the fruit producing a normal yield of oil, but in view of the fact that irrigation is necessary during the dry season, it seems unlikely that Ceylon can compete with the other new producing areas like Malaya and Sumatra, where the climate is naturally favourable.

**Anglo-Egyptian Sudan.**

Certain published statistics of palm kernels include exports from the Anglo-Egyptian Sudan of Palm Nuts, known as "Dom Palm Nuts." This fruit has no resemblance to the oil palm nut in that it is not oil producing and is utilised solely for the production of vegetable ivory. These exports have not, therefore, been included in this survey.

**II.—FOREIGN COUNTRIES.****French West and Equatorial Africa.**

Conditions of cultivation and production in the French colonies in West and Equatorial Africa are very similar to those in Nigeria and these areas rank second to British West Africa as exporters of palm kernels. French West Africa includes the Ivory Coast, Dahomey, French Guinea and Senegal; French Equatorial Africa includes Gabon, Moyen-Congo, and Oubangui-Chari-Tchad. These colonies cover a large and productive area, which is gradually being developed. Since the war the major part of the ex-German Colonies of Togoland and the Cameroons, where the oil palm is widely cultivated, have been placed under French mandate.

In 1919, the French authorities appointed a Commission to enquire into the measures necessary to improve the oil palm industry in their African Colonies. The recommendations included the establishment of power mills for the treatment of palm produce, and the regular plantation of the best type of oil palm to supplement the forest-grown trees. A central station has since been established on the Ivory Coast where all aspects of the problem are being carefully considered. As yet, the improvements which are gradually being

introduced have had no visible effect on the volume of exports, but if the new system of plantation and treatment is persevered with, an increase in supply and an improvement in the quality of the palm produce may be anticipated.

The total exports from the French colonies and mandated territories in West and Equatorial Africa are shown in the following table:—

TABLE X.—*Exports of Palm Kernels from the Principal French Colonies in West and Equatorial Africa.*  
(In tons.)

Source of Supply.	1909-13 (Average). (a)	1924.	1925.	1926.	1927.	1928.	1929.	1930.
<b>French West Africa—</b>								
Dahomey .. ..	33,657	44,924	44,504	41,396	47,478	31,100	35,469	50,874
Ivory Coast .. ..	5,828	12,850	14,348	15,275	10,704	12,084	11,158	10,783
French Guinea .. ..	4,621	10,450	10,413	11,117	12,250	12,333	11,936	12,651
Senegal .. ..	1,500	2,715	2,871	2,911	2,887	3,048	2,897	3,034
Total .. ..	45,606	70,939	72,136	70,699	73,319	58,565	61,440	77,347
<b>French Equatorial Africa—</b>								
Moyen Congo .. ..	1	4,935	5,422	6,073	5,573	5,477	4,541	3,379
Other Colonies .. ..	468	3,088	3,295	3,121	2,807	3,038	3,266	3,519
Total .. ..	469	(a)8,023	(a)8,717	9,194	8,380	8,515	7,807	6,898
<b>French Mandated Territories (b)—</b>								
Cameroons .. ..	15,266	28,329	35,840	34,911	33,156	31,874	33,692	(c) 35,800
Togoland .. ..	9,504	12,331	8,676	9,792	9,200	6,065	6,116	(c) 10,136
Total .. ..	24,770	40,660	44,516	44,703	42,356	37,939	39,808	45,936
Grand Total .. ..	70,845	119,622	125,369	124,596	124,055	105,019	109,055	130,181

(a) Source: Year Book of the International Institute of Agriculture, Rome.

(b) Include for the pre-war period a slightly larger area than the existing French zones.

(c) Source: "Togo-Cameroun, Magazine Mensuel de l'Agence Economique des Territoires Africains sous mandat, Automne 1931."

As in British West Africa, there has been a considerable growth in palm kernel exports from the French African colonies since the war; the average annual exports during the period 1924 to 1930 amounted to nearly 120,000 tons as against about 71,000 tons in the pre-war quinquennium. This increase of nearly 70 per cent. compares with an increase of about 50 per cent. in the case of British West Africa. The exports in 1928 and 1929 showed an appreciable decrease which has been attributed to an insufficiency of rainfall in the former year.

The oil palms have apparently recovered from the damage thereby inflicted, and in 1930 the total exports from these colonies attained a record level of about 130,000 tons, or 5 per cent. higher than the average exports for the four years prior to the decline.

#### FRENCH WEST AFRICA.

French West Africa accounts for about 60 per cent. of the exports of palm kernels from the French African colonies, and this proportion has not appreciably varied since before the war. The lack of sufficient rainfall in Dahomey in 1927-28 caused serious damage to the oil palms in this area with the result that the quantity of kernels available for export in 1928 declined by over 30 per cent. Exports in 1929 from French West Africa were still below normal, owing to the slow recovery of the palms, but in 1930 they rose considerably above the 1927 level. This was mainly due to the increase in the exports of Dahomey, which attained a record of 50,000 tons as compared with 47,000 tons in 1927, before the decline. French Guinea and Senegal also showed slight increases, but exports from the Ivory Coast have continued to decrease.

The following table shows the principal importers of the palm kernels exported from this area.

TABLE XI.—*Distribution of Exports of Palm Kernels from French West Africa.*  
(In tons.)

COUNTRIES.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.
Germany .. ..	(a) 25,729	16,740	26,804	30,959	37,788	38,506	40,873	49,189
United Kingdom and other British countries .. ..	(b)	26,827	16,729	19,902	24,734	13,126	9,204	12,092
Netherlands .. ..	(b)	1,318	634	2,408	249	1,766	6,526	7,894
France .. ..	(b)	25,809	27,919	17,384	10,502	4,558	3,799	5,881
Belgium .. ..	(b)	245	—	—	41	51	806	39
Togoland .. ..	(b)	—	—	—	—	192	232	(b)
Denmark .. ..	(b)	—	—	—	—	366	—	1,069
Other countries ..	(b)	—	50	46	5	—	—	1,183
Total .. ..	(c) 45,606	70,939	72,136	70,699	73,319	58,565	61,440	77,347

(a) Source : *Annuaire Economique Colonial*, 1930.

(b) Included in "Other countries."

(c) Source : *Year Book of the International Institute of Agriculture*, Rome.

The rapid increase in the exports taken by Germany, in contrast to the rapid decline in exports to the United Kingdom and France, will be noted, and in this respect the trend in the French West African trade in palm kernels resembles that of British West Africa. Germany has fully regained the pre-eminent position which she held before the War in this trade. The decrease in the case of France is the more remarkable in view of the French policy of giving preference to her colonies in regard to trade and is attributable to the decreased consumption of the commodity in that country.

#### FRENCH EQUATORIAL AFRICA.

Exports of palm kernels from the French Colonies in Equatorial Africa have increased about eighteen-fold in the post-1924 period as compared with the estimated exports of the pre-war quinquennium. This represents by far the largest proportional increase attained by any producing area during this period. The exports reached their highest point in 1926 when they exceeded 9,000 tons as against under 500 tons in 1909-13. Since then they have shown a tendency to decline and by 1929 had sunk to about 7,800 tons. Complete details of the distribution of these exports are not available. About one-half are exported through the Belgian Congo, and their ultimate destination is not indicated. France, Belgium, and Germany, in that order, import the remainder.

#### MANDATED TERRITORIES.

##### (i) FRENCH CAMEROONS.

The French Mandate of the Cameroons is the second largest exporter of palm kernels among the French African territories. In contrast to the other French African Mandate of Togoland a considerable increase has been effected in the volume of palm kernels exported in recent years as compared with the pre-war period. In 1909-13, the ex-German Colony of the Cameroons, which covered a slightly larger area than the present French Mandate, exported an average of about 15,000 tons of kernels annually as compared with an annual average of about 33,000 tons in the period 1924-30. Since 1924 the exports have been relatively stable but in common with the other African Colonies there was an appreciable increase in 1930.

The relatively satisfactory state of the oil palm industry in the French Cameroons is attributed to the improvement in transport

facilities by the building of roads and railways. The industry is almost entirely in native hands and the authorities are encouraging the plantation of palms in thinly planted areas and are supplying seed for this purpose.

Details of the distribution of the exports are not available.

(ii) FRENCH TOGOLAND.

Exports of Palm Kernels from French Togoland have decreased by more than 50 per cent. between 1924 and 1929 and, since 1927, have been generally below the pre-war exports of the ex-German Colony of Togoland, which covered a slightly larger area than the present French Zone. This regression, according to the "Annuaire Economique Colonial, 1930," was mainly due to the neglect of the oil palm by the natives in favour of the cultivation of other foodstuffs, which find a more profitable market in the adjoining coastal area, and also to an insufficiency of rainfall in the years 1927-28, which considerably reduced the fruit yield of the oil palm. The decline in the exports of palm kernels in 1927-29 was coincident with a sharp rise in the exports of maize, manioc, yams and other foodstuffs, and in 1930, when exports of palm kernels rose to well above the 1927 level, there was a fall in the exports of these foodstuffs, which seems to indicate that the export trade in these crops is to some extent interchangeable with that of the oil palm products. The oil palm industry is mainly in the hands of the natives, but experimental stations have been established and plantations have been attempted on a small scale.

No details are available as to the distribution of the exports of palm kernels from Togoland.

**The Belgian Congo.**

The development of the oil palm in this Colony is one of the outstanding features of the industry. From being an insignificant source of the world's supply of palm products before the war, when it furnished about 2 per cent. of the volume entering world trade, the Belgian Congo has grown to be the second most important source of supply outside the British Empire and in recent years has furnished about 13 per cent. of the world supply. Between 1912 and 1924 its exports of palm kernels increased over eight-fold and between 1924 and 1930 there has been a further substantial increase. In no other producing area has such a remarkable development been recorded.

Prior to 1911 the industry was confined entirely to the Mayumbe district, a relatively restricted area, at the mouth of the Congo River. Production was accordingly small and exports of palm products showed no development up to that date, palm kernel exports amounting to approximately 6,000 tons per annum. No palm produce whatever was exported from the interior of the country, not because of the absence of the oil palm in those areas but owing to difficulties of transport and scarcity of labour. As later experience proved, natural palmeries existed in the interior to a sufficient extent to support a considerable industry.

The collapse of the Congo rubber industry in 1911, due partly to the competition of the Dutch East Indies and British Malaya, brought the Congo to the verge of bankruptcy, and turned attention to other possible sources of trade. In that year the "*Huileries du Congo Belge*," now a division of "*Huilever S.A.*," obtained extensive concessions from the Belgian Government, with a view to developing the palm products industry in the interior. In addition to the planting and industrial side, the Company has organised a very effective trading organisation, which has been largely instrumental in stimulating native interest in the industry, an important factor in an area where, in the last resort, the successful exploitation of the palmeries must depend upon native co-operation.

The heavy demand for vegetable oils during the war focussed attention on the potentialities of the Belgian Congo where large supplies of palm products were available. The Belgian authorities gave serious attention to the problems of production, and they claim that certain varieties of the Congo oil palm fruit are equal in quality to that produced on the modern plantations in British Malaya and the Dutch East Indies. Much research has been devoted to the best varieties of palms to plant, and, what is perhaps more important, attention has been devoted to developing the natural palmeries. The initial costs of plantation, moreover, have been kept low as the State which owns the land leases it for only a few centimes per hectare. Production is being rapidly extended by both native and European enterprise. Mills for treating the fruit, equipped with the latest machinery, have been erected, transport facilities provided and every encouragement given to organised production. Difficulties due to the comparative scarcity of native labour and distance of the principal producing areas from the sea are in this way being surmounted.

Progress for the first decade after the reorganisation of the industry was necessarily slow, but recent export figures offer striking evidence of the efficacy of the methods employed. This is also borne out by the figures published in a monograph issued by the International Congress of Tropical Agriculture held in Antwerp in July, 1930, which show that between 1914 and 1929 the percentage of palm kernels extracted from the fruit treated increased by more than 100 per cent. This result was obtained by improving both the methods of cultivation of the oil palm and the methods of extraction of the kernel.

Methods of cultivation have for the most part centred on the improvement of native palmeries, by cleaning away the undergrowth and thinning and pruning the trees, and this has resulted in a large increased yield per acre as the following table of the results obtained in a palmery of about 5,000 acres shows.

TABLE XII.—*Yield of Palm Fruit on a Cultivated Native Palmery.*(a)

Number of years after commence- ment of improved cultivation.				Yield in lbs. per acre.
2	..	..	..	445
3	..	..	..	710
4	..	..	..	1,115
5	..	..	..	1,250
6	..	..	..	1,425
7	..	..	..	1,560

(a) Source: Report on the oil palm industry in the Belgian Congo published by the International Congress of Tropical Agriculture, Antwerp, July, 1930.



The following table shows the exports of palm kernels from the Belgian Congo in the pre-war period and annually from 1924. It will be seen that in addition to the exports of domestic palm kernels, the Congo also re-exports appreciable quantities of palm kernels imported from the neighbouring French and Portuguese colonies and the mandated territory of Ruanda-Urundi.

TABLE XIII.—Exports of Palm Kernels from the Belgian Congo.  
(In tons.)

Source of Supply.	1912-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	
Congo produce—										
Upper Congo ..	(a)	37,199	60,996	57,690	61,350	60,196	62,682	54,006	} 46,418	
Lower Congo ..	(a)	9,518	11,915	11,608	11,472	11,188	11,501	11,288		
Total ..		6,945	46,717	72,911	69,298	72,822	71,384	74,183	65,294	46,418
Ruanda-Urundi (Mandated territory) produce .. ..	—	360	(b) 300	(b) 300	295	361	362	148	(d)	
Transit trade:—										
Produce of—										
French Africa ..	—	4,209	6,687	6,938	5,680	6,754	5,821	4,280	} (d)	
Angola .. ..	795	265	229	346	289	62	235	303		
Tanganyika ..	—	—	61	—	—	—	—	—		
Total ..		795	4,474	6,977	7,284	5,969	6,816	6,056	4,583	(d)
Grand Total ..		7,740	51,551	(a) 80,188	(c) 76,882	79,086	78,561	80,601	70,025	(c) 51,149

(a) Details are not available for both years. In 1912 the Lower Congo furnished 5,785 tons and the Upper Congo 42 tons.

(b) Approximate estimates; official figures not available.

(c) Partly estimated.

(d) Not yet available; assumed same as 1930 in Grand Total.

The rapid growth of exports of palm products from the Belgian Congo has become a matter of serious concern to producers in British West Africa, but as yet this competition seems mainly to be felt in the production of palm oil, where the efficient mechanical methods of extraction employed in the Congo are resulting in the production of a very high grade oil. This aspect of the question will be further

discussed in the chapter on Palm Oil. As far as palm kernels are concerned, mechanical aids to efficiency are not of such importance and in consequence the Nigerian industry has been better able to withstand Congo competition. After 1929, domestic exports of palm kernels from the Belgian Congo fell heavily while those from Nigeria have slightly increased.

The distribution of the domestic exports of palm kernels from the Belgian Congo is shown in the following table for 1912 and annually since 1924. Details of the trade of other pre-war years are not available nor is the distribution of the transit trade published in the official returns.

TABLE XIV.—*Distribution of Domestic Exports of Palm Kernels from the Belgian Congo.*

(In tons.)

COUNTRIES.	1912.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Belgium .. ..	303	36,674	69,275	65,535	67,042	62,168	62,357	45,378	} (a)
Angola .. ..	1,747	2,087	2,175	1,669	1,334	1,615	1,875	1,864	
Tanganyika ..	—	1,246	1,344	965	1,112	1,008	654	237	
Germany .. ..	682	314	11	—	2,228	5,530	6,414	14,417	
United Kingdom ..	681	4,322	—	1,100	1,091	855	—	1,474	
Netherlands ..	1,968	2,048	—	—	—	—	2,707	1,525	
Other countries ..	420	26	106	29	15	208	176	399	
Total .. ..	5,801	46,717	72,911	69,298	72,822	71,384	74,183	65,294	46,418(b)

(a) Details not yet available.  
 (b) Preliminary figure.

Although the bulk of the exports of palm kernels from the Belgian Congo are shipped to Antwerp, their ultimate destination is principally Germany and the Netherlands, only a small proportion being retained for Belgian consumption. Germany, since the war, has not only rapidly increased her direct shipments of kernels from the Congo but also her indirect shipments *via* Belgium.

#### Portuguese West Africa.

The Portuguese African Colonies of Angola, Portuguese Guinea, San Thomé and Príncipe produce considerable quantities of palm kernels, and in 1929 the exports exceeded 20,000 tons. In Angola the plantation method has recently been introduced and foreign

capital, chiefly Belgian, has been attracted to the industry, but this development is still in its infancy and production is for the most part in native hands.

The following table indicates the development of the trade in palm kernels from the Portuguese colonies in West Africa in recent years :—

TABLE XV.—*Exports of Palm Kernels from Portuguese West Africa.*  
(In tons.)

Colony.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.
Angola .. .. .	(a) 5,867	5,739	7,302	6,460	6,788	7,290	6,528	(a) 5,873
Portuguese Guinea ..	(a) 5,682	9,631	8,734	11,302	9,827	9,524	10,896	(a) 11,068
San Thomé and Príncipe (a)	1,001	2,990	3,284	2,729	3,338	2,942	3,338	(b) 3,000
<b>Total .. .. .</b>	<b>12,530</b>	<b>18,360</b>	<b>19,320</b>	<b>20,491</b>	<b>19,953</b>	<b>19,756</b>	<b>20,762</b>	<b>(c) 19,941</b>

(a) Source : Year Book of International Institute of Agriculture, Rome.

(b) Approximate estimate ; official figure not yet available.

(c) Partly estimated.

While there has been a marked increase in the total exports from Portuguese West Africa in comparison with the pre-war period, particularly from Portuguese Guinea and San Thomé and Príncipe, no appreciable development has occurred in recent years. Part of the exports may represent Congo produce since, according to the Congo returns, Angola does an import and export trade in palm kernels with the Belgian Congo. In the period 1924 to 1929 the net exports from the Belgian Congo to Angola averaged about 1,500 tons per annum, and in judging the volume of exports from Angola, allowance should be made for this amount which represents about one-fourth of the exports of palm kernels from that colony.

Details of the distribution of the exports are not available, but it is known that Portugal and Germany are the chief markets.

#### **Dutch East Indies.**

The results achieved from the intensive and scientific cultivation of the African oil palm on the east coast of Sumatra, which is by far the most important centre of cultivation in the Dutch East Indies,

indicate that this area may soon become an important source of supply of oil palm products. The cultivation of the oil palm in the Dutch East Indies commenced about 1914, and has been rapidly extended. Between 1916 and 1930 the total area planted rose from about 3,000 acres to over 150,000 acres. The progress in recent years is indicated by the following table.

TABLE XVI.—*Oil Palm Production in the Dutch East Indies.*(a)

Year.	Area Planted.	Area in Production.	Production of Kernels.
	Acres.	Acres.	Tons.
1921 .. .. .	31,972	8,288	151
1922 .. .. .	41,256	9,415	504
1923 .. .. .	47,028	11,300	715
1924 .. .. .	59,751	12,288	1,113
1925 .. .. .	78,155	23,998	1,717
1926 .. .. .	72,951	27,099	1,601
1927 .. .. .	106,913	39,571	3,884
1928 .. .. .	124,351	47,031	5,675
1929 .. .. .	142,604	58,002	6,952
1930 .. .. .	151,297	74,353	9,666

(a) Source: "Statistical Abstract for the Dutch East Indies."

In contrast to the African industry, practically all the oil palms in the Dutch East Indies are grown on plantations, there being very little native production. The industry has the advantage of a well-planned and scientifically organised association of planters, with well-equipped research stations, which enable planters to keep in touch with every development likely to render their work more efficient. The transportation difficulty has been solved by the use of narrow gauge railways from the plantations to factories, where the fruit is treated, the palm oil separated and the kernels extracted. The lengthy and wasteful native method of cracking the nuts and extracting the kernels by hand has been replaced by nut-cracking machines which are in general use in Sumatra.

The Dutch planters have sought with some success to cultivate a variety of palm with a high yield of pericarp and a low yield of kernel, the object being to produce a fruit with a higher oil palm content,

- palm oil being a much more valuable commodity than palm kernels. The shipment of palm kernels from the Dutch East Indies, as is indicated in the following table, has not as yet assumed large proportions, but it is developing rapidly and will no doubt continue to expand as the area in bearing increases.

TABLE XVII.—*Exports of Palm Kernels from the Dutch East Indies.*  
(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Netherlands .. ..	440	276	893	2,843	4,575	4,878	5,084	4,681
United Kingdom .. ..	540	850	1,004	357	270	371	1,211	1,538
Germany .. ..	248	324	263	306	696	1,462	3,182	4,590
Other countries .. ..	13	30	2	201	88	2	2	1,183
Total .. ..	1,241	1,480	2,162	3,707	5,629	6,713	9,479	11,992

As yet the volume of palm kernels shipped by the Dutch East Indies is small in comparison with the world total. In 1930 the total world export was over 550,000 tons, out of which the Dutch East Indies contributed only about 9,000 tons, and it seems probable that although the exports are increasing steadily, no serious competition in the palm kernel trade will be offered in the near future by the Dutch East Indies to the West African producers. The Dutch East Indian planters are devoting particular attention to the palm oil industry, and it is here that the competition of this new producing area is likely to be felt.

The Netherlands is now the largest importer of palm kernels from the Dutch East Indies, a position held by the United Kingdom until 1926. The Netherlands retains the bulk of these kernels for crushing, a small percentage only being entered for transshipment to other countries. Exports to Germany have increased rapidly and that country is also taking a larger share of the Dutch East Indian kernels transhipped from the Netherlands.

#### **Liberia.**

Liberia is a fairly important source of palm kernels, and during the period 1924 to 1930 this area exported on an average 8,000 tons of palm kernels per annum, the larger part of which was consigned

to Germany. No development in the trade in this commodity is observable and this may be attributed to transport difficulties. There are no railways and the only means of transport into the interior are by motors or ox-carts. Roads are being constructed and improvement in this direction may lead to a development of the oil palm industry.

The following table shows the available information regarding the volume and distribution of exports of palm kernels since 1924.

TABLE XVIII.—*Exports of Palm Kernels from Liberia. (a)*  
(In tons.)

COUNTRIES.	1924. (b)	1925.	1926.	1927.	1928.	1929.	1930.
Germany .. ..	} (c)	5,310	4,860	6,072	} (c)	} (c)	} (c)
Netherlands .. ..		1,601	1,996	2,003			
United Kingdom .. ..		2,061	1,276	855			
Other countries .. ..		—	6	1			
Total .. ..	8,218	8,972	8,138	8,931	7,584	8,589	6,313

(a) Export statistics for pre-war quinquennium not traced. Figures for the years 1928-30 supplied by H.M. Chargé d'Affaires, Monrovia.

(b) Source: Year Book of the International Institute of Agriculture, Rome.

(c) Details of distribution not available.

### Brazil.

The African oil palm was introduced into Brazil many years ago, and has become acclimatised particularly in the Amazon Valley. At present, however, there is only a negligible export of oil palm products, the palm oil being consumed for food, and the palm kernels largely neglected in favour of other more remunerative oil nuts. Of these, the Babassu nut is one of the most important, both on account of the quantity produced and its high oil content. The Babassu nut is similar to the palm kernel, but it is a distinct product and has not been included in this survey. Further details in regard to the Babassu nut will be found in a subsequent volume on Miscellaneous Oil Seeds and Nuts.

## **IMPORT.**

Prior to the War the oil seed crushing industry had shown a more rapid development on the Continent than in the United Kingdom. In the seventeenth century, linseed and rapeseed oil extraction was an established industry and at the beginning of the 19th century there were about 500 windmills crushing these seeds, mostly in Holland.<sup>(a)</sup> The industry grew up around the principal oilseed importing ports, such as Hull and Liverpool in the United Kingdom, Hamburg and Bremen in Germany, and the Rhine towns supplied by the ports of Antwerp and Rotterdam. These centres of production were also convenient centres of distribution for the oil and oilcake extracted by the crushing mills.

The principal object of the crushing industry in England in the past was for oilcake for cattle-feed, whilst on the Continent and especially in some parts of France and Germany the principal demand was for oils, and more particularly edible oils for the manufacture of margarine which prior to the War was in less demand in the United Kingdom than on the Continent. During and since the war, the margarine industry has made great strides in the United Kingdom, with the result that the crushing of such oilseeds and nuts as palm kernels, copra, sesame seed and groundnuts and the production generally of edible oils has considerably increased.

In regard to the crushing methods adopted, little change has occurred since the introduction of the present so-called Anglo-American system about 1872 and the improvements effected have been confined to comparatively small details of more efficient extraction. The general development of the oil crushing industry has been in the direction of increasing the capacity of mills, as the larger mills have proved to be more economical.

The following paragraphs relate to the importation of palm kernels into the chief consuming countries, and indicate the development and extent of their kernel crushing industries.

### **United Kingdom.**

During the war, the United Kingdom superseded Germany as the largest importer of palm kernels. The British Colonies in West Africa which were by far the largest exporters were also the nearest

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<sup>(a)</sup> See "Organisation and Business Methods of the Oilseed Trade," by G. N. Chapman, Secretary of the International Association of Seed Crushers.

sources of vegetable oil supply, a matter of much importance in war-time when transport facilities were of prime consideration. She retained this position until 1925, since when Germany has succeeded in recapturing the premier position in the palm kernel trade and the imports into the United Kingdom have considerably diminished.

Pre-war figures of United Kingdom imports of palm kernels are not available but on the basis of the distribution of the exports from British West Africa which then provided over 70 per cent. of the palm kernels entering world trade, the imports of this commodity into the United Kingdom in the pre-war quinquennium may be estimated at between 35,000 and 40,000 tons. The trade since 1914 was as follows :—

TABLE XIX.—*United Kingdom's Trade in Palm Kernels.*  
(In Tons.)

Year.	Imports.			Re-exports.	Amount retained.
	From British Countries.	From Foreign Countries.	Total.		
1914	66,186	8,611	74,797	9,185	65,612
1915	195,389	37,860	233,249	24,177	209,072
1916	186,650	54,851	241,501	29,490	212,011
1917	201,403	46,757	248,160	22,406	225,754
1918	268,930	26,404	295,334	—	295,334
1919	246,790	57,636	304,426	—	304,426
1920	248,092	38,434	286,526	1,331	285,195
1921	200,909	38,304	239,213	16,562	222,651
1922	196,038	16,100	212,138	5,644	206,494
1923	215,151	46,390	261,541	10,988	250,553
1924	240,980	56,021	297,001	9,404	287,597
1925	203,948	39,446	243,394	8,858	234,536
1926	179,713	41,816	221,529	6,057	215,472
1927	149,017	34,723	183,740	200	183,540
1928	141,655	22,590	164,245	126	164,119
1929	138,019	13,993	152,012	842	151,170
1930	113,648	12,193	125,841	174	125,667
1931	110,463	13,363	123,826	177	123,649



These figures clearly reflect the powerful impetus given to the crushing of palm kernels in the United Kingdom during the war and the effect of Germany's re-entry as an effective competitor for world supplies after 1924. By 1915, imports had risen from 75,000 to 233,000 tons and continued to expand to a peak of 304,000 tons in 1919. Since then they have rapidly declined with the exception of 1923 and 1924, when Germany's foreign trade was severely handicapped by currency difficulties. With the resumption of normal trading conditions in Germany the imports of palm kernels into the United Kingdom again fell and by 1931 had decreased to 124,000 tons or about 40 per cent. of the volume of the peak-year, 1919. Despite this diminution, the imports in 1931 were still about three times the estimated volume of the pre-war quinquennium.

The great bulk of the imports of palm kernels into the United Kingdom are derived from Empire sources. In no year for which details are available has the Empire supplied less than 75 per cent., and in 1929, 1930 and 1931 the proportion was about 90 per cent. Re-exports of palm kernels were relatively high during part of the war period and in the years 1915 to 1917 they averaged about 25,000 tons per annum, or slightly more than 10 per cent. of the imports, the bulk going to the Netherlands. In 1918 and 1919 no exports were recorded but an appreciable volume was exported in the years 1921 to 1926, averaging about 9,600 tons per annum of which 7,200 tons went to Germany. Since then the exports have considerably declined and in the period 1927 to 1931 averaged about 300 tons per annum.

The principal sources of the United Kingdom's imports of this commodity since 1924 are shown in Table XX on page 39 which also indicates the large fall in the share of the world's supplies taken by the United Kingdom.

Almost the whole of the Empire supplies are derived from British West Africa. Nigeria is by far the most important individual source and in the period 1924 to 1931 furnished no less than two-thirds of the aggregate imports of palm kernels into the United Kingdom. The non-Empire supplies come almost entirely from French West and Equatorial Africa. From March 1st, 1932, imports into the United Kingdom of palm kernels from foreign countries are

subject to a duty of 10 per cent. *ad valorem* and it is therefore probable that such imports will in future form an even smaller part of the whole than in the past.

TABLE XX.—Imports of Palm Kernels into the United Kingdom.  
(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
<b>British countries—</b>								
Nigeria (including British Cameroons) .. ..	175,054	151,823	141,365	117,469	114,121	117,477	98,292	95,493
Sierra Leone .. ..	57,801	47,466	32,411	27,598	25,236	15,703	14,909	13,708
Gold Coast (including British Togoland) ..	7,438	3,580	4,273	3,093	1,694	4,026	199	558
Gambia .. ..	505	591	634	407	318	262	51	83
Other British countries ..	182	488	1,030	450	286	551	197	621
<b>Total from British countries .. ..</b>	<b>240,980</b>	<b>203,948</b>	<b>179,713</b>	<b>149,017</b>	<b>141,655</b>	<b>138,019</b>	<b>113,648</b>	<b>110,463</b>
<b>Foreign countries—</b>								
French West and Equatorial Africa .. ..	48,543	35,087	39,161	33,766	21,043	13,429	10,135	11,472
Belgian Congo .. ..	4,355	1,915	58	50	904	—	—	362
Dutch East Indies .. ..	330	483	722	642	232	298	1,836	1,152
Liberia .. ..	898	912	789	224	65	82	45	89
Portuguese West Africa ..	422	346	10	—	16	9	(a)	17
Germany .. ..	—	345	567	12	1	—	—	—
Other foreign countries ..	1,473	358	509	29	329	175	177	271
<b>Total from foreign countries .. ..</b>	<b>56,021</b>	<b>39,446</b>	<b>41,816</b>	<b>34,723</b>	<b>22,590</b>	<b>13,993</b>	<b>12,193</b>	<b>13,363</b>
<b>Grand Total .. ..</b>	<b>297,001</b>	<b>243,394</b>	<b>221,529</b>	<b>183,740</b>	<b>164,245</b>	<b>152,012</b>	<b>125,841</b>	<b>123,826</b>
Percentage of total imports derived from British countries .. ..	81	84	81	81	86	91	90	89
Percentage of world supplies taken by United Kingdom	58	43	40	33	31	28	23	(b)

(a) Included in "Other foreign countries."

(b) Not yet available.

The development of palm kernel crushing in the United Kingdom is of course reflected in the variation in the net imports of palm kernels, and it is accordingly clear that it has suffered a severe setback

in recent years. Apart from the diminished demand from the domestic palm kernel oil using industries which will be referred to later, this decrease is due in part to the absence of a wide market in the United Kingdom for palm kernel cake. In contrast to Germany, where there is a large and growing demand for this cake (a), its use is not common amongst British farmers. Another cause of the decreased imports of palm kernels is bound up with the foreign trade in palm kernel oil. There has been in recent years a heavy fall in the exports of domestic palm kernel oil and a smaller, though not unimportant, increase in the importation of foreign oil. Between 1924 and 1931 exports of domestic palm kernel oil decreased from 31,254 tons to 6,834 tons, while imports during the same period rose from 365 tons in 1924 to 7,883 tons in 1930 but fell to 1,617 tons in 1931. Comparable pre-war figures are not available, as prior to 1914 the trade returns of the United Kingdom did not distinguish between palm oil and palm kernel oil. The exports of domestic palm kernel oil since 1924 are shown in the following table :—

TABLE XXI.—*Exports of Palm Kernel Oil produced in the United Kingdom.*

(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
<b>Unrefined oil—</b>								
United States of America	2,954	26,760	23,231	13,390	13,968	15,366	4,855	4,382
Poland (including Dantzig)	1,186	663	582	368	107	105	309	165
Portugal .. .. .	310	476	585	316	295	40	1	—
Germany .. .. .	8,753	486	103	261	10	15	580	67
France .. .. .	1,309	819	175	45	142	15	44	9
Netherlands .. ..	9,922	1,963	710	1,600	2,190	1	150	51
Belgium .. .. .	2,730	300	10	2	—	—	—	—
Other countries .. ..	1,098	795	699	404	674	542	733	789
<b>Total .. .. .</b>	<b>28,262</b>	<b>32,262</b>	<b>26,095</b>	<b>16,386</b>	<b>17,386</b>	<b>16,084</b>	<b>6,672</b>	<b>5,463</b>
<b>Refined oil—</b>								
Irish Free State .. ..	1,154	1,502	730	243	807	480	1,293	1,212
Other countries .. ..	1,838	1,808	905	735	578	143	454	159
<b>Total .. .. .</b>	<b>2,992</b>	<b>3,310</b>	<b>1,635</b>	<b>978</b>	<b>1,385</b>	<b>623</b>	<b>1,747</b>	<b>1,371</b>
<b>Grand Total .. ..</b>	<b>31,254</b>	<b>35,572</b>	<b>27,730</b>	<b>17,364</b>	<b>18,771</b>	<b>16,707</b>	<b>8,419</b>	<b>6,834</b>

(a) See Table XXX.

It will be seen that since 1925 there has been a heavy and fairly consistent fall in exports of both the refined and unrefined oil. The chief reduction is in the shipments to the United States, which after rising from about 3,000 tons in 1924 to nearly 27,000 tons in 1925 fell to less than 5,000 tons in 1931. Germany has acquired most of this lost trade. Exports to Germany and the Netherlands which together aggregated nearly 19,000 tons in 1924 practically ceased in 1929, and amounted to less than 1,000 tons in 1930 and little over 100 tons in 1931.

The foreign trade of the United Kingdom in imported palm kernel oil since 1924 is shown in the following table.

TABLE XXII.—*United Kingdom's Imports and re-exports of Palm Kernel Oil.*

(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Unrefined oil :—								
Imports from—								
Germany .. ..	—	1	25	—	232	4,129	6,953	323
Netherlands .. ..	6	45	302	587	191	1,121	115	221
Belgium .. ..	—	34	13	1	—	—	—	—
Other countries .. ..	29	21	10	41	67	114	219	75
Total .. ..	35	101	350	629	490	5,364	7,287	619
Re-exports .. ..	55	391	101	56	54	29	23	196
Net imports .. ..	(a) —20	(a) —290	249	573	436	5,335	7,264	423
Refined oil :—								
Imports from—								
Germany .. ..	(b)	(b)	(b)	(b)	(b)	203	341	7
Netherlands .. ..	192	47	131	206	315	90	90	285
Denmark .. ..	130	33	—	8	—	(b)	164	668
Sweden .. ..	7	30	268	267	76	—	—	—
Other countries .. ..	1	70	12	30	1	27	1	38
Total .. ..	330	180	411	511	392	320	596	998
Re-exports .. ..	—	37	23	29	85	—	41	20
Net imports .. ..	330	143	388	482	307	320	555	978
Grand Total, net imports	310	(a) —147	637	1,055	743	5,655	7,819	1,401

(a) Re-exports in excess of imports.

(b) Included in "Other countries."

The trade in foreign palm kernel oil shows a large increase in imports of unrefined oil which rose substantially in 1929 and 1930, when they averaged over 6,000 tons per annum as compared with 320 tons per annum in the five preceding years, but in 1931 they declined to about 600 tons. The increase in 1929 and 1930 was largely due to a considerable increase in imports from Germany. The result of this development has been to reduce the active balance in the palm kernel oil trade in 1931 to about 6,000 tons as against over 35,000 tons in 1925.

The diminished demand of the domestic industries using palm kernel oil has been very marked in recent years. Between 1924 and 1931 the apparent annual consumption fell from about 98,000 tons to about 50,000 tons, a decline of about 50 per cent. The estimated annual amount of palm kernel oil available for consumption since 1924 is shown in the following table. The loss of weight in refining palm kernel oil varies from 4 per cent. to 9 per cent., according to the grade of oil produced and in view of the relative unimportance of this loss it has been ignored in computing the weight of oil available for consumption.

TABLE XXIII.—*Estimated Amount of Palm Kernel Oil available for Consumption in the United Kingdom.*  
(In thousands of tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
United Kingdom produce (a) ..	129.4	105.5	97.0	82.6	73.9	68.0	56.6	55.6
Add: Net imports of foreign oil	0.3	(b) -0.1	0.6	1.1	0.7	5.7	7.8	1.4
	129.7	105.4	97.6	83.7	74.6	73.7	64.4	57.0
Less: Exports of domestic oil..	31.3	35.6	27.7	17.4	18.8	16.7	8.4	6.8
Estimated amount available for consumption.	98.4	69.8	69.9	66.3	55.8	57.0	56.0	50.2

(a) Oil equivalent of net imports of palm kernels estimated at 45 per cent. of weight of kernel.

(b) Exports in excess of imports.

This large decrease in the apparent consumption may be attributed in part to the greater utilisation of coconut oil which, it will be recalled, is to an important extent interchangeable with palm kernel oil for both edible and industrial purposes. Between the periods 1924 to 1927 and 1928-31 the aggregate apparent consumption of these oils was fairly steady but the proportion of palm kernel oil in

the total fell from 52 per cent. to 37 per cent. The following table shows the apparent annual consumption since 1924.

TABLE XXIV.—*Estimated Amounts of Palm Kernel Oil and Coconut Oil available for Consumption in the United Kingdom.*

Year.	Palm Kernel Oil.		Coconut Oil.		Total.
	Amount (in thousands of tons).	Proportion of the total (in per cent.).	Amount (in thousands of tons).	Proportion of the total (in per cent.).	
1924 .. ..	98	60	66	40	164
1925 .. ..	70	47	79	53	149
1926 .. ..	70	49	72	51	142
1927 .. ..	66	52	61	48	127
1928 .. ..	56	40	85	60	141
1929 .. ..	57	36	102	64	159
1930 .. ..	56	40	83	60	139
1931 .. ..	50	35	92	65	142
Average—					
1924-1927 ..	76	52	70	48	146
1928-1931 ..	55	38	91	62	146

**Germany.**

Before the war, Germany held a virtual monopoly of palm kernel crushing and although she was gradually relinquishing this position, she imported in the pre-war quinquennium no less than 76 per cent. of the world's supplies of palm kernels. The United Kingdom, France and the Netherlands had established oil-crushing plants shortly before the war to meet the growing demand for palm kernel and other vegetable oils, and this development was naturally hastened between 1914 and 1918. For some years afterwards, Germany's foreign trade was severely restricted by internal currency difficulties, and it was not until these were surmounted in 1924 that her imports of palm kernels began to recover rapidly. In 1927 imports exceeded the pre-war level for the first time and they have since further increased, and in the period 1928-31 were 20 per cent. above the pre-war quinquennium. Notwithstanding this large increase, Germany's share of the world's imports of palm kernels is far below that of 1909-13.

The following table shows the average annual imports of palm kernels into Germany in the pre-war period and the annual figures since 1924, together with the share of the world's supplies taken by Germany. No figures of re-exports are available but the re-export trade is known to be very small.

TABLE XXV.—Imports of Palm Kernels into Germany.  
(Special Trade.)  
(In tons.)

COUNTRIES.	1909-13 (Average) (a)	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
British West Africa	219,169	79,594	147,678	162,004	186,387	196,707	204,476	211,983	184,343
Belgian Congo ..	199	8,933	50,891	58,523	70,206	83,207	80,439	78,554	64,380
French West Africa	6,665	241	4,249	3,678	2,671	4,481	4,246	2,143	3,397
Camerouns ..	3,514	327	718	4,235	4,788	1,444	2,640	1,935	572
Liberia ..	1,964	9,269	7,866	3,072	1,877	1,415	518	777	539
Togoland ..	6,759	12	371	1,713	1,054	291	—	146	98
Dutch East Indies	(b)	898	1,113	713	1,259	2,493	2,118	3,177	4,674
Portuguese West Africa ..	1,289	1,213	113	546	868	2,355	1,157	213	221
British India ..	(b)	2	—	295	—	—	1,298	2,467	(b)
Union of South Africa ..	47	559	8,198	—	—	140	120	—	(b)
Other countries ..	666	508	594	—	228	76	2,591	452	4,926
Total ..	240,272	101,556	221,791	234,779	269,338	292,609	299,603	301,847	263,128
Percentage of world supplies taken by Germany ..	76	20	39	43	48	55	56	54	(c)

(a) Pre-war frontiers. (b) Included in "Other countries." (c) Not available.

Almost the whole of the palm kernels entering Germany for consumption now come from British West Africa and the Belgian Congo, according to the German returns of special trade which indicate the country of origin as distinct from the country of consignment. This system of recording imports results in substantial discrepancies between the individual figures of exports from countries of consignment and the import figures into Germany, but the differences become relatively small if the aggregate figures are compared. In the period 1924 to 1931, British West Africa furnished 69 per cent. of Germany's imports of this commodity and the Belgian

Congo 25 per cent. In the pre-war quinquennium British West Africa provided over 91 per cent. of the total and the diminution in its share of German trade is entirely due to the rapid rise of the Belgian Congo as an exporter.

Since 1925 there has been a close correlation between the movement in the imports of palm kernels into Germany and the United Kingdom—the two countries which together absorb between 80 and 90 per cent. of the world's supplies of this commodity. As will be seen from the following table, the rise in Germany's imports has, on the whole, coincided with an almost equal fall in those of the United Kingdom.

TABLE XXVI.—*Imports of Palm Kernels by the United Kingdom and Germany.*

(In thousands of tons.)

Year.	United Kingdom. (a)	Germany. (b)	Total.
1925 .. ..	234.5	221.8	456.3
1926 .. ..	215.5	234.8	450.3
1927 .. ..	183.5	269.3	452.8
1928 .. ..	164.1	292.6	456.7
1929 .. ..	151.2	299.6	450.8
1930 .. ..	125.7	301.8	427.5
1931 .. ..	123.6	263.1	386.7

(a) Net imports.

(b) Gross imports. The re-exports of palm kernels are not separately indicated in the trade returns, but are known to be small.

The crushing of palm kernels in Germany, which had virtually ceased towards the end of the war, has more than rehabilitated itself, and Germany is now crushing more kernels than before the war, both for the export trade and for home consumption. Since the war the foreign trade in palm kernel oil has changed from a net import trade of over 11,000 tons in 1920 to a net export trade of 41,600 tons in 1930, but in 1931 there was a substantial decline to about 29,000 tons. The post-war development was no doubt encouraged by the import duties imposed in 1925 on edible oils and fats which were intended to further the oilseed crushing and processing industries.



The German trade in palm kernel oil before and since the war is shown in the following table :—

TABLE XXVII.—*Germany's Trade in Palm Kernel Oil.*  
(*Special Trade.*)  
(In tons.)

Year.	Exports.	Imports.	Net exports (+) or Net imports (—).
1909 .. ..	41,914	39	+ 41,875
1910 .. ..	43,135	52	+ 43,083
1911 .. ..	38,237	129	+ 38,108
1912 .. ..	31,822	6	+ 31,816
1913 .. ..	28,491	48	+ 28,443
1920 .. ..	2	11,061	— 11,059
1921 .. ..	479 (a)	11,965	— 11,486 (b)
1922 .. ..	2,396	3,605	— 1,209
1923 .. ..	4,163	10,409	— 6,246
1924 .. ..	3,732	6,218	— 2,486
1925 .. ..	13,825	3,448	+ 10,377
1926 .. ..	18,378	1,448	+ 16,930
1927 .. ..	25,028	968	+ 24,060
1928 .. ..	37,593	1,817	+ 35,776
1929 .. ..	42,060	975	+ 41,085
1930 .. ..	43,690	2,090	+ 41,600
1931 .. ..	30,916	1,471	+ 29,445

(a) May to December only. Full year's figures not available.

(b) Approximate.

Table XXVIII shows the principal countries participating in Germany's foreign trade in palm kernel oil. Perhaps the most striking feature revealed is the re-entry of the United Kingdom in the list of purchasers of German palm kernel oil during 1929 and 1930. Prior to the war she was the second largest consignee, but her imports of palm kernels were then relatively small. In 1929 and 1930 she was again importing large quantities of German palm kernel oil, but in 1931 these imports fell substantially and the recent imposition of the 10 per cent. tariff on foreign vegetable oils by the United Kingdom will no doubt act as a deterrent to further imports. The United States of America since 1925 has been Germany's largest purchaser,

thus re-occupying the position she held before the war. The decrease in exports to the Netherlands has been accompanied by an increase in the imports from that country. It will be observed that increasing quantities of palm kernel oil are shown as imported from British West Africa, but the trade returns of that area show only insignificant amounts as exported. It would, therefore, appear that the description of the oil or the source indicated in the German trade returns is inexact.

TABLE XXVIII.—*Germany's Trade in Palm Kernel Oil.*  
(*Special Trade.*)  
(In tons.)

	1909-13 (Average). (a)	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
<b>Exports to—</b>									
United States of America ..	13,002	240	3,361	5,166	7,090	10,659	20,186	16,709	10,070
Poland ..	—	330	1,882	3,134	4,323	6,883	6,615	8,892	7,945
United Kingdom ..	11,135	—	—	35	—	352	5,682	6,799	112
Czechoslovakia ..	—	1,359	3,571	4,270	3,891	4,080	4,559	4,874	5,763
Netherlands ..	499	596	1,182	2,673	4,936	7,482	1,214	52	55
Austria ..	7,812	315	991	550	1,088	1,404	1,079	1,116	1,154
Switzerland ..	1,353	241	882	804	1,323	1,450	1,051	1,528	1,352
Belgium ..	816	(b)	(b)	(b)	(b)	(b)	(b)	(b)	67
Finland ..	255	—	154	57	97	191	180	(b)	133
Denmark ..	860	362	443	—	5	393	(b)	(b)	196
Danzig ..	—	37	352	400	494	1,567	533	1,901	3,001
Hungary ..	—	45	295	456	816	1,203	114	220	119
Other countries ..	1,043	207	712	833	965	1,929	847	1,599	949
<b>Total ..</b>	<b>36,775</b>	<b>3,732</b>	<b>13,825</b>	<b>18,378</b>	<b>25,028</b>	<b>37,593</b>	<b>42,060</b>	<b>43,690</b>	<b>30,916</b>
<b>Imports from—</b>									
United Kingdom ..	36	5,356	530	583	32	99	165	185	154
Netherlands ..	(b)	667	2,582	690	739	1,271	409	1,402	610
British West Africa ..	—	—	—	58	94	146	88	303	327
Dutch East Indies ..	—	—	—	—	—	152	210	176	222
Other countries ..	19	195	336	117	103	149	103	24	158
<b>Total ..</b>	<b>55</b>	<b>6,218</b>	<b>3,448</b>	<b>1,448</b>	<b>968</b>	<b>1,817</b>	<b>975</b>	<b>2,090</b>	<b>1,471</b>
<b>Net exports ..</b>	<b>36,720</b>	<b>(c)2,486</b>	<b>10,377</b>	<b>16,930</b>	<b>24,060</b>	<b>35,776</b>	<b>41,085</b>	<b>41,600</b>	<b>29,445</b>

(a) Pre-war frontiers.

(b) Included in "Other countries."

(c) Net import.

The domestic consumption of palm kernel oil in Germany has also substantially increased since the war, and for some years Germany has apparently been consuming fully 30 per cent. more palm kernel oil than in the pre-war quinquennium, although in 1931 an appreciable decrease in the apparent supply has taken place. The estimated annual amount available for consumption is shown in the following table.

TABLE XXIX.—*Estimated Amount of Palm Kernel Oil available for Consumption in Germany.*

(In thousands of tons.)

	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
German production (a) ..	108.1	45.7	99.8	105.7	121.2	131.7	134.8	135.8	118.4
Add: Imports .. ..	0.1	6.2	3.4	1.4	1.0	1.8	1.0	2.1	1.5
	108.2	51.9	103.2	107.1	122.2	133.5	135.8	137.9	119.9
Less: Exports .. ..	36.8	3.7	13.8	18.4	25.0	37.6	42.1	43.7	30.9
Estimated amount available for consumption .. ..	71.4	48.2	89.4	88.7	97.2	95.9	93.7	94.2	89.0

(a) Oil equivalent of imports of palm kernels estimated at 45 per cent. of weight of kernels.

It will be seen that the average net exports of palm kernel oil in the period 1928-31 have been at about the pre-war figure, as a result of the rapid expansion of exports. Imports have rapidly declined but are still appreciably higher than in the pre-war period and since 1926 have shown no decided downward trend. The substantial increase in Germany's export trade in palm kernel oil since 1925 has been largely effected at the expense of British trade. The annual net exports from the United Kingdom decreased from about 35,700 tons in 1925 to about 600 tons in 1930, while in the same period net exports from Germany increased from 10,400 to 41,600 tons. In 1931 the tendency was reversed; net exports from the United Kingdom rose by nearly 5,000 tons to 6,000 tons, while those from Germany fell by about 12,000 tons to 29,400 tons.

Apart from the oil produced, the residue of the palm kernels which is manufactured into palm kernel cake is an important commodity. Germany, having an important livestock industry and comparatively poor pasturage in many districts, provides a ready market for palm kernel cake as cattle food. In the United Kingdom, on the other hand, the potentialities of palm kernel cake as a cattle feed have not been exploited to any marked degree. The following table shows the estimated annual amount of palm kernel cake available for consumption in Germany since 1924.

TABLE XXX.—*Estimated Amount of Palm Kernel Cake Available for Consumption in Germany.*

(In thousands of tons.)

Year.	Production. (a)	Net Imports.	Estimated Amount available for Consumption.
1924 .. ..	55.9	(b)	(c)
1925 .. ..	122.0	(b)	(c)
1926 .. ..	129.1	(b)	(c)
1927 .. ..	148.1	(b)	(c)
1928 .. ..	160.9	(b)	(c)
1929 .. ..	164.8	2.6	167.4
1930 .. ..	166.0	9.0	175.0
1931 .. ..	144.7	22.8	167.5

(a) Computed at 55 per cent. of weight of imported kernels.

(b) Not separately indicated in trade returns.

(c) Not available.

#### The Netherlands.

The Dutch trade in palm kernels is largely a transit trade and only a relatively small proportion of the imports are retained for domestic consumption. In this respect the Dutch trade resembles that of Belgium, but whereas in the case of Belgium the crushing of palm kernels has shown no development since before the war, the Dutch industry has grown very substantially.

The following table shows the Dutch trade in palm kernels and the annual quantities retained for home consumption.

TABLE XXXI.—*Dutch Trade in Palm Kernels.*

(In tons.)

	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	
<b>Imports from—</b>										
British West Africa ..	16,799	18,293	6,809	9,691	27,743	30,060	25,020	52,348	} (a)	
Belgian Congo ..	—	23,592	27,897	45,790	51,106	52,302	50,798	39,796		
French Africa ..	—	2,199	54	1,620	4,857	3,827	3,674	16,770		
Dutch East Indies ..	—	—	1,503	1,587	2,893	5,173	4,753	6,372		
Belgium ..	835	10,706	10,436	8,966	6,548	8,237	6,484	6,200		
Union of South Africa ..	—	—	64	48	315	104	376	564		
Germany ..	30,225	2,093	3,959	1,414	563	624	228	54		
Other countries ..	147	19,145 (a)	32,721 (a)	13,084 (a)	2,581	1,806	5,602	1,622		
<b>Total ..</b>	<b>48,006</b>	<b>76,028</b>	<b>83,443</b>	<b>82,200</b>	<b>96,606</b>	<b>102,133</b>	<b>96,935</b>	<b>123,726</b>		<b>(a)</b>
<b>Exports to—</b>										
Germany ..	44,172	40,085	65,472	62,148	78,735	94,675	84,992	91,244	} (a)	
Denmark ..	—	—	—	—	—	—	317	2,101		
United Kingdom ..	—	9,700	1,553	1,063	482	181	279	1,085		
Belgium ..	122	3,308	822	1,224	680	399	400	344		
France ..	—	—	—	—	—	—	339	317		
Other countries ..	19	1,807	—	—	4	175	3,361	17		
<b>Total ..</b>	<b>44,313</b>	<b>54,900</b>	<b>67,847</b>	<b>64,435</b>	<b>79,901</b>	<b>95,430</b>	<b>89,688</b>	<b>95,108</b>	<b>(a)</b>	
<b>Amount retained</b>	<b>3,693</b>	<b>21,128</b>	<b>15,596</b>	<b>17,765</b>	<b>16,705</b>	<b>6,703</b>	<b>7,247</b>	<b>28,618</b>	<b>25,520</b>	

(a) Details not yet available.

Before the war, the Netherlands obtained almost the whole of its palm kernels from Germany and British West Africa, the German kernels being for the most part undoubtedly of British West African origin. After the war the Belgian Congo remained for many years the most important source of supply. During the period 1924 to 1929 the annual imports of palm kernels from the Belgian Congo and Belgium, which obtains almost the whole of its imports of palm kernels from the Belgian Congo, averaged about 50,000 tons as

compared with about 20,000 tons from British West Africa. In 1930 there was a marked change in the relative importance of the sources of supply; imports of British West African kernels in that year increased from 25,000 to 52,000 tons, of French West African from less than 4,000 to more than 16,000 tons, whereas imports of Congo kernels, both direct and through Belgium, decreased from 57,000 to 46,000 tons. The increasing production of palm kernels by the Dutch East Indies is at present being mainly absorbed by the Netherlands and imports from that source have made steady progress but still account for only about 5 per cent. of the aggregate amount.

The volume of imports has risen fairly consistently and during the past few years has been on an average over double the pre-war volume. A record level was attained in 1930, when imports aggregated 123,700 tons as compared with 48,000 tons in the pre-war quinquennium.

Exports of palm kernels go almost entirely to Germany, which on an average has taken about 95 per cent. of the whole since 1924. Before the war, Germany was recorded as the principal consignee of kernels from the Netherlands as well as the principal consignor. This apparent anomaly is due to the fact that prior to 1917 the Dutch trade returns did not specify the country of origin or of ultimate destination but solely the country through which the commerce first passed in the case of exports or last passed in the case of imports. Thus in the pre-war quinquennium the large imports recorded from Germany probably represent African kernels imported *via* Hamburg and the large exports recorded to Germany in the same period probably include kernels consigned *via* Germany to other central European countries. This difficulty is also present in the post-war period, though not to such a marked degree. For instance, prior to 1928 a large part of the imports of kernels by Czechoslovakia are recorded in the Czechoslovakian returns as coming from the Netherlands whereas the Netherlands record no exports to Czechoslovakia.

The retention of palm kernels by the Netherlands, although still a small part of the total imports, has been on a much higher level since 1924 than in the pre-war quinquennium. The amount retained in the seven years 1924 to 1931 averaged over 17,000 tons annually as compared with less than 4,000 tons before the war. This large increase is due to the development of the Dutch crushing industry.

which is in turn linked up with an expanding vegetable fat industry and a growing export trade in palm kernel oil. Additional encouragement to the crushing industry has been provided by an increased import duty on all vegetable oils operative from January 1st, 1932.

The Dutch trade in palm kernel oil which is, on balance, an export trade, is fairly substantial. Imports, which are derived mainly from Germany, fell off considerably in 1929 and 1930, after having shown a large and consistent increase, but exports, the bulk of which are recorded as going to Germany and Belgium, have on the whole been fairly well maintained. The following table shows the details of this trade since 1924. Pre-war figures are not available as the Dutch trade returns did not then distinguish palm kernel oil from certain other vegetable oils.

TABLE XXXII.—*Dutch Trade in Palm Kernel Oil.*  
(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931. (b)
<b>Imports from—</b>								
Germany .. ..	—	1,317	2,716	4,725	5,300	790	267	
United Kingdom ..	6,361	1,600	515	1,360	2,429	41	1	
Other countries ..	1,648	497	15	6	488	625	377	
<b>Total ..</b>	<b>8,009</b>	<b>3,414</b>	<b>3,246</b>	<b>6,091</b>	<b>8,217</b>	<b>1,456</b>	<b>645</b>	
<b>Exports to—</b>								
Belgium .. ..	5,640	3,815	3,413	4,838	3,249	1,185	2,174	
Germany .. ..	4,081	812	1,236	332	981	596	1,728	
Poland .. ..	(a)	124	143	110	95	207	677	
Finland .. ..	(a)	12	45	16	102	47	667	
France .. ..	(a)	83	34	40	358	27	566	
Sweden .. ..	(a)	330	61	90	5	35	356	
Switzerland .. ..	(a)	144	38	60	41	32	308	
Portugal .. ..	(a)	5	28	76	103	—	173	
United Kingdom ..	(a)	38	203	606	216	36	165	
Czechoslovakia ..	(a)	—	—	66	—	—	11	
Norway .. ..	(a)	6	7	114	40	—	4	
United States of America .. ..	(a)	30	1,368	329	163	40	—	
Other countries ..	541	74	111	103	196	155	239	
<b>Total ..</b>	<b>10,262</b>	<b>5,473</b>	<b>6,687</b>	<b>6,780</b>	<b>5,579</b>	<b>2,360</b>	<b>7,068</b>	
<b>Net exports ..</b>	<b>2,253</b>	<b>2,059</b>	<b>3,441</b>	<b>689</b>	<b>2,638(c)</b>	<b>904</b>	<b>6,423</b>	<b>4,978</b>

(a) Included in "Other countries."

(b) Details not yet available.

(c) Net imports.

The same difficulties as occur in the case of palm kernels in regard to distinguishing the ultimate destination of exports and the true origin of imports occur in regard to the trade in palm kernel oil.

The estimated amount of palm kernel oil available annually for domestic consumption since 1924 is shown in the following table. It will be seen that there has been some tendency towards increased consumption since 1926.

TABLE XXXIII.—*Estimated Amount of Palm Kernel Oil available for Consumption in the Netherlands.*

(In thousands of tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Netherlands production (a)	9.5	7.0	8.0	7.5	3.0	3.3	12.9	11.5
Net exports .. ..	2.3	2.1	3.4	0.7	2.6(b)	0.9	6.4	5.0
Estimated amount available for consumption ..	7.2	4.9	4.6	6.8	5.6	2.4	6.5	6.5

(a) Oil equivalent of net imports of palm kernels estimated at 45 per cent. of weight of kernels.

(b) Net imports.

The margarine industry in the Netherlands, in which palm kernel oil largely enters has shown some decline in recent years. According to the official statistics (\*) the production of margarine increased substantially until 1927, when it amounted to about 138,000 tons, but thereafter it steadily diminished, and in 1930 it amounted to about 125,000 tons. At the same time, the proportion of vegetable oils in the raw materials used in the industry has consistently decreased, falling from about 80 per cent. in 1927 to about 50 per cent. in 1930, and this is no doubt due to the greater utilisation of whale oil. The greater part of the reduced consumption of vegetable oils in this industry, details of which are not furnished, appears to have fallen on coconut oil, the apparent consumption of which has appreciably decreased. The following table shows the apparent annual consumption of palm kernel oil and coconut oil in the Netherlands since 1924.

(\*) See "Maandschrift Van het Centraal Bureau Voor de Statistiek," April 30, 1931.



TABLE XXXIV.—*Estimated Amounts of Palm Kernel Oil and Coconut Oil available for Consumption in the Netherlands.*

Year.	Palm Kernel Oil.		Coconut Oil.		Total.
	Amount.	Proportion of the total.	Amount.	Proportion of the total.	
	thousands of tons.	per cent.	thousands of tons.	per cent.	thousands of tons.
1924 ..	7.2	13	47.1	87	54.3
1925 ..	4.9	12	38.5	88	43.4
1926 ..	4.6	8	50.5	92	55.1
1927 ..	6.8	14	40.5	86	47.3
1928 ..	5.6	14	33.4	86	39.0
1929 ..	2.4	7	33.6	93	36.0
1930 ..	6.5	26	18.7	74	25.2
1931 ..	6.5	26	18.3	74	24.8
Average—					
1924-27 ..	5.9	12	44.2	88	50.1
1928-31 ..	5.3	17	26.0	83	31.3

**Czechoslovakia.**

Annual imports of palm kernels into Czechoslovakia now exceed 20,000 tons as compared with an annual average of about 12,000 tons in the period 1924 to 1928. The following table shows the annual imports since 1924.

TABLE XXXV.—*Imports of Palm Kernels into Czechoslovakia. (Special Trade.)*  
(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Netherlands ..	14,447	13,261	11,836	2,162	—	—	—	—
British West Africa ..	826	—	—	6,499	11,750	17,222	19,901	22,698
Other countries ..	15	406	17	52	743	3,372	745	102
Total .. ..	15,288	13,667	11,853	8,713	12,493	20,594	20,646	22,800

It will be seen that almost the whole of the palm kernels imported in the period 1924 to 1926 are recorded as coming from the Netherlands but their original source is not indicated. From 1927 they are

shown as coming for the most part from British West Africa and there is little doubt that that country was the main source of the imports in the preceding period. Neither the Dutch nor the British West African trade returns show exports of palm kernels to Czechoslovakia. This apparent disagreement between the trade returns of consignor and consignee countries is of course not uncommon where commodities are not shipped direct and is due to the different methods of recording such transit trade.

For several years now, no re-exports of palm kernels from Czechoslovakia have been recorded and presumably the whole of the imports are crushed in the country. In addition to the oil so produced substantial quantities are imported, while there are also some relatively small exports. The Czechoslovakian trade in palm kernel oil since 1924 is indicated in the following table.

TABLE XXXVI.—*Czechoslovakian Trade in Palm Kernel Oil.*  
(*Special Trade.*)  
(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Imports from—								
Germany (a) .. ..	3,364	4,111	4,113	5,050	4,991	4,149	4,310	5,674
United Kingdom .. ..	897	90	119	30	—	17	439	—
Netherlands .. ..	647	79	—	23	—	118	29	—
Italy .. ..	57	—	—	—	—	—	—	—
British West Africa ..	49	—	—	18	35	189	—	—
Belgium .. ..	22	—	—	6	—	—	—	—
Other countries .. ..	11	17	6	6	15	12	89	101
Total .. ..	5,047	4,297	4,238	5,133	5,041	4,485	4,867	5,775
Exports .. ..	157	165	447	10	445	452	166	150
Net imports .. ..	4,890	4,132	3,791	5,123	4,596	4,033	4,701	5,625

(a) Including Hamburg and Bremen.

It will be seen that the annual net imports of palm kernel oil have varied between about 4,000 and 5,000 tons since 1924. By far the principal source of the imports is Germany but a part of these imports—less important now than was formerly the case—is probably not of

German origin since it reaches Czechoslovakia via Hamburg and Bremen, and is thus, no doubt, transit trade. It will be observed that small quantities of palm kernel oil are shown as imported from British West Africa but the trade returns of that area for the years in question show only insignificant amounts of palm kernel oil as exported and it would therefore appear that the description of the oil or the source indicated in the Czechoslovakian trade returns is inexact. The Czechoslovakian export trade in palm kernel oil averaged about 250 tons per annum over the period 1924 to 1931.

The estimated volume of palm kernel oil available for domestic consumption has shown a marked increase in the past few years and in 1931 amounted to about 16,000 tons as compared with about 9,000 tons in 1927. The annual figures since 1924 are as follows.

TABLE XXXVII.—*Estimated amount of Palm Kernel Oil available for Consumption in Czechoslovakia.* \*

(In thousands of tons.)

Year.	Oil equivalent of Imports of Palm Kernels (a).	Net Imports of Palm Kernel Oil.	Amount available.
1924 ..	6.9	4.9	11.8
1925 ..	6.2	4.1	10.3
1926 ..	5.3	3.8	9.1
1927 ..	3.9	5.1	9.0
1928 ..	5.6	4.6	10.2
1929 ..	9.3	4.0	13.3
1930 ..	9.3	4.7	14.0
1931 ..	10.3	5.6	15.9

(a) Oil equivalent of imports of palm kernels estimated at 45 per cent. of weight of kernels.

#### Denmark.

Imports of palm kernels into Denmark have shown a very large increase in recent years, the volume rising from about 1,000 tons in 1925 to over 18,000 tons in 1930, but in 1931 there was a substantial decrease to about 10,000 tons. Before the war, Denmark's imports of kernels, which averaged about 1,300 tons per annum were definitely decreasing and ceased completely between 1915 and 1918. In 1919 over 8,000 tons were imported but this level was not maintained and

the average annual imports during the period 1920 to 1923 were 3,500 tons. Imports were small in 1924 and 1925 but in 1926 they rose to 6,000 tons and have since shown a marked upward tendency.

The following table shows the annual imports since 1924 together with the average of the pre-war period.

TABLE XXXVIII.—*Imports of Palm Kernels into Denmark.*  
(*Special Trade.*)  
(In tons.)

COUNTRIES.	1911-13 (Average). (a)	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931. (b)
United Kingdom ..	—	—	—	—	3,448	9,956	9,576	15,499	
Germany .. ..	103	1,598	1,028	6,017	8,413	461	72	2,794	
Portugal .. ..	—	—	—	—	1,491	1,713	—	—	
Dutch East Indies	779	—	—	—	—	—	—	—	
British India ..	322	—	—	—	—	—	—	—	
Other countries ..	63	151	—	—	—	—	—	—	
Total ..	1,267	1,749	1,028	6,017	13,352	12,130	9,648	18,293	10,442

(a) Includes a slightly smaller area than in the post-war period. The trade returns prior to 1911 do not separately specify palm kernels.

(b) Preliminary figure, details not yet available.

From 1928 to 1930 the bulk of the Danish imports of palm kernels came from the United Kingdom, whereas prior to this, except for a period in the early part of the war, no imports were obtained from this source. Germany had been for some years almost the sole source of supply, but since 1928 that country has been furnishing only a small proportion of Denmark's palm kernel imports.

Between 1919 and 1922 Denmark imported a large part of her palm kernels direct from the African producing areas, but since 1923 she has secured her supplies indirectly and their origin is therefore not indicated, although the returns of British West Africa since 1927 show appreciable quantities exported to Denmark (exceeding 5,000 tons in each of the years 1928 and 1929, and nearly 11,000 tons in 1930). It may be assumed that the kernels indicated as coming from Portugal are Portuguese African produce. Prior to the War, British India and the Dutch East Indies figure as the chief sources of supply, but neither of these areas was then a producer of palm kernels.

No re-exports of palm kernels from Denmark are indicated in the period under review and the whole of the imports are no doubt crushed in the country. The ready demand for oil cake in Denmark as also in the Netherlands has played some part in the development of the kernel crushing industry. The trade returns also show an increase in the net exports of palm kernel oil since 1929 which indicates that the crushing industry is now able to provide a growing export surplus as well as cope with a substantially increased domestic consumption of the oil.

The following table shows the Danish trade in palm kernel oil since 1925, the first year for which the returns separately indicate this commodity.

TABLE XXXIX.—*Danish Trade in Palm Kernel Oil.*  
(*Special Trade.*)  
(In tons.)

	1925.	1926.	1927.	1928.	1929.	1930.
Imports from—						
United Kingdom ..	163	—	—	32	—	—
Germany .. ..	804	—	—	486	15	39
Netherlands ..	(a)	—	—	4	—	—
Other countries ..	29	—	—	—	2	4
Total .. ..	996	—	—	522	17	43
Exports to—						
Poland .. ..	83	309	1,297	696	194	128
Lithuania .. ..	(a)	77	46	50	30	250
Norway .. ..	(a)	(a)	(a)	100	27	2
Finland .. ..	(a)	23	90	44	4	20
Sweden .. ..	(a)	26	298	46	2	51
Bulgaria .. ..	10	18	117	10	—	—
Faroe Islands ..	18	15	53	—	—	—
Other countries ..	53	35	52	122	26	375
Total .. ..	164	503	1,953	1,068	283	826
Net exports .. ..	832(b)	503	1,953	546	266	783

(a) Included in "Other countries."

(b) Net Imports.

Note.—Details of imports for 1931 are not yet available. Preliminary figures of exports show an increase to 1,264 tons.

The following table shows the estimated annual consumption of palm kernel oil in Denmark since 1925. It will be seen that a fairly consistent and strongly marked increase was effected until 1930, but that a substantial decrease occurred in 1931, probably attributable to the decreased demand for oil-cake and margarine, owing to the relatively low price of grain and butter.

TABLE XL.—*Estimated Amount of Palm Kernel Oil available for Consumption in Denmark.*(a)

(In thousands of tons.)

	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Danish production (b) ..	0.5	2.7	6.0	5.5	4.3	8.2	4.7
Net exports (-) or net imports (+) ..	+0.8	-0.5	-2.0	-0.5	-0.3	-0.8	-1.2(c)
Estimated amount available for consumption	1.3	2.2	4.0	5.0	4.0	7.4	3.5

(a) Details not available prior to 1925.

(b) Oil equivalent of imports of palm kernels estimated at 45 per cent. of weight of kernels.

(c) Preliminary figure, allowing for imports as in 1930.

A large part of the palm kernel oil available is utilised in the edible fat industry. Not only is the production of margarine increasing in Denmark but the proportion of palm kernel oil used in its manufacture appears to be rising at the expense of coconut oil. According to the official statistics of industrial production, (\*) the amount of palm kernel oil utilised for this purpose in 1930 was about 4,400 tons as against less than 1,000 tons per annum in the period 1924-27. The annual utilisation of coconut oil during the same period decreased from about 34,000 tons in 1924-27 to about 25,000 tons in 1930. The following table indicates the various ingredients utilised in margarine production since 1924. The growing proportion of animal oils and fats which has occurred, may be attributed to the greater utilisation of whale oil, which is presumably included under the item "prepared animal oils."

(\*) "Statistiske Efterretninger," 17th June, 1931.

TABLE XLI.—*Materials used in the Manufacture of Margarine in Denmark.*(a)

(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.
<b>Animal fats and oils—</b>							
Oleomargarine ..	1,301	1,279	1,289	1,073	804	815	1,041
Animal stearin ..	124	—	—	30	59	240	92
Premier jus ..	2,479	2,509	2,647	2,880	2,842	3,106	2,952
Neutral lard and other pork fat ..	501	403	413	448	555	588	689
Prepared animal oils	856	1,643	3,159	4,619	6,667	7,466	10,126
Other animal oils and fats ..	—	59	30	7	1	2	5
<b>Total animal fats and oils</b>	<b>5,261</b>	<b>5,893</b>	<b>7,538</b>	<b>9,057</b>	<b>10,928</b>	<b>12,217</b>	<b>14,905</b>
<b>Vegetable fats and oils—</b>							
Coconut oil ..	36,704	36,211	33,466	30,451	28,141	27,555	24,638
Palm fat (b) ..	267	689	295	894	3,488	3,734	4,396
Groundnut oil ..	2,761	3,090	3,168	3,283	3,536	3,017	4,194
Cottonseed oil ..	2,190	2,608	4,330	4,621	4,299	5,332	4,121
Sesame oil ..	4,074	4,595	3,552	3,531	3,682	3,480	3,713
Soya oil ..	3,796	2,686	2,716	3,072	4,208	4,360	4,292
Sunflower seed oil ..	1,794	2,175	1,033	1,702	1,300	925	1,838
Prepared vegetable oils	1,004	1,023	1,279	2,713	3,109	3,790	5,115
Other vegetable oils and fats ..	—	—	—	132	238	236	252
<b>Total vegetable fats and oils ..</b>	<b>52,590</b>	<b>53,077</b>	<b>49,839</b>	<b>50,399</b>	<b>52,001</b>	<b>52,429</b>	<b>52,559</b>
<b>Grand Total ..</b>	<b>57,851</b>	<b>58,970</b>	<b>57,377</b>	<b>59,456</b>	<b>62,929</b>	<b>64,646</b>	<b>67,464</b>

(a) Source : Danish official statistics of industrial production.

(b) Presumably almost entirely palm kernel oil.

**France.**

France, like the United Kingdom, began to crush palm kernels during the War, but it has been unable to withstand successfully the re-entry of German competition, with the result that since 1925

French imports of palm kernels have fallen consistently until they are now about one-third of their former volume. Nevertheless, they are still four times as large as in the pre-war quinquennium.

The following table shows the French imports of palm kernels in the pre-war quinquennium and their development since 1924, together with their estimated oil equivalent.

TABLE XLII.—*Imports of Palm Kernels into France.*  
(*Special Trade.*)  
(In tons.)

COUNTRIES.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
French West Africa	2,166	25,464	23,266	20,598	10,410	4,034	4,177	4,731	5,861
French Cameroons	—	1,223	3,867	3,619	847	636	2,983	2,168	2,394
British West Africa	174	3,073	1,887	3,811	4,939	7,162	3,270	2,028	1,129
French Equatorial Africa .. ..	304	465	234	817	241	385	609	1,956	953
French Togoland..	—	472	649	1,478	394	(a)	(a)	(a)	(a)
Other countries ..	45	1,178	3,073	139	266	245	185	1,099	343
Total ..	2,689	31,875	32,978	30,462	17,097	12,462	11,224	11,982	10,680
Estimated oil equivalent in thousands of tons (b)	1.2	14.3	14.8	13.7	7.7	5.6	5.1	5.4	4.8

(a) Included in "Other countries."

(b) Oil equivalent of imports of palm kernels estimated at 45 per cent. of weight of kernels.

Until 1927, French West Africa supplied France with the bulk of her palm kernels but imports from this source during the period 1928 to 1931 constituted only about 40 per cent. of the whole. Since 1928 some increase in the supplies from the French African Colonies and mandated territories has been observed, coupled with a marked decrease in the imports from British West Africa, which between 1925 and 1928 had substantially increased its consignments of palm kernels to France.

By far the greater part of the palm kernels imported by France are crushed within the country, the exports being insignificant, and the bulk of the oil produced is retained for home consumption. Palm kernel oil is not separately indicated in the French trade returns but



it is clear from an examination of the returns of the more important countries trading with France that this commodity plays a relatively unimportant part in French trade. The oil content of the imported kernels may, therefore, be considered as indicating the volume of palm kernel oil available for French consumption which on this basis has shown a marked decline after 1926. Oil-cake is in smaller demand in France than in other parts of Northern Europe, and in consequence preference is given to the crushing of copra which yields a higher percentage of oil and a lower percentage of cake than palm kernels.

**The United States of America.**

The crushing of palm kernels in the United States was until recently on a very small scale, and prior to 1926 no imports at all were recorded. An import duty on palm kernel oil was imposed in June, 1930, and the crushing of palm kernels commenced on a large scale in that year. Imports of nuts and kernels, which between 1927 and 1929 had averaged about 60 tons per annum rose to nearly 7,000 tons in 1930 and to over 16,000 tons in 1931.

TABLE XLIII.—*Imports of Palm Nuts and Kernels by the United States of America.*  
(In tons.)

Year.	Amount.
1926 .. .. .	179
1927 . . . . .	54
1928 .. .. .	73
1929 .. .. .	48
1930 .. .. .	6,885
1931 .. .. .	16,410

Imports of palm kernel oil are substantial and for some years past have been on a very much higher level than before the War when they amounted to about 11,000 tons per annum. During the War,

the import trade in this commodity practically ceased owing to the fact that kernel-crushing countries were themselves consuming the great bulk of their production. Even as late as 1924 the imports of palm kernel oil into the United States only amounted to 2,119 tons or less than 20 per cent. of the pre-war average. Since then, imports have considerably increased and the annual average for the seven years 1925 to 1931, amounted to over 21,000 tons or about double the pre-war average, although imports have declined heavily in the past two years. The following Table shows the average imports for two pre-war years and the annual imports since 1924.

TABLE XLIV.—*Imports of Palm Kernel Oil into the United States of America.*  
(In tons.)

COUNTRIES.	1912-13 (Average). (a)	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931. (b)
Germany .. ..	9,176	53	2,111	9,038	5,917	12,181	16,223	10,320	
United Kingdom ..	1,650	1,927	21,217	23,183	13,112	11,124	14,930	2,622	
Other countries ..	224	139	165	1,252	219	718	56	50	
Total ..	11,050	2,119	23,493	33,473	19,248	24,023	31,209	12,992	7,224

(a) Prior to 1912, palm kernel oil was not separately indicated in the U.S. trade returns.

(b) Preliminary figure supplied by the United States Dept. of Agriculture; details not available.

The imports have fluctuated considerably from year to year, but the post-war trend until 1929 was definitely upward. The substantial decrease in 1930 and 1931 may be attributable in large measure to the imposition as from June, 1930, of an import duty of 1 cent per pound on all palm kernel oil intended for edible purposes. Coconut oil, which is imported duty-free from the Philippines, has always been the most important vegetable oil for margarine production and the duty may check the tendency towards increasing competition by palm kernel oil as a raw material in the manufacture of this commodity. The utilisation of palm kernel oil in the manufacture of soap and for other technical purposes should continue since the import duty does not apply to oil intended for non-edible purposes, and denatured or

otherwise rendered unfit for edible purposes prior to import. A further result of the imposition of the import duty has been an increase in the imports of palm kernels for domestic crushing, as reflected in the production statistics reproduced in Table XLV below.

The United States Department of Agriculture has published statistics compiled from reports of the Bureau of the Census concerning the factory production, consumption and stocks of palm kernel oil in the United States since 1925 and these, together with the imports of palm nuts and kernels and palm kernel oil, are summarised in the following table.

TABLE XLV.—*Imports, Consumption and Stocks of Palm Kernel Oil in the United States of America.*

(In tons.)

Year.	Imports. (a)			Production.		Consumption. (c)		Stocks at end of year. (d)	
	Nuts and Kernels (Oil equivalent). (b)	Oil.	Total.	Crude Oil.	Re-fined Oil.	Crude Oil.	Re-fined Oil.	Crude Oil.	Re-fined Oil.
1925	—	23,493	23,493	—	461	22,764	1,972	4,024	135
1926	81	33,473	33,554	—	2,927	34,021	3,090	171	25
1927	24	19,248	19,272	—	2,391	9,887	1,308	5,436	951
1928	33	24,023	24,056	—	7,414	20,263	7,479	7,403	278
1929	22	31,209	31,231	—	6,950	26,031	6,179	6,059	534
1930	3,098	12,992	16,090	318	14,353	24,121	13,174	6,230	895
1931(e)	7,384	7,224	14,608	8,278	11,227	24,616	10,830	3,768	743

(a) Gross imports; exports are not separately shown but are known to be small.

(b) Estimated on the basis of 45 per cent. of the weight of imported nuts and kernels.

(c) Includes consumption other than that used for ordinary purposes by households, retailers, etc., or for lubrication purposes.

(d) Includes all stocks other than those in the hands of households, local tradesmen, etc., except such as may be held in public warehouses. Stocks in hands of importers and exporters are included.

(e) The figures for 1931 were furnished by the United States Dept. of Agriculture. Those for earlier years were published in "Foreign Crops and Markets," 23rd June, 1930, and 10th August, 1931.

The figures in the foregoing table indicate the large development that has occurred in the refining of palm kernel oil in the United States in recent years, which coincided with an increase in the consumption of the oil in its refined state. It is apparent that almost the whole of the demand for the refined oil, which is no doubt mainly for the manufacture of edible fats, is met by domestic refineries and that the palm kernel oil imported, the bulk of which comes from the United Kingdom, is almost entirely crude oil.<sup>(a)</sup> It should be observed that in judging the volume of consumption of palm kernel oil from the above figures, the crude oil figures alone should be taken into account, since the crude oil "consumed" for refining is included therein and duplication would occur if the crude and refined oil figures were added together. It will be seen that, according to the published figures, the large decrease in imports of palm kernel oil in 1930 and 1931 did not result in a material reduction in the factory consumption in those years. It remains to be seen whether the new import duty will result in a curtailment of the total consumption of palm kernel oil or whether it will merely succeed in replacing imported oil for edible purposes by home crushed oil. The figures of consumption and stocks in Table XLV are not complete and this, no doubt, accounts for the apparent lack of agreement between the imports, consumption and stocks, which is particularly noticeable in the latter years of the period under review.

#### **Belgium.**

No importing country in recent years has shown such a large proportionate increase in its gross imports of palm kernels as Belgium, whose imports in the period 1924-29 were over twelve times as great as before the war.

This substantial increase is almost entirely due to the remarkable development of the oil palm industry in the Belgian Congo. The great bulk of Belgium's imports are re-exported, with the result that the kernels retained in the post-war period show but little change as compared with the pre-war period.

Table XLVI on page 66 shows the Belgian trade in palm kernels and the annual quantities retained for home consumption. Since the war over 95 per cent. of the palm kernel imports have been derived from the Belgian Congo which, it will be recalled,

<sup>(a)</sup> So far as the imports from the United Kingdom are concerned this is confirmed by the United Kingdom trade returns.

exports almost the whole of its palm kernels to the mother country. Before the war little more than 12 per cent. of the Belgian imports of kernels came from the colony, the bulk of the Belgian supplies being obtained from the Netherlands. The exports are now consigned mainly to Germany, which has rapidly increased its trade with Belgium in this commodity since 1924. The export trade with the Netherlands, on the other hand, has substantially and consistently declined in recent years, and in 1929, the last year for which detailed figures are available, it was about 15 per cent. of the 1924 volume.

TABLE XLVI.—*Belgian Trade in Palm Kernels.*  
(In tons.)

	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930. (a)	1931. (a)
<b>Imports from—</b>									
Belgian Congo ..	674	38,211	66,110	71,154	73,962	61,475	53,269		
Netherlands ..	3,824	699	287	126	302	400	(c)		
United Kingdom	260	52	(c)	98	(c)	(c)	(c)		
British West									
Africa ..	75	(c)	98	(c)	(c)	1,214	162		
Other countries	509	392	865	1,408	1,579	978	3,828		
<b>Total ..</b>	<b>5,342</b>	<b>39,354</b>	<b>67,360</b>	<b>72,786</b>	<b>75,843</b>	<b>64,067</b>	<b>57,259</b>		
<b>Exports to—</b>									
Germany ..	79	18,630	42,235	43,717	53,679	50,808	50,428		
Netherlands ..	636	18,982	20,221	24,049	16,827	9,606	2,957		
United Kingdom	(c)	188	(c)	(c)	7	(c)	(c)		
France ..	(c)	7	(c)	(c)	(c)	(c)	(c)		
Portugal ..	(c)	(c)	(c)	(c)	19	(c)	(c)		
Other countries	732	4	63	1,547	164	122	356		
<b>Total ..</b>	<b>1,447</b>	<b>37,811</b>	<b>62,519</b>	<b>69,313</b>	<b>70,696</b>	<b>60,536</b>	<b>53,741</b>		
<b>Amount retained..</b>	<b>3,895</b>	<b>1,543</b>	<b>4,841</b>	<b>3,473</b>	<b>5,147</b>	<b>3,531</b>	<b>3,518</b>	<b>3,858</b>	<b>4,747</b>
<b>Equivalent in palm kernel oil (in thousands of tons) (b) ..</b>	<b>1.8</b>	<b>0.7</b>	<b>2.2</b>	<b>1.6</b>	<b>2.3</b>	<b>1.6</b>	<b>1.6</b>	<b>1.7</b>	<b>2.1</b>

(a) Preliminary figures; particulars of transit trade not yet available.

(b) Oil equivalent of net imports of palm kernels estimated at 45 per cent. of weight of kernels.

(c) Included in "Other countries."

The retentions of palm kernels varied considerably in the immediate post-war period, but after 1924 they ranged from 3,500 to 5,000 tons per annum.

The Belgian trade statistics include palm kernel oil with a number of other vegetable oils, and it is therefore not possible to indicate the trade in palm kernel oil or the volume retained for domestic consumption. The bulk of the retained palm kernel oil is presumably utilised in the margarine industry, the output of which has increased rapidly, rising from 26,000 tons in 1923 to 49,000 tons in 1930.

#### **Portugal.**

Portuguese trade returns do not specify palm kernels separately although it is known that Portugal has an import and export trade in this commodity. A large proportion of the exports from Portuguese West Africa which, it will be recalled amount to about 20,000 tons per annum are consigned to Portugal, and certain European countries draw part of their supplies of kernels from Portugal.

#### **Other Countries.**

There are no palm kernels and very little palm kernel oil recorded as imported into the more important British Empire countries other than the United Kingdom. In Australia, New Zealand, Canada, the Union of South Africa and India little or no consumption of palm kernel oil appears to be taking place. Animal or other vegetable fats in those countries are relatively plentiful and there would at present appear to be no prospects of an appreciable market for palm kernel oil in connection with the edible fat and the soap and candle industries of those countries.

As regards the foreign countries not specified in the foregoing paragraphs, Italy, Austria, Poland, Norway and Sweden either do not separately classify palm kernels and palm kernel oil in their trade returns or import negligible quantities. No imports of either kernels or oil have been traced in regard to any of the South American or Asiatic countries, and neither the export returns of palm kernel producing countries nor those of the chief oilseed crushing countries include any exports of palm kernels or oil to Asia or South America.

## CHAPTER II.

### PALM OIL.

Palm Oil is produced from the fleshy pericarp of the fruit of the oil palm, and is the most important of the oil palm products. As has already been stated, the pericarp itself does not enter into world trade, as owing to its perishable nature it is necessary to express the oil as near to the centre of production as possible. Statistics of palm oil production are not available and, as with palm kernels, the export figures must serve as an indication of the development of the industry. Palm oil is consumed in large quantities by the native population of the producing areas both as an article of food and as an illuminant, and is also being utilised in growing quantities in certain producing areas as a motor fuel, although, as yet, this form of utilisation is still largely in the experimental stage. For this reason statistics of exports are less reliable as an indication of production of palm oil than of palm kernels. The small proportion of palm oil exported as compared with the total supply of the commodity is very pronounced in the older and more important producing areas, and in the case of Nigeria, for instance, the exports of palm oil are estimated to represent less than one-third of the estimated maximum yield corresponding to the volume of kernels exported. There are thus large quantities of palm oil which do not enter world trade, although a larger proportion of the production would no doubt be exported if the inducement to the native producer were increased.

Most of the palm oil produced is obtained by primitive hand methods, mechanical methods being largely confined to the new producing areas in the Dutch East Indies, the Belgian Congo and British Malaya. Different methods produce different types of palm oil; hand production from the fermented pericarp yields a hard oil with a free fatty acid content ranging usually between 40 and 75 per cent. which may increase with storage; hand production from the fresh pericarp yields a medium oil with a free fatty acid content of between 25 and 40 per cent., while mechanical methods yield a soft oil with a free fatty acid content varying between

*To face page 69.]*



**GOLD COAST.**

**Cutting bunches of palm fruit.**

*Reproduced by courtesy of the Imperial Institute, South Kensington.*



2 and 25 per cent. Exports of hard oil have decreased but still form the bulk of the West African trade, the price margins between the hard, medium and soft oils having provided an insufficient incentive for the general adoption of the more inconvenient and laborious methods involved in the production of soft and medium oils.

The oil yield of the pericarp is chiefly dependent on the ripeness of the fruit and the method of oil production. The effective yield is reduced if wasteful hand-methods are used, and increased with mechanical processes.

Palm oil is utilised mainly in the soap and candle industries and to a lesser extent in the tin-plate industry. It is also being increasingly used in the edible fat industries but the amount so utilised is still relatively small owing largely to technical difficulties in connection with its use for edible purposes, which make other oils and fats more attractive.

In the following paragraphs the recent development of the exports of palm oil from the principal producing areas and its distribution to the principal consuming countries are indicated. As in the chapter dealing with palm kernels and palm kernel oil, discrepancies will be found between the export and import tables as a result of the different methods of classification of the exports and imports, and of the different ways of recording their origin and destination.

## **PRODUCTION AND EXPORT.**

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### **I.—BRITISH EMPIRE COUNTRIES.**

#### **British West Africa.**

As one would expect from its pre-eminent position as an exporter of palm kernels, British West Africa is also the principal source of the world supply of palm oil. The following table shows the average annual exports in the pre-war period and the annual exports since 1924.

TABLE XLVII.—*Exports of Palm Oil from British West Africa.*  
(In tons.)

Colony.	1909-13 (Average). (a)	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931. (d)
Nigeria (b) ..	81,732	127,083	128,113	113,267	113,240	127,111	131,845	135,801	118,179
Sierra Leone ..	2,877	3,110	2,987	2,868	3,609	2,525	2,845	3,652	1,359
Gold Coast (c)	6,401	1,350	1,423	1,752	1,090	502	596	489	319 (e)
Total ..	91,010	131,543	132,523	117,887	117,939	130,138	135,286	139,942	119,857

(a) Certain figures were published in gallons and have been converted at the rate of 1 gallon = 9 lbs.

(b) Includes exports from British Mandated Territory of the Cameroons from 1924.

(c) Includes exports from British Mandated Territory of Togoland from 1924 to 1930.

(d) Preliminary figures.

(e) Excluding exports from Togoland.

It will be seen that almost the whole of the British West African palm oil comes from Nigeria, and the proportion furnished by that colony in recent years has grown appreciably as compared with the pre-war period. Between 1924 and 1931, Nigeria supplied 97 per cent. of the aggregate exports from British West Africa as compared with 90 per cent. in the pre-war quinquennium. This is mainly due to the fact that Nigeria has furnished almost the entire post-war increase in the exports, and partly due to the marked decrease in supplies from the Gold Coast, the annual exports from that colony in the period 1924 to 1931 averaging about 1,000 tons as compared with 6,400 tons before the war.

It is clear from a comparison of the exports of palm kernels from British West Africa with the exports of palm oil that a very large part of the available supply is being consumed locally or wasted. This is true of all the colonies in this region, but particularly of Sierra Leone, whose palm oil exports during the period 1924 to 1931 represent only about 5 per cent. of the palm kernel exports as compared with 15 per cent. in the case of the Gold Coast and about 50 per cent. in the case of Nigeria. The Gambia, which exports between 600 and 700 tons of palm kernels annually, is an importer and not an exporter of palm oil. On the basis of a possible yield of palm oil equivalent to  $\frac{2}{3}$  of the weight of palm kernels produced (see Table I), Nigerian production of palm oil based on palm kernel

exports should have averaged about 430,000 tons annually in the past eight years, production in Sierra Leone over 100,000 tons, in the Gold Coast over 10,000 tons and in the Gambia over 1,000 tons. The local consumption of palm oil is very large and the loss due to wasteful methods is difficult to estimate, but there is no doubt that it is substantial. According to an authoritative report on the oil palm industry in British West Africa, (a) the native farmer has so far failed to improve his crude methods of extracting palm oil. Not only is waste resulting, but an inferior quality of oil is being produced which will be less able as time goes on to compete with the higher grade oil produced by mechanical methods in the Belgian Congo and the Dutch East Indies. The conservative character of the native farmer in British West Africa renders difficult the introduction of mechanical methods of palm oil production in that area. There is at present little co-operation between the cultivator and the European trading concerns and some improvement in this direction is regarded as the best means of overcoming the difficulty. Educational methods are necessarily slow, but the measures adopted, particularly in Nigeria, which are referred to below, are gradually resulting in an improvement in the condition of the industry and the quality of the product.

#### NIGERIA.

Almost the whole of the Nigerian exports of palm oil are the product of native labour, the oil being extracted mainly by slow and wasteful processes. A few small mills have been established, and machinery installed, but they have, as yet, not proved very successful owing mainly to the following reasons.(b)

- (i) Opposition of the small trader, who incites the native to refuse to supply the mill.

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(a) Report on the Oil Palm Industry in British West Africa by F. M. Dyke, Technical Officer of the Niger Company, Ltd., and Associated Companies, 1927.

(b) The following official reports refer to this matter :—  
Colonial No. 10.—Report by the Committee appointed by the Secretary of State for the Colonies, September, 1923.  
Cmd. 2744/1926.—Report by the Parliamentary Under-Secretary of State for the Colonies on his visit to West Africa.  
Cmd. 3235/1928.—Report by the Parliamentary Under-Secretary of State for the Colonies on his visit to Malaya, Ceylon and Java.  
Nigerian Handbook, 1929, and Annual Agricultural Reports of the Colony.

(ii) Irregularity of supply owing to the vagaries of native producers.

(iii) Difficulty of transport of the pericarp, the native being unwilling to carry his produce any distance, and the pericarp itself being too perishable to admit of much handling.

These factors are hindering the development of the mechanical production of palm oil in Nigeria, and as a result the oil from that source is generally of an inferior quality from the point of view of both cleanliness and acidity. With the increased trade in vegetable oils and fats have come more stringent requirements as to quality and standards, and it is here that the native product frequently fails to meet market requirements. This fact has been recognised by the Nigerian Government and attempts are now being made to meet the deficiencies by the following means :—

(i) The natural palmeries are being improved by thinning and new planting.

(ii) Mechanical small-scale production is being encouraged by offering a subsidy to any firm or individual willing to erect a mill.

(iii) Bulk handling of the oil at the ports is being encouraged, and is now capable of handling the whole of the Nigerian palm oil exports during the greater part of the year.

(iv) A general system of Government supervision and inspection of the oil production has been introduced with a view to the improvement of the quality and to the establishment of a system of grading.

These measures, which are referred to in a survey of the oil palm industry by a former Superintendent of Agriculture in Southern Nigeria, (a) will, it is thought, attain the desired results, once the African is convinced by educational methods of the advantage to be gained by their adoption.

The export trade in palm oil, although showing a consistent increase in recent years, might have developed even more, but for the extension of transport facilities within the Colony, which is resulting in the marketing of increasing quantities of oil in the

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(a) See Article by S. M. Gilbert, Superintendent of Agriculture in Southern Nigeria, 1923-1929, entitled "The Oil Palm Industry," published in "Tropical Agriculture," Vol. VII, No. 8, August, 1930.

Northern Provinces for native consumption. This tendency is also being further encouraged at the present time by the low prices realised for the commodity in the world markets.

#### SIERRA LEONE.

Much attention is being devoted by the Department of Agriculture of Sierra Leone to the improvement of the yield of the local varieties of oil palm, certain of which, according to official reports,<sup>(a)</sup> are inferior to those in Nigeria. The relatively small volume of palm oil exported from this Colony has already been referred to, and it is clear that a considerable part, estimated at more than 95 per cent. of the palm oil content of the fruit, is either consumed locally or not produced. An improvement of the methods of production by the adoption of mechanical processes in place of the wasteful hand methods would undoubtedly lead to a material increase in the volume of palm oil exported.

In recent years, coincident with an appreciable diminution in the palm kernel exports, a marked increase in the export trade in palm oil has taken place, the amount rising from 2,525 tons in 1928 to 3,652 tons in 1930, the highest point attained for many years. The authorities are supervising the production of the oil and encouraging the utilisation of mechanical methods and the observed increase in exports may no doubt be attributed to these efforts.

#### GOLD COAST.

In this Colony the native farmer has devoted his attention to more lucrative crops of which cacao is much the most important. Improvement in the palmeries has been confined to those small areas where extracting factories have been erected and run by European enterprise and capital, namely at Butre and Bukunor, the latter being a small factory with a capacity of 3,000 tons of fruit per annum, erected under the Government scheme for subsidising oil palm factories. Oil palm breeding and selection work, and experimental work connected with the improvement of the palm groves, have been undertaken by the Department of Agriculture. Exports of palm oil have shown a substantial and fairly consistent decrease since 1926 and are now only a small fraction of the pre-war amount.

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(a) Report on the Sierra Leone Oil Palm Industry, C.L.F. 2586/351/1925.

GAMBIA.

No exports of palm oil are reported from this Colony although judging by the production of palm kernels appreciable quantities are no doubt produced. On the contrary, Gambia is an importer of palm oil, an average of over 100 tons per annum being imported in recent years.

BRITISH CAMEROONS AND BRITISH TOGOLAND.

Exports from these mandated territories are still small, and are included in the trade returns of Nigeria and the Gold Coast respectively. In the Cameroons the export of palm oil is increasing steadily, but in Togoland the volume exported has been negligible since 1927. In both territories there is a native crushing industry to supply local needs, but in the case of Togoland, very little interest is taken in the production of an export surplus. The following table shows the exports from these two territories since 1924, comparable post-war figures not being available.

TABLE XLVIII.—*Exports of Palm Oil from the Mandated Territories of the British Cameroons and British Togoland.*

(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.
British Cameroons ..	105	192	454	635	998	1,023	1,204
British Togoland (a) ..	263	244	152	12	49	24	87
Total ..	368	436	606	647	1,047	1,047	1,291

(a) Exports passing over Anglo-French frontiers only; exports to Gold Coast not included (see Colonial No. 63/1931). The figures for 1924 to 1928 are published in gallons and have been converted at the rate of 1 gallon = 9 lbs.

The distribution of the exports of palm oil from British West Africa has undergone a marked change since the War, mainly as a result of the increased tendency towards direct purchase from the sources of supply rather than indirectly from the United Kingdom. This

matter will be more fully dealt with in the subsequent paragraphs relating to the Import trade. The following table shows the distribution of the British West African exports of palm oil.

TABLE XLIX.—*Distribution of Palm Oil Exports from British West Africa.*  
(In tons.)

COUNTRIES.	1909- 13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931. (a)
United States of America .. ..	—	14,447	33,809	27,784	42,120	43,793	60,223	61,417	
United Kingdom ..	75,706	73,585	73,608	64,887	50,277	48,377	43,300	37,341	
Italy .. ..	—	9,115	10,773	12,417	10,491	17,932	13,701	17,675	
Germany .. ..	11,636	25,947	6,290	8,259	10,215	12,970	9,950	12,440	
Netherlands .. ..	—	7,210	6,246	2,027	2,209	3,768	6,609	9,341	
Belgium .. ..	—	212	249	920	844	936	134	652	
France .. ..	2,159	456	1,108	1,034	1,581	1,606	657	404	
Union of South Africa ..	—	512	379	507	—	—	300	180	
Spanish Possessions ..	—	—	—	6	7	555	103	95	
Cuba .. ..	—	—	—	—	—	—	101	70	
Other countries .. ..	1,509	59	61	46	195	201	208	327	
Total .. ..	91,010	131,543	132,523	117,887	117,939	130,136	135,286	139,942	119,857

(a) Preliminary figure; details not yet available.

It will be seen that the United Kingdom has been taking a decreasing proportion of the exports. In the pre-war quinquennium she took 83 per cent. of the whole as compared with 55 per cent. in the period 1924 to 1926 and 34 per cent. in the period 1927 to 1930. The United States of America on the other hand took no direct imports in the pre-war quinquennium, 20 per cent. of the whole in the period 1924 to 1926, and 40 per cent. in the period 1927 to 1930. Similarly, Italy and the Netherlands now take appreciable quantities of palm oil direct from the British West African market whereas before the War they purchased this commodity for the most part in the United Kingdom or Germany.

#### British Malaya.

Palm oil is produced in British Malaya by mechanical means, preference being given to the centrifugal method which, although sometimes adding to the initial costs of the mills, is more efficient.

Exports of palm oil have gradually increased in recent years although they still constitute less than 2 per cent. of the aggregate volume entering world trade. Five additional mills were established in 1930 and it seems likely, therefore, that production will continue to expand. In quality the Malayan product can compare favourably with the high grade oil produced in the Dutch East Indies, though the costs of production are estimated to be slightly higher.

The following table shows the annual production of Palm Oil in British Malaya since 1923.

TABLE L.—*Production of Palm Oil in British Malaya.*(a)  
(In tons.)

Year.	Amount.
1923 .. .. .	195
1924 .. .. .	286
1925 .. .. .	536
1926 .. .. .	716
1927 .. .. .	915
1928 .. .. .	1,345
1929 .. .. .	1,819
1930 .. .. .	3,253 (b)
1931 .. .. .	5,136 (c)

(a) Compiled from returns supplied by Estates, published in the "Malayan Agricultural Journal," July, 1931.

(b) Source: Supplement to the "F.M.S. Government Gazette," July 17, 1931.

(c) Source: "Malayan Agricultural Journal," April, 1932.

The Malayan trade in palm oil since 1925 is indicated in the following table. Prior to that year the figures are not separately indicated in the trade returns.



TABLE LI.—*British Malayan Trade in Palm Oil.*

(In tons.)

	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Exports to—							
United Kingdom ..			228	420	605	1,964	2,373
United States of America ..			246	737	1,019	772	1,267
Netherlands ..			—	20	21	153	} 1,023
Germany ..			—	—	—	95	
Philippines ..			111	72	147	74	
Union of South Africa ..			—	—	31	77	
Hong Kong ..			150	50	25	—	
Siam ..			99	104	18	57	
Belgium ..			—	35	20	—	
France ..			20	—	—	55	
Australia ..			—	23	—	2	
Other countries ..			—	2	3	4	
Total ..	473	725	854	1,463	1,889	3,253	4,663
Imports from—							
Sumatra ..	—	—	86	128	58	42	89
Java ..	—	—	—	1	—	—	—
Total ..	—	—	86	129	58	42	89
Net exports ..	473	725	768	1,334	1,831	3,211	4,574

(a) Details of distribution not available.

The United Kingdom and the United States take the bulk of the palm oil exported from British Malaya, which has increased ten-fold since 1925. Efforts are being made to inaugurate a system of bulk shipment of palm oil from British Malaya with a view to reducing cost of freight and containers. One firm operating on a large scale has already adopted this method but as yet no steps have been taken to enable the smaller producers to participate in this more economical form of shipment.\*

\* See "Malayan Agricultural Journal," December, 1931.

### Tanganyika.

The trade of this mandated territory in palm oil is very small and is showing little tendency to develop. The annual exports in the period 1928 to 1931 averaged only 25 tons, the bulk of which was Tanganyika produce. The destination of these exports is for the most part the neighbouring colonies and protectorates but in 1928, and 1931 the United Kingdom was the principal market.

### Other British Countries.

British Guiana, Seychelles, and Ceylon as indicated in the previous chapter, have experimented in the cultivation of the oil palm, but there is, so far, no recorded production or export of palm oil.

## II.—FOREIGN COUNTRIES.

### Dutch East Indies.

The development of the oil palm industry in the Dutch East Indies has been referred to in the preceding chapter and the rapid increase of exports of palm oil in recent years, indicated in the following table, furnishes further evidence of the rapid progress which the industry has made since the War.

TABLE LII.—Exports of Palm Oil from the Dutch East Indies.(a)  
(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
United States of America	171	2,344	5,395	8,966	14,295	22,668	36,458	37,698
Netherlands .. .. .	1,258	1,570	3,855	7,904	6,404	4,381	6,950	7,047
United Kingdom .. ..	2,818	1,265	2,330	3,565	4,850	6,541	3,889	10,787
Japan .. .. .	111	266	100	99	410	486	383	402
Germany .. .. .	663	1,333	1,029	113	1,489	605	318	3,445
France .. .. .	68	5	60	89	122	100	46	(b)
Belgium .. .. .	(b)	10	37	82	354	98	81	47
Other countries .. ..	29	169	263	452	460	421	427	1,839
Total .. .. .	5,118	6,962	13,069	21,270	28,384	35,300	48,552	61,265

(a) Gross weights, including container. Net weights not available for earlier years. In 1930 and 1931 container represented about 2-3 per cent. of gross weight.

(b) Included in "Other countries."

Exports of palm oil from the Dutch East Indies are extremely high in comparison with the exports of palm kernels. This state of affairs also obtains in British Malaya and is characteristic of the new producing areas. It arises from three main causes:—

(i) The type of oil palm grown in these areas contains an abnormally large pericarp, and, in consequence a relatively high content of palm oil and a relatively low content of palm kernel. The average ripe fruit in Malaya, for instance, as already indicated, contains between four and five times as much palm oil as palm kernel whereas the fruit of the older producing areas such as Nigeria, contains less than twice as much palm oil as palm kernel.

(ii) The mechanical methods of extraction in use in these areas are very much more efficient than the primitive hand methods employed in the older areas, where it has been estimated that they result in a wastage of as much as 40 or 50 per cent. of the palm oil content.

(iii) Palm oil, not being an indigenous product of these areas, is not used to such an extent by the natives as in the older areas. In West Africa, native consumption of palm oil absorbs a substantial part of the production.

The cumulative effect of these causes may be observed by comparing the relative exports of palm oil and palm kernels in Nigeria, Dutch East Indies and the Belgian Congo, details of which are summarised in Table LIII on page 80. The strikingly high proportion in the case of the Dutch East Indies may be partly due to the incomplete extraction of the available kernels; the figures as they stand are too high for even the maximum palm oil production based on the exports of kernels.

The Dutch East Indies has now risen to second place as an exporter of palm oil, and there seems to be every indication of still further expansion. The oil is produced in large factories, mainly by hydraulic presses. This system is claimed to have the advantage over the mechanical methods adopted in British Malaya and the Belgian Congo of a smaller capital cost, and lower expenditure on upkeep. The storage and shipment of the oil is also a factor which has been carefully and systematically investigated by the Dutch planters, as freight and storage form an important item of marketing cost, with production so far from the chief market. Bulk handling, although expensive to initiate, effects a considerable economy in the long run and is being increasingly adopted.

TABLE LIII.—*Relation between the Exports of Palm Kernels and Palm Oil from certain Producing Areas.*

(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
<b>Nigeria—</b>								
Palm kernel exports ..	252,847	272,925	249,103	257,206	246,638	251,477	260,022	254,455
Palm oil exports ..	127,083	128,113	113,267	113,240	127,111	131,845	135,801	118,179
Palm oil exports expressed as a percentage of palm kernel exports ..	50	47	45	44	52	52	52	46
<b>Belgian Congo—</b>								
Palm kernel exports ..	46,717	72,911	69,298	72,822	71,384	74,183	65,294	46,418
Palm oil exports ..	13,881	18,396	18,152	18,079	26,082	29,812	36,397	35,997
Palm oil exports expressed as a percentage of palm kernel exports ..	30	25	26	25	37	40	56	78
<b>Dutch East Indies—</b>								
Palm kernel exports ..	1,241	1,480	2,162	3,707	5,629	6,713	9,479	11,992
Palm oil exports ..	5,118	6,962	13,069	21,270	28,384	35,300	48,552	61,265
Palm oil exports expressed as a percentage of palm kernel exports ..	412	470	604	574	504	526	512	502

The result of Dutch efforts to develop production has been to bring on the market a steadily increasing supply of high-grade palm oil of low acidity, suitable as an edible oil, whereas, in the past, the palm oil obtainable from African sources by native methods has been utilisable, for the most part, in such industries as candle and soap-making. The recent decline in the price of palm oil may have a depressing effect on the industry, and it remains to be seen whether in the present unfavourable market conditions, larger overhead charges incidental to factory production in this area will permit of successful competition with the less expensive native methods employed in British West Africa.

As will be seen from Table LII, the United States of America is the chief importer of palm oil from the Dutch East Indies, and has increased her imports from that source to a remarkable degree since 1924. In 1930 the United States took directly three-quarters of the total exports as compared with less than 4 per cent. in 1924 and 50 per cent. in 1928. The high-grade Dutch East Indian oil finds a ready market in the United States. The Netherlands also

imports from this source, but part is transhipped to Belgium and Germany. Imports into the United Kingdom have shown a tendency to increase, but as yet the Dutch East Indies provides only a very small proportion of the total British imports of palm oil.

#### **French West and Equatorial Africa.**

The production of palm oil in the French African Colonies is carried on by much the same methods as in British West Africa. Experimental mills have been established, but difficulties in obtaining regular supplies have hampered their working, and as yet the industry depends largely upon native hand methods of production. A large proportion of the palm oil content of the fruit is wasted in consequence of the inefficient production and in addition much of the oil actually produced is consumed by the natives with the result that only a small proportion of the available palm oil supply of these Colonies enters world trade. In this respect the French African palm oil industry compares unfavourably with British West Africa but this may be attributed to the fact that in view of the smaller extent of the industry in the French Colonies, the natives' requirements of palm oil absorb a larger proportion of the available supply than in British West Africa. Table LIV on page 82 shows the exports of palm oil from the French African Colonies and the sources of supply.

The average increase in exports during the post-war period under review as compared with the pre-war quinquennium is about 30 per cent. or substantially less than in British West Africa where the corresponding increase is about 40 per cent. French West Africa was until recently the second largest source of world supplies but this position has now been definitely occupied by the Dutch East Indies, which area has made considerable progress during the post-war period, while the French African trade has, for many years, been almost stationary. The unsatisfactory condition of the industry in French West Africa was brought to the notice of the authorities in 1919 when a careful investigation was made and recommendations proposed.<sup>(a)</sup> The gradual disappearance of the industry was predicted unless effective remedial measures were promptly undertaken. The recommendations included the introduction of mechanical power mills to reduce waste in production

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<sup>(a)</sup> The report of Dr. G. Van Pelt on the Oil Palm Industry in French West Africa is referred to in Colonial No. 10/1925.

TABLE LIV.—Exports of Palm Oil from the Principal French Colonies in West and Equatorial Africa.

(In tons.)

Source of Supply.	1909-13 (Average). (a)	1924.	1925.	1926.	1927.	1928.	1929.	1930.
French West Africa—								
Dahomey .. ..	12,750	16,920	16,611	17,622	17,934	9,603	15,082	21,241
Ivory Coast .. ..	6,016	7,739	8,130	6,656	6,613	6,667	6,970	8,336
French Guinea .. ..	82	716	860	750	778	885	493	449
Other colonies .. ..	—	—	7	—	—	—	4	76
Total .. ..	18,848	25,375	25,608	25,028	25,325	17,155	22,549	28,102
French Equatorial Africa—								
Moyen-Congo .. ..	9	368	412	598	547	688	805	520
Other colonies .. ..	86	138	111	115	115	161	361	427
Total .. ..	95	(a) 506	(a) 523	713	662	849	1,166	947
French Mandated Territories (b)—								
Camerouns .. ..	3,549	4,206	6,173	5,719	4,445	5,332	8,229	(c) 6,758
Togoland .. ..	2,859	3,294	2,622	2,619	2,046	1,308	1,565	(c) 2,199
Total .. ..	6,408	7,500	8,795	8,338	6,491	6,640	9,794	8,957
Grand Total .. ..	25,351	33,381	34,926	34,079	32,478	24,644	33,509	38,006

(a) Source: Year Book of the International Institute of Agriculture, Rome.

(b) Include for the pre-war period, slightly larger area than the existing French zones.

(c) Source: "Togo Cameroun, Magazine Mensuel de l'Agence Economique des Territoires Africains sous Mandat, Automne 1931".

and the systematic plantation of oil palms to supplement the native palmeries. Later reports indicate that a substantial advance has been made by the establishment of a central research station at Bingerville in the Ivory Coast. Production has been maintained, with the exception of the year 1928 when the palms in Dahomey suffered severely from inadequate rainfall; the figures for 1930 indicate that the ground lost in 1928 has been more than recovered.

#### FRENCH WEST AFRICA.

The share of French West Africa in the total exports of palm oil from the French African colonies, which both before and after the war had been about three-quarters, diminished appreciably in 1928 and 1929 but recovered in 1930 to about its former level.

Dahomey is the principal source of supply and prior to 1928 furnished over 17,000 tons per annum or nearly three-quarters of the French West African exports. A heavy reduction in the exports from this colony, amounting to nearly 50 per cent., occurred in 1928 owing to a substantial diminution in production following upon insufficient rainfall, but conditions improved substantially in 1929 and by 1930 exports were 20 per cent. above the 1927 level which had hitherto constituted a record.

The Ivory Coast supplies almost the whole of the balance of the French West African trade, its annual exports amounting to over 6,000 tons. The only other source of supply is French Guinea, but the volume is relatively small and has consistently decreased since 1928.

The distribution of the palm oil exports from French West Africa since 1924 is shown in the following table. It will be seen that the share of France and the French Colonies has decreased during the period, as well as that of the United Kingdom. The shares of Germany and most of the other importing countries have, on the other hand, substantially increased.

TABLE LV.—*Distribution of Palm Oil Exports from French West Africa.*(a)  
(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.
France and French Colonies .. ..	14,653	14,514	15,402	9,780	11,995	8,097	9,234
United States of America .. ..	904	2,767	3,153	5,009	2,442	4,184	2,566
Germany .. ..	2,290	1,233	1,611	2,887	1,141	3,378	7,082
United Kingdom .. ..	6,865	5,005	2,909	4,766	1,036	2,119	1,249
Netherlands .. ..	543	900	1,079	2,162	194	1,881	1,653
Belgium .. ..	16	136	258	324	14	1,378	490
Italy .. ..	101	1,026	557	393	237	1,083	1,503
British Colonies .. ..	—	—	—	—	90	314	4,165
Other countries.. ..	3	27	59	4	6	115	160
Total .. ..	25,375	25,608	25,028	25,325	17,155	22,549	28,102

(a) Pre-war figures not available.

#### FRENCH EQUATORIAL AFRICA.

The French Colonies in Equatorial Africa furnish only a relatively small volume of palm oil for export and the aggregate amount, although showing a considerable and consistent increase in recent years, is still little more than 1,000 tons per annum. The greater part of the oil produced is no doubt consumed locally and no material development can be anticipated in the near future. The Moyen-Congo furnishes about three-quarters of the aggregate exports from this area and almost the whole of the balance is derived from Oubangui-Chari-Tchad which in recent years has shown the greatest relative progress of all the French African possessions, its exports between 1926 and 1930 having increased more than three-fold.

The distribution of the exports from French Equatorial Africa is not accurately known as a large part is shipped through the Belgian Congo and its ultimate destination is not indicated. Germany and Belgium take almost the whole of the balance.

#### MANDATED TERRITORIES.

##### (i) FRENCH CAMEROONS.

Next to Dahomey, the French mandated territory of the Cameroons is now the largest exporter of palm oil in French Africa. In 1929 and 1930 its exports of this commodity averaged about 7,500 tons per annum or nearly double the volume exported in 1924. This large increase may be attributed to the development of the native palmeries with the aid of European capital. Future development in this industry will depend to a great extent upon the opening up of railway transport through the natural palmeries. It has been estimated that with the substitution of such transport for human portorage, and the establishment of modern oil mills, the Cameroons would be in a position to export annually 100,000 tons of palm kernels and 25,000 to 30,000 tons of palm oil.<sup>(a)</sup> This, it is stated, would leave about 140,000 tons of palm oil available for local consumption.

The distribution of the exports of palm oil from this area is not known.

##### (ii) FRENCH TOGOLAND.

This area has shown a material decrease in palm oil exports since 1924 despite official encouragement of the industry. This decrease has been attributed to the poor harvests subsequent to two

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<sup>(a)</sup> See "Le Togo et le Cameroun, Numéro spécial," 1926.



consecutive dry seasons, which materially affected the oil palm areas during the years 1927-28. The similar decrease in the exports of cocoa during the same period seems to confirm this explanation of the fall in the exports of palm products. As was stated in the previous chapter, there has been a tendency in recent years for the native to neglect the oil palm in favour of more remunerative crops, and this has also contributed to the appreciable decline in palm oil exports.

Methodical attempts are being made by the agricultural authorities of the colony to overcome native indifference to the industry, which also stands in need of the co-operation of European capital in order to assist its further development. The exports of palm oil from French Togoland represent only a small part of the possible production in that area. Only one mill for the extraction of oil exists, at Agou, and there is no doubt that the establishment of further modern plant would permit of a considerable extension and improvement of the output of the native palmeries, which are at present largely unexploited. An appreciable increase in exports was recorded in 1930, but the level of that year was still substantially below that of the pre-war period and of the period 1924-26.

The projected railway line through the valley of Mono should also prove a contributing factor in the expansion of this industry by facilitating the transport of the produce, and the opening up of the interior.

The distribution of the exports of palm oil from French Togoland is known for 1926 only, when France and the United States of America each took about 30 per cent. of the exports.

#### **Belgian Congo.**

The production of palm oil is one of the most important industries of the Belgian Congo, and its growth since the outbreak of the War has been greater than in any other producing area in Africa. The industry, which for more than a decade prior to the War had been stagnant, has since developed rapidly, and between 1914 and 1930 exports of palm oil have increased about eighteen-fold and the Belgian Congo has become one of the most important sources of supply in the world.

Much of the success achieved has been due to the co-operation of European capital, with the aid of which mechanical methods of production have been introduced and the means of transport improved. The production of palm oil in this colony is now largely in the hands

of the *Huileries du Congo Belge*, which in 1931 produced about 17,000 tons of oil, or nearly 50 per cent. of the volume exported. This company which works in close co-operation with other Congo companies whose oil it purchases under contract at the centres of production, operates fairly small mills close to the producing areas and obtains 85 to 90 per cent. of the oil content of the pericarp, or over 18 per cent. oil to fruit, as against 10 to 12 per cent. obtainable by native hand methods of production.\* This remarkable improvement in effective yield which may be attributed to the increasing use of mechanical methods, to the extension of bulk handling, and to the improved varieties of oil palm cultivated, has been a gradual development as the following table shows :—

TABLE LVI.—*Development of Palm Oil Production in the Belgian Congo by the Huileries du Congo Belge.*(a)

Year.	Fruit treated (in tons).	Palm Oil extracted (in tons).	Oil to Fruit (in per cent.).
1914 ..	1,354	171	12·64
1915 ..	10,875	1,518	13·86
1916 ..	18,043	2,382	13·20
1917 ..	22,585	3,430	15·18
1918 ..	26,902	4,499	16·72
1919 ..	25,365	4,609	18·17
1920 ..	28,780	5,260	18·27
1921 ..	31,203	5,626	18·03
1922 ..	40,555	7,339	18·09
1923 ..	44,558	7,940	17·82
1924 ..	53,139	9,531	17·93
1925 ..	55,723	10,002	17·95
1926 ..	57,403	10,139	17·65
1927 ..	64,295	11,759	18·29
1928 ..	73,600	13,731	18·66
1929 ..	82,863	15,590	18·81
1930 ..	94,876	17,754	18·71
1931 ..	93,366	17,140	18·35

\* See "Tropical Agriculture," Vol. VII, No. 8, August, 1930, page 207.

(a) Source.—The figures for the years 1914 to 1929 were taken from the "Report on the oil palm industry in the Belgian Congo," published by the International Congress of Tropical Agriculture, Antwerp, July, 1930. The figures for the years 1930 and 1931 were furnished by Messrs. Unilevers, London.

The exports of palm oil from the Belgian Congo together with palm oil from neighbouring areas are shown in the following table.

TABLE LVII.—*Exports of Palm Oil from the Belgian Congo.*

(In tons.)

Source of Supply.	1912 -13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931	
Congo produce—										
Upper Congo ..	(a)	11,068	14,155	14,403	14,623	21,732	25,064	31,650	} 35,997	
Lower Congo ..	(a)	2,813	4,241	3,749	3,456	4,350	4,748	4,747		
Total .. ..		1,949	13,881	18,396	18,152	18,079	26,082	29,812	36,397	35,997
Ruanda-Urundi (Mandated Territory) produce .. ..	—	114	(b) 100	(b) 100	76	108	80	75	(d)	
Transit trade—										
Produce of—										
French Equatorial										
Africa .. ..	—	206	367	529	510	445	959	1,058	(d)	
Angola .. ..	154	71	34	65	122	73	267	132	(d)	
Total .. ..		154	277	401	594	632	518	1,226	1,190	(d)
Grand Total ..		2,103	14,272	(c) 18,897	(c) 18,846	18,787	26,708	31,118	37,662	(c) 37,262

(a) Details are not available for both years. In 1912 the Lower Congo furnished 1,945 tons and the Upper Congo 11 tons.

(b) Approximate estimate; official figures not available.

(c) Partly estimated.

(d) Not yet available; assumed same as 1930 in Grand Total.

The large growth in exports has been mainly due to the opening up of the interior. In 1912, Lower Congo, that is the coastal region around the mouth of the river, furnished about 2,000 tons of palm oil while the more inaccessible Upper Congo furnished only 11 tons. In 1930, the Lower Congo furnished less than 5,000 tons of palm oil and the Upper Congo over 31,000 tons. This development has been rendered possible by the opening up of communications through the

construction of motor roads and railways and by the provision of motor boats, steam boats and tankers on the numerous rivers. Following the check to the growth of exports which occurred in the period 1925 to 1927 there has been a renewal of the upward trend, and the exports of Congo produce in 1930 were more than double those of 1927. It is significant that this substantial increase has proceeded despite adverse market conditions and it presages an even more important growth when more favourable conditions rule in the world's markets.

The distribution of non-Congo produce is not indicated in the official trade returns, but it no doubt mainly follows the channels of the Congo produce, the distribution of which is shown in the following table.

TABLE LVIII.—*Distribution of Domestic Exports of Palm Oil from the Belgian Congo.*

(In tons.)

COUNTRIES.	1912.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Belgium .. ..	17	4,549	7,461	6,089	5,231	7,145	8,949	8,930	5,083
United States of America .. ..	—	7,029	10,287	11,426	12,105	17,348	18,306	22,167	22,244
United Kingdom .. ..	298	1,394	—	—	—	268	1,902	3,412	552
Angola .. ..	722	609	613	538	404	560	637	907	—
Germany .. ..	120	74	—	—	—	227	10	2	16
Netherlands .. ..	547	41	—	—	—	—	—	457	7,911
Other countries .. ..	252	185	35	99	339	534	8	516	191
Total .. ..	1,956	13,881	18,396	18,152	18,079	26,082	29,812	36,397	35,997

The exports to the United States have increased at a much more rapid pace than those to other countries, and in 1931 about three-fifths of the palm oil exported found a market there. Prior to 1930 the only other appreciable shipments were made to Belgium, which consumes more than half of the oil so imported, the remainder being re-exported to the Netherlands and Germany; but in 1930 the United Kingdom increased its imports of Congo palm oil by about 80 per cent., the volume representing about 10 per cent. of the exports from the

Colony. In 1931 exports to the United Kingdom fell heavily to about one-sixth of the 1930 volume while the Netherlands became a prominent importer.

#### Portuguese West Africa.

Although the Portuguese colonies in West Africa export appreciable quantities of palm kernels, their exports of palm oil are relatively small, suggesting that the bulk of the palm oil produced in those areas is consumed locally. The low volume of exports is particularly striking in the case of Portuguese Guinea which in the period 1926 to 1930 exported annually an average of over 10,000 tons of palm kernels and only 400 tons of palm oil. The following table shows the exports since 1924 and in the pre-war quinquennium.

TABLE LIX.—*Exports of Palm Oil from Portuguese West Africa.*  
(In tons.)

COUNTRIES.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.
Angola .. .. .	1,552	2,662	4,556	3,584	3,336	3,639	3,140	3,551
Portuguese Guinea (a) ..	31	(b) 250	(b) 250	274	351	294	526	586
San Thomé and Príncipe	13	276	306	300	253	223	337	(b) 300.
Total .. .. .	1,596	(c) 3,188	(c) 5,112	4,158	3,940	4,156	4,003	(c) 4,437

(a) Source of pre-war and post 1925 figures: Year Book of the International Institute of Agriculture, Rome.

(b) Approximate estimate.

(c) Partly estimated.

Angola provides the bulk of the palm oil exported from these areas, Portuguese Guinea, San Thomé and Príncipe supplying together the balance of about 20 per cent. The aggregate volume of exports has fluctuated at about 4,000 tons per annum since 1926 as compared with about 1,600 tons in the pre-war quinquennium, about 3,000 tons in 1924 and over 5,000 tons in 1925. The detailed distribution of the exports is not indicated but from the available information it is clear that Portugal is the principal importer and that Germany takes appreciable amounts.

**Liberia.**

The trade statistics of Liberia in the case of palm oil exports are available since 1925 only and show the following position.

TABLE LX.—*Exports of Palm Oil from Liberia. (a)*  
(In tons.)

COUNTRIES.	1925.	1926.	1927.	1928.	1929.	1930.
Germany .. .. .	1,758	1,390	1,327	} (c)	} (c)	} (c)
Netherlands .. .. .	526	544	563			
United Kingdom.. .. .	415	513	428			
Other countries .. .. .	3	5	89			
Total (b) .. .. .	2,702	2,452	2,407	1,811	2,431	2,116

(a) Export statistics prior of 1925 not traced; figures for the years 1928 to 1930 supplied by H.M. Chargé d'Affaires, Monrovia.

(b) Converted from gallons on the basis of 1 gallon = 9 lbs.

(c) Details of distribution not available.

Little variation has occurred in the exports of palm oil since 1925. Details of distribution have not been traced since 1927, but from 1925 to 1927 Germany took more than half the exports, and the balance was shared by the Netherlands and the United Kingdom.

**IMPORT.**

**United Kingdom.**

Before the War, the United Kingdom was by far the largest importer of palm oil in the world. Exact figures are not available, as prior to 1914 the trade returns did not distinguish between palm oil and palm kernel oil, but on the basis of the distribution of the exports of palm oil from British West Africa, which then furnished 75 per cent. of the world supplies, it is clear that the gross imports of the United Kingdom represented about two-thirds of all the palm oil entering world trade in the pre-war quinquennium. This estimate is borne out by an examination of the combined gross imports of palm oil and palm kernel oil in the pre-war quinquennium which amounted to about 90,000 tons per annum. German trade returns record an

export of about 11,000 tons of palm kernel oil to the United Kingdom which probably represented the bulk of the imports of palm kernel oil during the period, there being little or no palm kernels crushed for export in other countries at that time. This would leave an approximate gross import of palm oil of 79,000 tons, or about two-thirds of the total world exports of that commodity.

No great increase in the imports of this commodity occurred during the War, this being in striking contrast to the very large increase in palm kernel imports. The United Kingdom was already the largest importer of palm oil, and there was, therefore, little margin left for her to extend her trade; as regards palm kernels on the other hand, she was only a small importer, and the War resulted in the diversion to the British crushing industry of the very large palm kernel imports previously taken by Germany, largely on account of the relative proximity of supplies in contrast to the situation of the copra, groundnut and other oilseed and nut producing areas. Immediately after the War there was a fairly sharp rise in imports of palm oil following the removal of Government control, but this upward movement was very short-lived and the tendency since 1920, when imports amounted to about 100,000 tons, has been definitely downward. In 1931 the imports of palm oil into the United Kingdom amounted to 49,000 tons, the lowest figure recorded for at least 20 years. The trend of imports of palm oil since 1914 is indicated in Table LXI on page 92 which shows the United Kingdom's trade in unrefined palm oil. Separate statistics for refined palm oil are not available prior to 1919, but the trade in this commodity is relatively unimportant. The export figures, moreover, relate to exports of unrefined imported produce only, and do not include the relatively insignificant amounts of unrefined palm oil which has undergone a process of "bleaching" for soap making and is classified in the trade returns as domestic produce. In recent years these exports have varied between 1,000 and 2,000 tons but separate figures are not available prior to 1917.

A noticeable feature revealed by the following figures is the greater dependence of the United Kingdom on foreign supplies since the War. A record import of palm oil from foreign countries was registered in 1929, when 25 per cent. of the aggregate imports were from foreign countries as compared with an average of 8 per cent. during the War and 13 per cent. during the quinquennium immediately after the War.

TABLE LXI.—*United Kingdom's Trade in Unrefined Palm Oil.*  
(In tons.)

Year.	IMPORTS.			Re-exports. (a)	Amount retained.
	From British Countries.	From Foreign Countries.	Total.		
1914 ..	62,564	3,351	65,915	42,209	23,706
1915 ..	61,007	6,362	67,369	30,316	37,053
1916 ..	54,925	7,253	62,178	13,993	48,185
1917 ..	67,145	5,940	73,085	19,872	53,213
1918 ..	80,336	4,508	84,844	496	84,348
1919 ..	84,095	8,985	93,080	13,882	79,198
1920 ..	89,606	10,340	99,946	33,011	66,935
1921 ..	48,478	9,861	58,339	22,395	35,944
1922 ..	59,968	11,298	71,266	19,839	51,427
1923 ..	55,370	8,932	64,302	15,793	48,509
1924 ..	62,183	11,792	73,975	11,938	62,037
1925 ..	68,764	11,712	80,476	7,981	72,495
1926 ..	60,010	9,410	69,420	3,630	65,790
1927 ..	47,118	10,501	57,619	2,329	55,290
1928 ..	44,532	7,419	51,951	2,155	49,796
1929 ..	44,702	15,073	59,775	1,916	57,859
1930 ..	39,671	10,439	50,110	1,027	49,083
1931 ..	34,335	14,406	48,741	1,014	47,727

(a) The small exports of unrefined palm oil, bleached for soap-making and classified in the trade returns as domestic produce are not separately indicated prior to 1917, and are not included in these figures.

The bulk of the imports are from Nigeria, which during the period 1924 to 1931, furnished an average of nearly 80 per cent. of the total supplies. The most important of the foreign sources of supply is the Dutch East Indies which in 1931 furnished 16 per cent. of the whole as against 2 to 3 per cent. in the period 1924 to 1926. It is noticeable that a fairly rapid increase is occurring in imports not only from the Dutch East Indies and the Netherlands but also from British Malaya and from Belgium and the Belgian Congo, all areas



where mechanical methods of oil production have been adopted. These higher grade oils are finding a ready market in the United Kingdom but there is still a good demand for the inferior oils from British and French West Africa.

The details of the sources of the imports of unrefined palm oil since 1924 are given in the following Table.

TABLE LXII.—Imports of Unrefined Palm Oil into the United Kingdom.  
(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
<b>British countries—</b>								
Nigeria (including British Cameroons) .. ..	57,932	64,984	56,346	44,146	42,721	41,932	36,659	30,541
Sierra Leone .. ..	2,623	2,686	2,653	2,372	1,177	2,030	1,075	979
Gold Coast (including British Togoland) ..	1,201	759	667	210	197	116	38	128
British Malaya .. ..	—	297	332	215	312	483	1,737	2,661
Other British countries..	427	38	12	175	125	141	162	26
<b>Total from British countries</b>	<b>62,183</b>	<b>68,764</b>	<b>60,010</b>	<b>47,118</b>	<b>44,532</b>	<b>44,702</b>	<b>39,671</b>	<b>34,335</b>
<b>Foreign countries—</b>								
Dutch East Indies ..	1,758	1,967	1,653	3,580	4,162	6,063	5,291	7,952
French African colonies..	7,903	8,552	6,690	5,735	2,385	5,020	2,035	3,978
Belgian Congo .. ..	1,301	4	56	68	18	2,332	1,963	1,264
Germany .. .. .	16	129	267	158	101	629	175	429
Netherlands .. ..	418	277	196	59	249	421	475	265
Liberia .. .. .	139	360	364	582	288	160	62	21
Belgium .. .. .	8	46	59	56	4	140	299	233
Portugal .. .. .	40	288	4	131	75	100	10	85
Portuguese West African colonies.. .. .	80	78	103	6	40	58	10	78
Other foreign countries ..	129	11	18	126	97	150	119	101
<b>Total from foreign countries</b>	<b>11,792</b>	<b>11,712</b>	<b>9,410</b>	<b>10,501</b>	<b>7,419</b>	<b>15,073</b>	<b>10,439</b>	<b>14,406</b>
<b>Grand Total ..</b>	<b>73,975</b>	<b>80,476</b>	<b>69,420</b>	<b>57,619</b>	<b>51,951</b>	<b>59,775</b>	<b>50,110</b>	<b>48,741</b>
Percentage of total imports derived from British countries .. .. .	84.1	85.4	86.4	81.8	85.7	74.8	79.2	70.5
Percentage of world supplies taken by the United Kingdom ..	39.0	40.0	36.4	29.3	24.0	24.7	18.4	(a)

(a) Not yet available.

In the pre-war period the larger part of the imports of unrefined palm oil were re-exported, but as the War progressed the exports diminished considerably, and in the last war-year they almost ceased. This rapid decline in the exports coupled as it was with a slightly rising level of imports, resulted in a marked increase in the retentions, which nearly quadrupled between 1914 and 1918. After the War, exports increased substantially for two years but steadily declined thereafter until in 1931 they represented only about 2 per cent. of the gross imports.

TABLE LXIII.—*Re-exports of Unrefined Palm Oil from the United Kingdom.*

(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
United States of America	2,467	3,201	1,216	494	405	440	39	} (a)
Netherlands .. .. .	4,122	1,471	295	138	141	239	62	
Sweden .. .. .	401	282	124	66	16	180	73	
France .. .. .	377	302	145	91	31	161	25	
Argentine Republic ..	327	397	416	407	244	125	142	
Germany .. .. .	1,519	661	38	123	36	49	47	
Italy .. .. .	780	495	151	105	94	47	31	
Belgium.. .. .	97	160	173	69	103	45	62	
Portugal .. .. .	196	123	206	125	3	11	65	
Egypt .. .. .	—	222	190	182	76	106	113	
Irish Free State ..	—	75	78	91	458	215	214	
Spain .. .. .	193	180	235	153	64	83	65	
Union of South Africa (including South-West Africa territory) ..	35	—	1	—	196	20	9	
Canada .. .. .	8	9	32	39	35	30	2	
Other countries ..	1,416	403	330	246	253	165	78	
Total .. .. .	11,938	7,981	3,630	2,329	2,155	1,916	1,027	1,014

(a) Details not yet available.

The substantial decline in imports has been due more to a diminution in the re-export trade than to reduced consumption. The average annual volume of unrefined palm oil retained during the quinquennium 1927 to 1931 declined by 13 per cent. as compared with

the preceding quinquennium whereas the corresponding decline in re-exports amounted to 86 per cent. The virtual disappearance of the United Kingdom's entrepôt trade in palm oil is due to the development of direct trade between the sources of supply and the countries of ultimate consumption. Such countries as the United States of America, Italy and the Netherlands, which in the past took substantial quantities of palm oil from the United Kingdom are now securing the bulk of their supplies direct from West Africa and the Dutch East Indies. Much the same development has occurred in the entrepôt trade in palm kernels, which has similarly declined substantially since the War.

The foregoing table shows the destination of the re-exports of unrefined palm oil since 1924. Prior to 1930 the United States of America and the Netherlands were still the principal importers. The recent growth of exports to the Irish Free State is an interesting development.

The United Kingdom also does a relatively small trade in refined palm oil which consists mainly of the export of home refined oil. The annual retentions of palm oil, both refined and unrefined, since 1924 are shown in the following table. The figures do not differ appreciably from those of Table LXI, which showed the retentions of imported unrefined palm oil, but they more closely represent the actual amounts of palm oil available for domestic consumption.

TABLE LXIV.—*Estimated Amounts of Palm Oil available for Consumption in the United Kingdom.*

(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Retentions of imported unrefined oil . . . . .	62,037	72,495	65,790	55,290	49,796	57,859	49,083	47,727
Less—								
Exports of domestic unrefined oil (a) . . . . .	2,480	2,166	2,183	544	1,244	694	1,080	365
Net exports of refined oil . . . . .	1,799	1,874	254	402	442	861	1,079	1,040
Total . . . . .	4,279	4,040	2,437	946	1,686	1,555	2,159	1,405
Amount available for consumption . . . . .	57,758	68,455	63,353	54,344	48,110	56,304	46,924	46,322

(a) These exports consist of foreign unrefined palm oil which has undergone a process of "bleaching" for soap-making.

The apparent consumption of palm oil has shown some decline over the period under review. Part of this decline, more particularly that recorded in 1930, may be more apparent than real, being probably attributable in some measure to the non-replenishment of stocks. The foregoing figures do not take account of the variations in stocks, because of the absence of such information, and this omission, no doubt, seriously affects the validity of the estimates of apparent consumption especially in more recent years when consumers have been anxious to reduce stocks owing to the falling market. Whether the decline recorded in the foregoing table is real or not, it is fairly clear that no growth in the consumption of palm oil in the United Kingdom has taken place for a number of years. It is known that other oils, particularly coconut oil and whale oil, are being utilised in the soap and candle industries for which palm oil is largely employed. In the tin-plate industry palm oil is utilised to a small extent, about 3,000 tons per annum being consumed in the United Kingdom in this way, but little development is anticipated from this source as its excellent properties in connection with the "pickling" of the plates are stated to be already fully appreciated. The finer qualities of palm oil are also used in the manufacture of edible fats but the proportion of the total supply used for this purpose is still small.

#### **The United States of America.**

The United States, like Germany, has shown a large increase in its imports of palm oil in recent years, the figures rising from 45,000 tons in 1924 to 128,000 tons in 1930. The average annual imports of the pre-war quinquennium were 27,000 tons. Since 1929, the United States has imported more than one-half of all the palm oil entering world trade. The upward trend was maintained in 1930, but a decrease of 13,000 tons occurred in 1931, the level of imports in that year being slightly below that of 1929. The very heavy importations in 1929 and 1930 had resulted in a large accumulation of palm oil in the country at the end of the latter year, and this, no doubt, was responsible for the decline in imports in 1931.

The following table shows the imports of palm oil into the United States since 1924 and in the pre-war quinquennium. The whole of the imports are shown in the trade returns as imported for consumption, and no separate figures of palm oil exports are indicated.

TABLE LXV.—Imports of Palm Oil into the United States of America.  
(In tons.)

COUNTRIES.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.	
British West Africa ..	—	18,837	26,072	26,953	36,085	37,179	64,629	61,869	} (a)	
Dutch East Indies ..	—	79	1,296	4,649	5,878	13,135	20,102	34,300		
Belgian Congo ..	—	6,220	9,471	9,178	11,447	11,792	16,101	20,580		
United Kingdom ..	17,511	8,826	14,038	4,533	4,732	3,979	5,376	4,171		
Germany ..	9,184	9,130	5,339	7,254	5,449	4,539	5,004	3,909		
French West Africa ..	—	—	3,059	2,414	4,285	3,299	3,727	867		
British Malaya ..	—	—	—	101	1,103	760	943	1,378		
Netherlands ..	—	1,133	1,770	862	460	195	35	1,096		
Belgium ..	9	609	176	693	74	197	39	147		
Other countries	238	603	910	1,732	1,875	473	926	28		
Total ..	27,342	45,437	62,131	58,369	71,388	75,548	116,882	128,345		(b)

(a) Details not yet available.

(b) Preliminary estimate.

The United States now derives almost the whole of its palm oil direct from the producing areas in contrast to the practice before the war when almost the whole was imported from the United Kingdom and Germany. British West Africa, mainly Nigeria, now provides about one-half of the total imports and the increase in its share after 1925 was accompanied by decreasing shares of the United Kingdom and Germany. The Dutch East Indies now takes second place, imports from this source having notably increased, and its share of the total in 1930 was over 26 per cent. as against 2 per cent. in 1925. The share of the Belgian Congo, on the other hand, has remained fairly stationary in recent years.

The rapid rise in the share of the Dutch East Indies is undoubtedly attributable to the high-grade of oil furnished from this area which finds a ready market as an ingredient in the manufacture of edible fats. The volume of palm oil consumed in this industry is not known but from the statistics of the consumption of palm oil in the oleo-margarine industry it is clear that while the volume so utilised is still small it is definitely increasing.

The bulk of the palm oil imported into the United States is utilised in the soap, candle and tin-plate industries and to the development of these industries in recent years—particularly the soap and tin-plate industries—is no doubt attributable the rapid growth in the volume

of palm oil imported. The annual factory consumption of palm oil in the United States together with the stocks of this commodity held by factories and warehouses, compiled from reports of the Bureau of the Census is shown in the following table which also gives, for purposes of comparison, the imports of palm oil for the years in question.

TABLE LXVI.—*Imports, Consumption and Stocks of Palm Oil in the United States of America.*

(In tons.)

Year.	Imports. (a)	Consumption. (b)	Stocks at end of year. (c)
1924 ..	45,437	35,114	10,557
1925 ..	62,131	49,028	11,535
1926 ..	58,369	54,446	8,035
1927 ..	71,388	48,066	18,449
1928 ..	75,548	79,881	9,705
1929 ..	116,882	88,399	23,472
1930 ..	128,345	98,209	41,884
1931 (d) ..	115,248	108,627	39,756

(a) Gross imports; exports are not separately shown but are known to be small.

(b) Excludes consumption by households, retailers and bakeries, or by contractors, etc., or for lubrication purposes of any kind.

(c) Includes all stocks other than those in the hands of households, local tradesmen, retailers, wholesalers or jobbers, except such as may be held in public warehouses. Stocks in hands of importers and exporters are included.

(d) The 1931 figures were furnished by the United States Department of Agriculture.

The foregoing figures show a rapid and fairly consistent increase in consumption. Between 1924 and 1931, the factory consumption of palm oil increased threefold. Stocks have also accumulated rapidly, the quantity held by factories and warehouses aggregating 40,000 tons at the end of 1931 as compared with about 10,000 tons at the end of 1924. The figures of consumption and stocks are not complete and this, no doubt, accounts for the apparent lack of agreement between the three sets of figures in the table.

#### Germany.

Germany has largely increased her imports of palm oil in recent years, when most of the other principal European importing countries have shown decreasing or stagnant imports of this commodity. In the period 1928-1931 her annual imports of palm oil averaged about 26,000 tons as against about 15,000 tons in the period 1924-1927 and about 12,000 tons in the pre-war quinquennium.

British West Africa provides about 80 per cent. of the palm oil imports of Germany, and most of the other producing areas in West Africa also furnish small quantities. The development of the Dutch East Indies, as a source of supply, is an outstanding feature of the German as of the British palm oil trade and this area is now the second principal source, the imports in 1931 amounting to about 6,700 tons, or over 18 per cent. of the total, as compared with about 90 tons or 1 per cent. of the total in 1924.

The following table shows the German import and export trade in palm oil since 1924 and in the pre-war quinquennium. The figures relate to the "special" trade only; the transit trade has been excluded for the reason that the exports of palm oil in transit are not separately indicated in the official returns. The export figures shown in the following table relate to palm oil originally imported for consumption and they are accordingly relatively small.

TABLE LXVII.—*German Trade in Palm Oil.*  
(*Special Trade.*)  
(In tons.)

	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
<b>Imports from—</b>									
British West Africa	10,871	8,002	14,434	7,337	11,807	15,218	15,081	22,630	27,348
Dutch East Indies	—	91	127	174	1,856	2,397	1,585	3,599	6,718
Belgian Congo ..	—	205	1,414	4,056	1,002	617	1,726	855	535
Other countries ..	1,356	763	2,309	2,326	2,213	1,712	1,355	1,983	1,601
<b>Total ..</b>	<b>12,227</b>	<b>9,061</b>	<b>18,284</b>	<b>13,893</b>	<b>16,978</b>	<b>19,944</b>	<b>19,747</b>	<b>29,067</b>	<b>36,202</b>
<b>Exports to—</b>									
Czechoslovakia ..	—	173	124	243	306	48	46	} 98	201
Other countries ..	108	110	328	527	214	213	103		
<b>Total ..</b>	<b>108</b>	<b>283</b>	<b>452</b>	<b>770</b>	<b>520</b>	<b>261</b>	<b>149</b>	<b>98</b>	<b>201</b>
<b>Amount retained ..</b>	<b>12,119</b>	<b>8,778</b>	<b>17,832</b>	<b>13,123</b>	<b>16,458</b>	<b>19,683</b>	<b>19,598</b>	<b>28,969</b>	<b>36,001</b>

The considerable increase in apparent consumption of palm oil in Germany in recent years may be attributed in large measure to the development of the soap industry as evidenced by the growth of the export trade in this commodity, which has increased from about 11,000 tons in 1926 to about 21,000 tons in 1931. The German export trade in soap in recent years and in 1913 is indicated in the following table.

TABLE LXVIII.—*Exports of Soap from Germany.*

(In tons.)

Item.	1913.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Soft soap and similar detergents in large containers ..	5,603	1,459	2,394	3,095	4,062	5,048	5,300	4,510	5,163
Hard soap and similar detergents	1,925	525	597	553	581	702	731	720	739
Soap ready for use formed or in tins, bottles, etc. ; liquid soap, soap powder, soap flakes, etc. ..	4,546	5,158	7,787	7,178	8,604	11,385	13,862	16,569	15,562
Total ..	12,074	7,142	10,778	10,826	13,247	17,135	19,893	21,799	21,484

**Italy.**

The development of Italy's trade in palm oil has been a striking feature of the post-war period. Imports during the period 1928-31 have averaged 19,000 tons per annum as compared with 16,000 tons during the period 1924-27 and about 7,600 tons in the pre-war quinquennium.

The following table shows the development and source of the Italian imports of palm oil since 1924, and in the pre-war period.

TABLE LXIX.—*Imports of Palm Oil into Italy.*

(In tons.)

COUNTRIES.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
British West Africa	361	9,748	7,783	12,099	9,747	16,661	11,747	16,041	20,144
Belgian Congo ..	30	408	342	883	583	2,049	1,601	3,378	2,928
Belgium .. ..	24	309	276	1,193	1,246	649	635	708	691
French West and Equatorial Africa	71	307	1,911	1,568	1,419	560	244	596	453
United Kingdom ..	5,613	2,813	2,178	1,307	1,781	1,426	868	378	437
British India and Ceylon .. ..	119	332	78	27	53	299	—	61	—
France .. ..	1,215	307	767	561	81	56	75	—	—
Portuguese West Africa .. ..	—	163	1,873	—	—	348	172	—	238
Other countries ..	170	844	482	748	121	452	385	405	822
Total ..	7,603	15,231	15,690	18,386	15,031	22,500	15,727	21,567	25,713



Italy is the chief market for higher free fatty acid grades of oil and British West Africa now supplies direct the great bulk of the palm oil taken by Italy, the share of this producing area having increased substantially in recent years. The Belgian Congo is also furnishing increasing amounts, but the other African territories have not been able to maintain the level of their Italian trade. Imports from the United Kingdom, which in the pre-war quinquennium represented the greater part of the whole, have declined steadily, Italy now purchasing the bulk of her supplies direct from the producing areas. Practically the whole of the palm oil imports are utilised in the country, exports averaging only 27 tons during the years 1924-31. Much of the increase in imports of palm oil may be attributed to the development of the Italian soap industry. Italy has been gradually becoming self-supporting in this commodity, and in 1930 her exports of soap exceeded imports for the first time.

#### **France.**

The French trade in palm oil has fluctuated appreciably from year to year since before the War, and in the period since 1924 the annual imports have varied between 20,400 tons and 8,500 tons. The bulk of the imports are utilised for domestic consumption, the annual exports since 1921 never attaining 1,000 tons.

Table LXX on page 102 shows the French trade in palm oil since 1924 and in the pre-war quinquennium. It will be seen that about 80 per cent. of the imports are derived from the French African Colonies, of which French West Africa is by far the most important.

The apparent consumption of palm oil in France has decreased by about 40 per cent. in recent years. During the period 1928-31 the amount retained averaged about 11,000 tons per annum as against nearly 17,000 tons in the period 1924 to 1927. In the pre-war quinquennium, the apparent consumption was about 15,000 tons per annum, and during the War and in the immediate post-war period it averaged about 20,000 tons. The definite and substantial diminution in consumption which has been in evidence since 1926 may be attributable to the greater utilisation of coconut oil in those industries such as soap and candle manufacture in which palm oil enters. The apparent annual consumption of coconut oil has increased considerably since 1927. The French trade in coconut oil is not

known for the greater part of the period under review as the trade returns prior to 1929 did not separately indicate this commodity; but the copra figures are available, and in the period 1924 to 1927, the net imports of copra in terms of coconut oil averaged 95,000 tons per annum, as compared with 123,000 tons in the period 1928 to 1931, an increase of nearly 30 per cent. In addition, the price of palm oil in recent years has not fallen to the same extent as that of coconut oil, and this has encouraged substitution of the latter oil wherever possible.

TABLE LXX.—*French Trade in Palm Oil.*

(*Special Trade.*)

(In tons.)

	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
<b>Imports from—</b>									
<b>French African Colonies—</b>									
French West Africa	14,647	16,909	14,903	17,153	8,743	12,483	6,493	8,454	6,557
French Cameroons	—	517	515	1,229	453	1,231	826	1,804	759
French Togoland	—	1,135	648	807	1,419	973	154	135	29
French Equatorial Africa .. ..	—	77	39	236	63	—	(a)	(a)	(a)
<b>Total .. ..</b>	<b>14,647</b>	<b>18,638</b>	<b>16,105</b>	<b>19,425</b>	<b>10,678</b>	<b>14,687</b>	<b>7,473</b>	<b>10,393</b>	<b>7,345</b>
British West Africa	976	61	81	214	269	189	(a)	(a)	(a)
United Kingdom ..	76	1,411	986	477	162	131	261	(a)	(a)
Other countries ..	1,027	192	178	315	420	681	721	983	1,698
<b>Total imports..</b>	<b>16,726</b>	<b>20,302</b>	<b>17,350</b>	<b>20,431</b>	<b>11,529</b>	<b>15,688</b>	<b>8,455</b>	<b>11,376</b>	<b>9,043</b>
<b>Exports to—</b>									
Italy .. ..	635	482	233	471	234	237	86	} 221	76
Other countries ..	911	452	290	349	251	205	95		
<b>Total exports..</b>	<b>1,546</b>	<b>934</b>	<b>523</b>	<b>820</b>	<b>485</b>	<b>442</b>	<b>181</b>	<b>221</b>	<b>76</b>
<b>Amount retained ..</b>	<b>15,180</b>	<b>19,368</b>	<b>16,827</b>	<b>19,611</b>	<b>11,044</b>	<b>15,246</b>	<b>8,274</b>	<b>11,155</b>	<b>8,967</b>

(a) Included in "Other countries."

### The Netherlands.

The Dutch trade in palm oil has shown extremely wide fluctuations since the War. The trade returns, which can be compared only since 1917, in which year their method of compilation was revised, show between 1917 and 1931 a variation of the retained amounts of between 900 tons in 1917 and 23,000 tons in 1924. Since 1927 the figures have been much more stable and the retained amounts have varied between 7,500 and 9,000 tons.

The annual trade figures since 1924 are summarised in the following table. The figures do not include the transit trade in palm oil, as this is not separately specified in the official returns, and the exports shown relate only to palm oil originally imported for domestic consumption.

TABLE LXXI.—*Dutch Trade in Palm Oil.*

(In tons.)

	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Imports from—								
British West Africa	9,497	508	1,355	2,751	2,778	2,895	5,510	4,755
Belgium .. ..	(a)	1,861	1,008	363	1,545	3,448	2,293	1,217
Dutch East Indies	2,149	1,099	4,707	4,313	2,784	916	1,161	1,647
Liberia .. ..	(a)	—	29	—	96	389	199	(a)
French Congo ..	(a)	38	105	504	382	208	147	437
French West Africa	3,192	532	398	803	215	372	126	(a)
Germany .. ..	1,289	516	429	5	197	203	65	(a)
North-West Borneo	(a)	21	89	40	24	24	63	(a)
Portuguese West Africa .. ..	(a)	63	87	—	167	413	52	(a)
United Kingdom ..	12,348	13,250	2,933	650	182	45	40	(a)
Belgian Congo ..	(a)	146	115	43	371	51	11	(a)
Other countries ..	1,595	11	109	108	38	78	2	315
Total .. ..	30,070	18,045	11,364	9,580	8,779	9,042	9,669	8,371
Exports .. ..	6,991	3,101	814	479	795	202	649	813
Amount retained ..	23,079	14,944	10,550	9,101	7,984	8,840	9,020	7,558

(a) Included in "Other countries."

Since 1924 Dutch trade in palm oil has substantially diminished but it should be noted that the year 1924 constituted a high record. The imports of 30,000 tons in that year compare with an annual average figure over the six preceding years of 4,300 tons ; the exports of 7,000 tons compare with 140 tons ; and the retained amount of 23,000 tons compares with about 4,000 tons. This sudden increase in 1924 may be attributed in part to the increased utilisation of palm oil in the production of margarine which also expanded rapidly in that year, the net exports rising from 57,000 tons in 1923 to 81,000 tons in 1924.(a)

The principal sources of supply of the Dutch imports of palm oil in recent years are British West Africa, Belgium and the Dutch East Indies, but in the earlier part of the period under review, the United Kingdom was by far the most important source. In 1924 and in 1925, between 12,000 and 13,000 tons were thence derived whereas in the period 1928 to 1930 the amount had sunk to less than 100 tons per annum. The supplies furnished by the Dutch East Indies reached a peak of 4,700 tons in 1926, but have since declined to about 1,400 tons in 1930 and 1931, a somewhat surprising development in view of the increase in imports of high grade oils in most oil-consuming countries. The large growth in recent years in the declared shipments of palm oil from the Dutch East Indies to the Netherlands is evidently mainly of produce ultimately destined for other countries ; this transit trade is not shown in the above table.

### **Belgium.**

Prior to 1925, the Belgian trade returns did not distinguish between palm oil and palm kernel oil, and it is, therefore, not possible to compare the trade since 1925 with that of earlier years. The returns distinguish between refined and unrefined palm oil, and the figures for each variety since 1925 are shown in the following table.

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(a) See " Review of Oilseed and Oil Markets for 1923," by Messrs. Frank Fehr & Company which contained the following statement in the Palm Oil Section :—

" It has now become possible for the margarine manufacturer to compete with the soapmaker for the low acidity oils and large quantities are being refined for margarine. It is estimated that 15/20,000 tons per annum may be diverted from the soap-pans to the refineries."

Palm oil did not, however, prove as successful as it was hoped in the production of margarine.

TABLE LXXII.—*Belgian Trade in Palm Oil.*  
(In tons.)

	1925.	1926.	1927.	1928.	1929.	1930. (b)	1931. (b)
<b>Imports.</b>							
Unrefined oil from—							
Belgian Congo ..	7,283	8,648	5,448	7,157	7,841		
Netherlands ..	448	314	983	1,171	1,592		
Germany ..	185	799	837	923	453		
United Kingdom ..	1,173	1,218	485	543	280		
British African Colonies ..	(a)	333	449	596	91		
French African Colonies ..	182	43	173	221	800		
Other countries ..	169	361	266	484	1,029		
Total ..	9,440	11,716	8,641	11,095	12,086		
Refined oil from—							
Netherlands ..	1,582	1,496	1,388	721	166		
Belgian Congo ..	227	(a)	(a)	19	54		
Other countries ..	17	36	9	44	178		
Total ..	1,826	1,532	1,397	784	398		
Grand Total ..	11,266	13,248	10,038	11,879	12,484		
<b>Exports.</b>							
Unrefined oil to—							
Netherlands ..	1,060	777	301	1,369	2,717		
Germany ..	1,075	619	619	1,129	1,197		
Italy ..	598	2,696	888	698	567		
France ..	125	415	134	256	429		
United States of America ..	1,811	1,182	(a)	262	197		
Other countries ..	725	1,117	1,081	796	985		
Total ..	5,394	6,806	3,023	4,510	6,092		
Refined oil to—							
France ..	76	14	(a)	226	158		
Netherlands ..	224	26	(a)	30	64		
Other countries ..	88	—	20	87	160		
Total ..	388	40	20	343	382		
Grand Total ..	5,782	6,846	3,043	4,853	6,474		
<b>Amounts retained—</b>							
Unrefined oil ..	4,046	4,910	5,618	6,585	5,994	5,280	3,350
Refined oil ..	1,438	1,492	1,377	441	16	—236	—242
Total ..	5,484	6,402	6,995	7,026	6,010	5,044	3,108

(a) Included in "Other countries."

(b) Preliminary figures; particulars of transit trade not yet available.

There was an increase in the aggregate retentions of refined and unrefined palm oil between 1925 and 1928 after which an appreciable decline occurred, the diminution between 1928 and 1931 amounting to about 56 per cent. The marked decrease in the import balance of refined palm oil between 1926 and 1929 and the change-over into an export balance in 1930 and 1931 indicate that Belgium is increasing her oil refining industry and is now adequately supplying domestic requirements.

As might be expected, the Belgian Congo is the principal source of supply, while the Netherlands, Germany and Italy are the principal destinations of the exports. Belgium's trade in palm oil is largely a transit trade but whereas the exports in 1925 and 1926 represented about one-half of the imports they represented only about 40 per cent. in the period 1927-29. Thus Belgium, like the United Kingdom, is experiencing a decreasing transit trade in palm oil.

The bulk of the palm oil retained by Belgium is utilised in the manufacture of soap and it is observed that the decline in the retentions of palm oil in 1929, 1930 and 1931, coincided with a substantial increase in the net imports of soap, the amount rising from about 1,100 tons in 1928 to over 5,000 tons in 1931.

### **Portugal.**

Imports of palm oil into Portugal showed a distinct upward trend between 1924 and 1927 and in the latter year aggregated about 4,000 tons as compared with about 3,000 tons in 1924 and about 1,800 tons in the pre-war quinquennium. This growth has not been maintained in more recent years and the average annual imports in the period 1928 to 1931 amounted to about 3,300 tons. The following table shows the annual imports of palm oil since 1924 and in the pre-war quinquennium.

Portuguese West Africa is the most important source of supply. Exports of palm oil are not separately indicated in the trade returns but they are known to be slight, and, consequently, almost the whole of the imports are available for domestic consumption.

TABLE LXXIII.—Imports of Palm Oil into Portugal.

(In tons.)

COUNTRIES.	1909-13. (Average.)	1924.	1925.	1926.	1927.	1928.	1929.	1930.
Portuguese West Africa .. ..	1,323	2,641	3,059	2,994	3,721	3,558	2,292	3,027
United Kingdom ..	403	284	145	243	154	50	66	125
Germany .. ..	87	—	—	—	—	—	—	—
Other countries ..	27	37	159	47	137	21	113	1
Total ..	1,840	2,962	3,363	3,284	4,012	3,629	2,471	3,153

*Note.*—Preliminary figures for 1931 show an increase to 3,858 tons, details of which are not available.

#### Sweden.

Between 1924 and 1927 the annual volume of imports of palm oil into Sweden were at an average level slightly below that of the pre-war quinquennium, but a distinct advance was made in 1929, when imports aggregated over 1,700 tons as compared with an average of about 900 tons per annum in the preceding quinquennium. The United Kingdom continued to be the principal immediate source of these imports until 1930. Between 1924 and 1929 she furnished about 70 per cent. of the total volume, as compared with about 80 per cent. before the war. The following table shows the development and source of Swedish imports of palm oil since 1924 and in the pre-war quinquennium. There are no recorded exports of palm oil from Sweden and the imports may be taken as representing the amount available for consumption.

TABLE LXXIV.—*Imports of Palm Oil into Sweden.*

(In tons.)

COUNTRIES.	1909-13. (Average.)	1924.	1925.	1926.	1927.	1928.	1929.	1930.
United Kingdom ..	784	531	774	669	639	697	1,136	488
Germany .. ..	127	101	6	9	14	78	315	511
Netherlands ..	—	106	280	85	85	129	231	163
Belgium .. ..	—	2	58	90	107	29	12	(a)
Other countries ..	61	19	5	2	22	45	21	31
Total .. ..	972	759	1,123	855	867	978	1,715	1,193

(a) Included in "Other countries."

**Czechoslovakia.**

Czechoslovakia which is a considerable importer of palm kernels, imports only small quantities of palm oil, the average volume since 1925 having amounted to about 1,200 tons. The following table shows the annual imports and their source since 1924. It will be seen that there was a substantial diminution in 1925 but that since then the level has been fairly steady.

TABLE LXXV.—*Imports of Palm Oil into Czechoslovakia.*

(In tons.)

COUNTRIES.	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Germany .. ..	794	671	858	514	589	984	764	799
British West Africa ..	156	(a)	12	52	332	588	112	24
Netherlands .. ..	2,086	401	314	185	—	—	21	—
Other countries.. ..	187	36	5	374	141	46	185	2
Total .. ..	3,223	1,108	1,189	1,125	1,062	1,618	1,082	825

(a) Included in "Other countries."



Germany is the chief source of supply, but the Netherlands, which is shown as having supplied about two-thirds of the imports in 1924, has furnished little or nothing since 1928; this apparent change in the trade channels is probably due to the modification in the system of recording imports to which reference has already been made. There is a small export of palm oil averaging about 90 tons during 1924-31 so that almost the whole of the imports indicated in the foregoing table are retained for home consumption.

#### **Other Countries.**

As regards British Empire countries other than the United Kingdom, small quantities of palm oil are imported by the Irish Free State, the Union of South Africa and Canada, but in no case does the quantity reach 500 tons per annum. India, New Zealand and Australia record no imports. In South Africa, New Zealand, Canada and Australia animal fats are plentiful and coconut oil is generally more readily accessible than palm oil. India, moreover, has plentiful supplies of coconut oil, groundnut oil and cottonseed oil and little or no demand appears to exist for palm oil.

As regards foreign countries, a number of European countries, notably Finland and Denmark import palm oil, but the trade is small, and in the case of Finland, the largest of them, amounted on an average to about 500 tons per annum in the period 1924-30. In a number of other countries, as for instance, Yugoslavia, Roumania, Bulgaria, Poland, Austria, Hungary, Norway and Switzerland, palm oil is not separately classified in the trade returns, but the imports are known to be relatively insignificant. Of the non-European foreign countries, Argentina is the only one deserving mention as an importer of palm oil. Her imports of this commodity are not shown separately but are combined with those of palm kernel oil and the aggregate annual imports of these two oils increased from 300 tons in 1924 to 900 tons in 1930. But despite this appreciable rise, the volume available for consumption is still small and it is unlikely that Argentina will provide an important market for palm oil in the near future on account of the ample supplies of animal fats available as a by-product of the live-stock industry.

## CHAPTER III.

### THE COURSE OF PRICES OF PALM KERNELS, PALM KERNEL OIL AND PALM OIL.

The average monthly prices of palm kernels, palm kernel oil and palm oil for the quarter-months since 1911 are set out in three tables at the end of this Chapter. They have been furnished by Messrs. Frank Fehr & Company, and are Liverpool landed prices. The course of these prices is illustrated in the diagram facing this page which also indicates the movement of the general commodity price index for purposes of comparison.

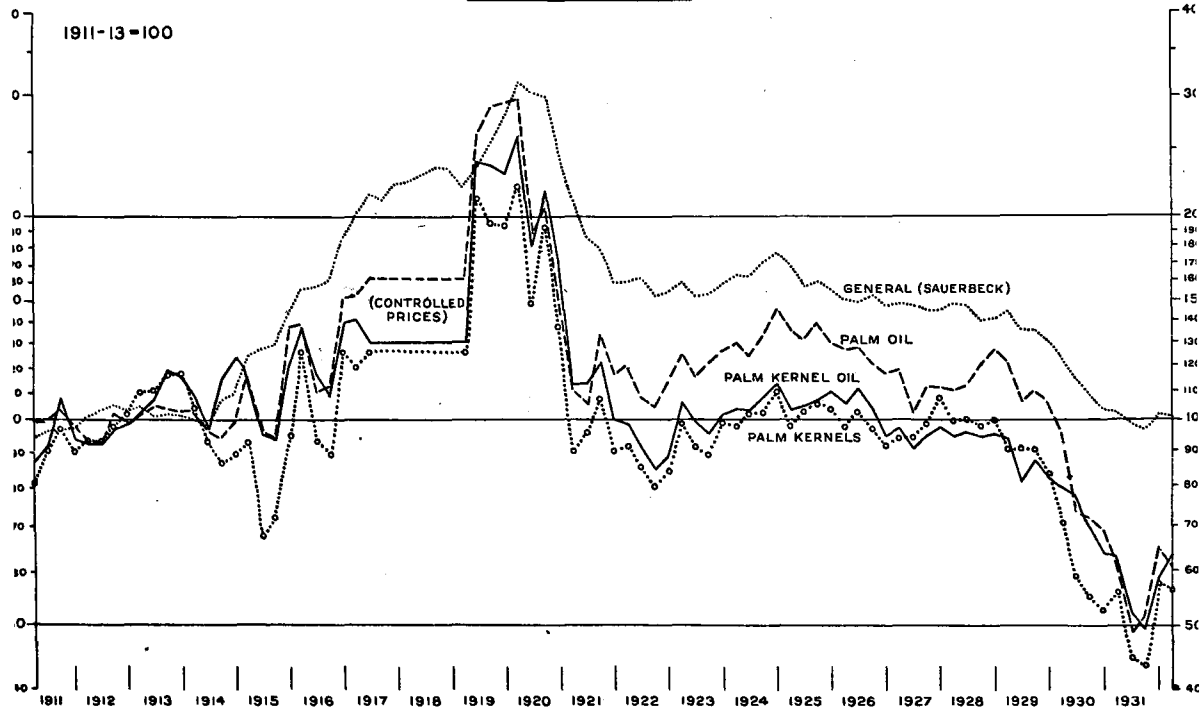
#### I.—PALM KERNELS AND PALM KERNEL OIL.

The prices of palm kernels and palm kernel oil both before the War and in the early part of the War were subject to substantial fluctuations. Between January, 1911, and July, 1914, the average monthly prices of palm kernels varied between £16 12s. 6d. and £24 per ton and the price of palm kernel oil between £32 15s. and £49 10s. per ton, a fluctuation of roughly 50 per cent. on the lower price. Both commodities were showing a definite upward trend up to the end of 1913, but thereafter palm kernels fell sharply until the middle of 1915, a fall of about 45 per cent. being realised, while palm kernel oil also fell although less consistently and precipitately, a reduction of about 20 per cent. being recorded in the same period. Much fluctuation, but an upward trend, was then observable in both commodities until the institution of a controlled price in May, 1917. The price of palm kernels was fixed at £26 per ton and that of palm kernel oil at £52 per ton. The controlled price in the case of palm kernels represented about 25 per cent. more than the average price for the period 1911–1913 and in the case of palm kernel oil about 30 per cent. more.

The price control of these two commodities remained in force until April, 1919, and its removal resulted in an immediate jump in prices. Palm kernel oil reached £111 15s. 0d. per ton in February, 1920, and

PRICE INDEX OF OIL PALM PRODUCTS AND THE GENERAL COMMODITY PRICE INDEX 1911 — 1931.

(LOGARITHMIC SCALE.)



remained at or above £90 per ton until May, 1920. Palm kernel prices also rose considerably, but not to the same extent. By January, 1921, both commodities had again sunk below the controlled price, and from that time until December, 1928, they fluctuated about the pre-war level. A considerable further price fall then occurred and continued with little interruption down to September, 1931. In that month palm kernel oil was quoted at £19 10s. 0d. per ton and palm kernels at £9 per ton. These are the lowest prices ruling for at least twenty years and represent barely 50 per cent. of the pre-war prices.

The recent heavy fall in prices may be attributed to the following special factors, apart from the general causes which have affected the price level of all commodities. (a)

(i) The enormous stocks of whale oil which is in active competition with palm kernel oil in the manufacture of margarine and soap.

(ii) The large production of groundnuts and copra, groundnut oil and coconut oil being also an important ingredient in the manufacture of edible fats.

(iii) The increased production and low price of butter consequent upon good harvests, which limited the market for margarine.

(iv) The reduced demand in Europe for oil cake as cattle feed owing to the abundance of pasturage and fodder crops.

In view of these factors and the sustained level of annual production of palm kernels, it seems probable that palm kernel and palm kernel oil prices will remain depressed for some time to come.

## II.—PALM OIL.

Before the War palm oil prices were relatively stable at about £30 per ton, and in the early part of the War, prior to the institution of a controlled price, the upward trend was very similar to that of

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(a) See Report on the Market for Palm Kernels and Palm Oil, 1930, published by the Antwerp Colonial Society.

palm kernel oil, although the relative levels reached were appreciably higher. The controlled price was fixed at £48 per ton, which was 60 per cent. above the average price of the period 1911-13. Much the same price movement as in the case of palm kernel oil was manifested on the removal of control in 1919, prices rising in the course of the succeeding year to about double the controlled price and falling towards the end of 1920 to below the controlled price.

Palm oil prices after the War fared, until recently, distinctly better than the prices of palm kernels and palm kernel oil. Not until January, 1930, did the price fall below the pre-war level, whereas palm kernels went below the pre-war level as early as 1921 and palm kernel oil in 1922. During the period 1921-28 the palm oil price index was on an average 20 per cent. above the pre-war level of 1911-13; during the same period the corresponding indices of palm kernels and palm kernel oil were respectively 3 per cent. below, and 1 per cent. above, the pre-war level. This relatively favourable market position of palm oil may be attributed to the heavy post-war demand for the commodity, for which no adequate substitute comparable in price was available until within the past few years; the heavy post-war demand was, of course, also reflected in the large increase in the volume absorbed by consuming countries. Since the end of 1928 palm oil prices have fallen rapidly, the percentage decrease between December, 1928, and September, 1931, being much greater than in the case of the other oil palm products, as Table LXXVI on page 113 shows.

The improvement in prices following the departure of the United Kingdom from the gold standard in September, 1931, was at first substantial and held until February, 1932, by which time palm kernels had appreciated by about 15 per cent., palm kernel oil by about 25 per cent. and palm oil by about 20 per cent. But there has since been a heavy fall in each category, particularly in palm oil and the average sterling price for that commodity in May, 1932, was slightly below that for September, 1931.

Prices did not materially advance up to February, 1932, in those countries which remained on the gold standard, and the rise in the United Kingdom appears to have been entirely due to the monetary factor. Prices of oil palm products, both in the United Kingdom and in foreign consuming centres, showed a falling trend after February, 1932.

TABLE LXXVI.—*Monthly Price Index of Oil Palm Products,  
December, 1928, to May, 1932.*

(Average monthly price, 1928 = 100.)

Month.	Palm Kernels.	Palm Kernel Oil.	Palm Oil.
1928—December .. ..	100·0	99·7	108·6
1929—March .. ..	91·2	98·0	102·9
June .. ..	80·9	85·2	90·4
September .. ..	90·6	91·8	94·3
December .. ..	83·0	86·6	90·7
1930—March .. ..	70·9	83·3	80·4
June .. ..	61·8	81·3	62·2
September .. ..	55·1	72·1	61·1
December .. ..	52·7	67·2	58·6
1931—March .. ..	55·8	65·6	52·1
June .. ..	44·2	54·4	41·1
September .. ..	43·6	51·1	44·3
December .. ..	57·6	60·7	56·0
1932—March .. ..	56·4	65·6	52·6
May .. ..	50·9	59·7	42·2

Palm oil has had to contend, since 1928, with intense competition from whale oil in its utilisation in the soap industry, and this fact has no doubt played an important part in the recent price depression. The trade anticipates that if the present marketing conditions persist a reduction in the supplies of palm oil will result, particularly in those furnished by native palmeries, as for instance, in Nigeria, where exports of palm oil in 1931 were 13 per cent. less than in 1930. Little or no reduction in supplies is anticipated from the plantations of the Dutch East Indies, Malaya and the Belgian Congo. Indeed the exports from the Dutch East Indies in 1931 showed a continuation of the rapid rise noted in the earlier years. Depressed prices, however, would appear likely to affect similarly the production of whale oil, and it is indeed doubtful whether a protracted period of low prices would, on the whole, be as detrimental to the interests producing the vegetable oil as to those producing the marine oil.

TABLE LXXVII.—*Course of Prices of Palm Kernels.*

(Average monthly price per ton, Liverpool landed.)

Terms :—2½ per cent. discount before April, 1917 ; net cash after April, 1917.

Year.	March.	June.	September.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1911 ..	16 12 6	18 11 3	20 10 0	18 7 6
1912 ..	19 5 0	19 2 6	20 10 0	21 2 6
1913 ..	22 13 9	22 15 0	23 18 9	24 0 0
1914 ..	21 11 3	19 5 0	17 15 0	18 3 9
1915 ..	19 2 6	13 16 3	14 16 3	19 12 6
1916 ..	26 2 6	19 5 0	18 7 6	26 0 0
1917 ..	24 15 0	(a) 26 0 0	(a) 26 0 0	(a) 26 0 0
1918 ..	(a) 26 0 0	(a) 26 0 0	(a) 26 0 0	(a) 26 0 0
1919 ..	(a) 26 0 0	43 12 6	40 7 6	39 12 6
1920 ..	45 15 0	30 17 6	39 17 6	28 2 6
1921 ..	18 10 0	19 15 0	22 3 0	18 10 0
1922 ..	18 17 0	17 14 0	16 10 0	17 8 6
1923 ..	20 5 0	18 17 6	18 5 0	20 8 9
1924 ..	20 7 6	21 3 9	21 7 6	22 15 0
1925 ..	20 5 0	21 5 0	21 15 0	21 8 9
1926 ..	20 7 6	21 5 0	20 2 6	19 0 0
1927 ..	19 10 0	19 10 0	20 6 3	20 16 3
1928 ..	20 12 6	20 15 0	20 5 0	20 12 6
1929 ..	18 16 3	16 13 9	18 13 9	17 2 6
1930 ..	14 12 6	12 15 0	11 7 6	10 17 6
1931 ..	11 10 0	9 2 6	9 0 0	11 17 6
1932 ..	11 12 6	(b) 10 10 0		

(a) Controlled price.

(b) May.

TABLE LXXVIII.—*Course of Prices of Palm Kernel Oil.*

(Average monthly price per ton, Liverpool naked ex mill.)

Terms :—2½ per cent. discount before April, 1917 ; net cash after April, 1917.

Year.	March.	June.	September.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1911 ..	34 15 0	36 5 0	43 0 0	37 10 0
1912 ..	36 10 0	37 5 0	39 0 0	39 10 0
1913 ..	41 10 0	42 12 6	47 0 0	46 5 0
1914 ..	43 0 0	39 0 0	46 2 0	49 8 0
1915 ..	47 16 3	37 13 9	36 15 0	48 11 3
1916 ..	55 1 3	46 12 6	43 10 0	56 0 0
1917 ..	56 7 6	(a) 52 0 0	(a) 52 0 0	(a) 52 0 0
1918 ..	(a) 52 0 0	(a) 52 0 0	(a) 52 0 0	(a) 52 0 0
1919 ..	(a) 52 0 0	96 0 0	94 10 0	91 10 0
1920 ..	109 0 0	72 7 6	86 0 0	66 10 0
1921 ..	45 10 0	45 5 0	48 15 0	40 0 0
1922 ..	39 10 0	37 0 0	33 15 0	35 1 6
1923 ..	42 5 0	40 0 0	38 6 9	41 2 6
1924 ..	41 10 0	41 7 6	43 0 0	44 12 6
1925 ..	41 12 6	42 5 0	42 12 6	43 17 6
1926 ..	42 10 0	44 12 6	41 7 6	37 12 6
1927 ..	39 0 0	36 5 0	37 12 6	39 2 6
1928 ..	38 0 0	38 5 0	37 15 0	38 0 0
1929 ..	37 7 6	32 10 0	35 0 0	33 0 0
1930 ..	31 15 0	31 0 0	27 10 0	25 12 6
1931 ..	25 0 0	20 15 0	19 10 0	23 2 6
1932 ..	25 0 0	(b) 22 15 0		

(a) Controlled price.

(b) May.



TABLE LXXIX.—*Course of Prices of Palm Oil.*  
(Average monthly price per ton of Bonny Old Calabar, Liverpool  
landed.)

Terms :—Net cash.

Year.	March.	June.	September.	December.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1911 ..	29 15 0	29 12 6	30 17 6	29 5 0
1912 ..	27 12 6	27 10 0	30 12 6	29 12 6
1913 ..	30 10 0	31 0 0	30 15 0	30 10 0
1914 ..	30 10 0	28 10 0	28 15 0	29 17 6
1915 ..	35 10 0	28 5 0	27 7 6	41 0 0
1916 ..	41 10 0	33 0 0	33 10 0	45 0 0
1917 ..	45 7 6	(a) 48 0 0	(a) 48 0 0	(a) 48 0 0
1918 ..	(a) 48 0 0	(a) 48 0 0	(a) 48 0 0	(a) 48 0 0
1919 ..	(a) 48 0 0	79 0 0	86 10 0	86 10 0
1920 ..	88 0 0	55 15 0	61 5 0	42 10 0
1921 ..	33 5 0	31 10 0	40 5 0	35 0 0
1922 ..	36 5 0	32 5 0	31 2 0	34 0 0
1923 ..	37 7 6	34 12 6	36 5 0	38 0 0
1924 ..	38 15 0	37 0 0	39 15 0	44 0 0
1925 ..	40 15 0	39 5 0	41 10 0	39 0 0
1926 ..	38 0 0	38 7 6	36 5 0	35 0 0
1927 ..	35 2 6	30 10 0	33 10 0	33 12 6
1928 ..	33 2 6	33 10 0	35 15 0	38 0 0
1929 ..	36 0 0	31 12 6	33 0 0	31 15 0
1930 ..	28 2 6	21 15 0	21 7 6	20 10 0
1931 ..	18 5 0	14 7 6	15 10 0	19 12 6
1932 ..	18 7 6	(b) 14 15 0		

(a) Controlled price.

(b) May.

CHAPTER IV.  
SUMMARY AND CONCLUSIONS.

I.—PALM KERNELS AND PALM KERNEL OIL.

The world production of palm kernels in the post-war period, as measured by exports, is on a considerably higher level than in the pre-war quinquennium, but little development has been observable in the volume entering world trade in recent years, as the following table shows.

TABLE LXXX.—*World Exports of Palm Kernels from Producing Countries.*

(In tons.)

Source of Supply.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
British Empire countries.									
British West Africa	218,724	321,234	343,417	322,438	329,906	320,572	318,986	322,739	313,464
British Malaya ..	—	—	—	—	179	260	283	486	726
Tanganyika ..	—	32	43	53	348	80	84	35	152
Total .. ..	218,724	321,266	343,460	322,491	330,433	320,912	319,353	323,260	314,342
Foreign countries ..									
French West and Equatorial Africa, etc. . . . .	70,845	119,622	125,369	124,596	124,055	105,019	109,055	130,181	(d)
Belgian Congo ..	(d) 6,945	46,717	72,911	69,298	72,822	71,384	74,183	65,294	46,418
Portuguese West Africa .. ..	12,530	18,360	19,320	20,491	19,953	19,756	20,762	(b) 19,941	(d)
Dutch East Indies ..	—	1,241	1,480	2,162	3,707	5,629	6,713	9,479	11,992
Liberia .. ..	(c) 8,000	8,218	8,972	8,138	8,931	7,584	8,589	6,313	(d)
Total .. ..	(b) 98,320	194,158	228,052	224,685	229,468	209,372	219,302	(b) 231,208	(d)
Grand total .. ..	(b) 317,044	515,424	571,512	547,176	559,901	530,284	538,655	(b) 554,468	(d)

(a) Average 1912-13.

(b) Partly estimated.

(c) Approximate estimate.

(d) Not yet available.

This halt in the development of the trade in palm kernels may be largely attributed to the relatively low price level that has been ruling for this commodity since 1920. The diminished inducement to the native grower resulting from this lower price has undoubtedly been reflected in a failure to expand output. An upward price movement would, no doubt, produce a material and early effect on the amount of palm kernels available for export.

More than 98 per cent. of the palm kernels entering world trade come from Africa, British West Africa, French West and Equatorial Africa and the Belgian Congo, being the chief producing areas. The aggregate share of these three areas has not varied greatly since the pre-war period but the individual shares of British West Africa and the Belgian Congo have undergone a marked change, that of the former decreasing from 69 per cent. in 1909-13 to 58 per cent. in 1930, while that of the latter increased during this period from 2 per cent. to 12 per cent. In recent years, British West Africa, which is virtually the only Empire source of palm kernels, has well maintained its share of the world trade in this commodity.

Of the non-African producing areas, the Dutch East Indies is the only one with a considerable trade and although it has shown a marked growth since 1924 it still provides less than 2 per cent. of the aggregate world supply. The following table shows the share in the world supply of the principal producing areas since 1924 and in the pre-war quinquennium.

TABLE LXXXI.—*Share of the Individual Producing Areas in the World Supply of Palm Kernels.*  
(In per cent.)

Source of Supply.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.
British Empire countries—								
British West Africa ..	69.0	62.3	60.1	58.9	58.9	60.5	59.2	58.2
Other countries ..	—	—	—	—	0.1	0.1	0.1	0.1
Total ..	69.0	62.3	60.1	58.9	59.0	60.6	59.3	58.3
Foreign countries—								
French West and								
Equatorial Africa ..	22.3	23.3	21.9	22.8	22.1	19.7	20.3	23.5
Belgian Congo ..	(c) 2.2	9.0	12.8	12.7	13.0	13.5	13.8	11.8
Portuguese West Africa ..	4.0	3.6	3.4	3.7	3.6	3.7	3.8	(b) 3.6
Dutch East Indies ..	—	0.2	0.3	0.4	0.7	1.1	1.2	1.7
Liberia ..	(b) 2.5	1.6	1.5	1.5	1.6	1.4	1.6	1.1
Total ..	(a) 31.0	37.7	39.9	41.1	41.0	39.4	40.7	(a) 41.7
Grand Total ..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(a) Partly estimated.

(b) Approximate estimate.

(c) Average 1912-13.

Before the War, Germany was the principal importer of palm kernels and that country had a virtual monopoly of the crushing of palm kernels. During the War, the United Kingdom, France and the Netherlands developed important crushing industries and although these have in recent years diminished in activity they are still substantial. Table LXXXII shows the net imports of palm kernels of the principal importing countries and indicates at the same time the magnitude of their crushing industries. The industry is almost entirely confined to Europe and is largely in British and German hands, although a marked development in recent years has been made in the United States of America. The table is not complete; the aggregate net imports of the specified countries fall short of the recorded exports from producing areas by 25,000 to 50,000 tons per annum. A number of importing countries, *e.g.*, Portugal and Sweden do not show palm kernels separately in their trade returns, although in the case of Portugal it is known that she takes a large part of the exports of Portuguese West Africa which amount to 20,000 tons per annum.

TABLE LXXXII.—*Net Imports of Palm Kernels into the Principal Importing Countries.*

(In tons.)

Countries.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Germany (a) ..	240,272	101,556	221,791	234,779	269,338	292,609	299,603	301,847	263,128
United Kingdom..	(b)	287,597	234,536	215,472	183,540	164,119	151,170	125,667	123,649
Netherlands ..	3,693	21,128	15,596	17,765	16,705	6,703	7,247	28,618	25,520
Czechoslovakia ..	—	15,288	13,667	11,853	8,713	12,493	20,594	20,646	22,820
Denmark ..	(c) 1,267	1,749	1,028	6,017	13,352	12,130	9,648	18,293	10,442
France (a) ..	2,689	31,875	32,976	30,462	17,097	12,462	11,224	11,982	10,680
United States of America ..	—	—	—	179	54	73	48	6,885	16,410
Belgium ..	3,895	1,543	4,841	3,473	5,147	3,531	3,518	3,858	4,747
Total of above countries ..	290,000 (d)	460,736	524,435	520,000	513,946	504,120	503,052	517,796	477,376

(a) The figures are gross imports (special trade). The re-exports are not available, but are known to be negligible.

(b) Not available; estimated at 35,000 to 40,000 tons.

(c) Average 1911-13.

(d) Including approximate estimate for the United Kingdom.

The foregoing table does not indicate the consumption of palm kernel oil by the countries in which the kernels are crushed since all

these countries either export part of the oil they produce or import oil to supplement their production or do both of these things. An estimate of the annual volume of palm kernel oil available for consumption in the principal kernel crushing and oil importing countries has been computed from their trade returns and is summarised in the following table, but the figures take no account of changes in stocks, particulars of which are not available.

TABLE LXXXIII.—*Estimated Amount of Palm Kernel Oil available for Consumption in the Principal Consuming Countries.*  
(In thousands of tons.)

Countries.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
Germany.. ..	71.4	48.2	89.4	88.7	97.2	95.9	93.7	94.2	89.0
United Kingdom	(a)	98.4	69.8	69.9	66.3	55.8	57.0	56.0	50.2
United States of America ..	(b) 11.1	2.1	23.5	33.6	19.3	24.1	31.2	16.1	14.6
Czechoslovakia ..	—	11.8	10.3	9.1	9.0	10.2	13.3	14.0	15.9
Denmark ..	(d)	(c) 1.0	1.3	2.2	4.0	5.0	4.0	7.4	3.5
Netherlands ..	(a)	7.2	4.9	4.6	6.8	5.6	2.4	6.5	6.5
France (d) ..	1.2	14.3	14.8	13.7	7.7	5.6	5.1	5.4	4.8
Belgium (d) ..	1.8	0.7	2.2	1.6	2.3	1.6	1.6	1.7	2.1
Total of above countries. ..	(a)	183.7	216.2	223.4	212.6	203.8	208.3	201.3	186.6

(a) Not available. (b) Average 1912-13. (c) Approximate estimate.  
(d) Oil equivalent of net imports of palm kernels only. Palm kernel oil not separately classified.

The apparent consumption of palm kernel oil in the eight principal consuming countries reached its peak in 1926 since when it has diminished and in the period 1928 to 1930 was about 10 per cent. below the 1926 level. In 1931 there was a further fall and the level in that year was 17 per cent. below the peak of 1926 possibly due to the accumulation of stocks. Consumption since the pre-war period has shown a large increase in every country for which comparable figures are available, except Belgium, where on the whole a slight decrease is in evidence, although this may be due to the absence of figures of imports of palm kernel oil. In Germany the increase between the pre-war period and 1925-31 was about 30 per cent.; in the United States of America over 100 per cent.; and in France over 600 per cent. Considerable decreases in apparent consumption have occurred in recent years in the United Kingdom, where between

1924 and 1931 there was a decrease of 50 per cent. and in France where the decrease was 66 per cent. in the same period.

The main causes of the diminution in apparent consumption in recent years are the competition offered by substitutable oils of which coconut oil, groundnut oil and whale oil are the most important; and the competition of fodder crops with palm kernel cake and meal. The part played by whale oil in the market for oils and fats has increased considerably in importance during recent years. It is now a formidable competitor to vegetable oils in the manufacture of margarine, and also in the soap industry. There has been a substantial increase in the production of whale oil within the past six years, and the availability of this oil is recognised in the trade as an important contributing factor to the heavy fall in prices of both palm oil and palm kernel oil.<sup>(a)</sup>

Although no comprehensive statistics of margarine and butter consumption are available it is reasonable to assume that the recent fall in butter prices has had the effect of decreasing the consumption of margarine. An enquiry carried out by the Empire Marketing Board in a representative Midland town in 1931 indicated an increase in the butter consumption of 15 per cent. and a decrease in margarine consumption of 19 per cent. as compared with 1928. <sup>(b)</sup> If this is typical of other towns and other countries, it explains in some measure the reduction in palm kernel oil consumption revealed in the foregoing table. In addition, the heavier fall in coconut oil prices as compared with palm kernel oil prices in recent years has undoubtedly encouraged the substitution of the former oil in both the margarine and soap industries. The price movement of these two oils between March, 1925, and May, 1932, is shown in Table LXXXIV on page 122.

## II.—PALM OIL.

The volume of palm oil entering world trade, has attained a level in recent years of more than double that of the pre-war quinquennium. The industry has undoubtedly developed to a greater degree than the palm kernel industry and has, moreover, in recent years shown a vigorous tendency to expand which is in marked contrast to the stagnant condition of the sister industry. Table LXXXV summarises the exports of palm oil from the producing areas. It will be seen that the aggregate exports in the post-war period have increased

<sup>(a)</sup> See "Report on the Market for Palm Kernels and Palm Oil, 1930," published by the Antwerp Colonial Society.

<sup>(b)</sup> See "Further Changes in the Demand for Butter," E.M.B. 48.

from about 190,000 tons in 1924 to over 270,000 tons in 1930 as compared with a pre-war figure of about 120,000 tons.

TABLE LXXXIV.—*Price Index of Palm Kernel Oil and Coconut Oil.*  
(March, 1925 = 100.)

Date.	Palm Kernel Oil (Naked ex mill— Liverpool).	Coconut Oil (Ceylon c.i.f.—London).
1925—March .. ..	100·0	100·0
June .. ..	101·5	104·9
September .. ..	102·4	103·3
December .. ..	105·4	104·3
1926—March .. ..	102·1	96·7
June .. ..	107·2	100·5
September .. ..	99·4	96·2
December .. ..	90·4	91·3
1927—March .. ..	93·7	96·7
June .. ..	87·7	93·5
September .. ..	90·4	93·5
December .. ..	94·0	93·5
1928—March .. ..	91·3	90·2
June .. ..	91·9	88·6
September .. ..	90·7	85·9
December .. ..	91·3	82·6
1929—March .. ..	89·8	76·6
June .. ..	78·1	69·0
September .. ..	84·1	73·4
December .. ..	79·3	72·6
1930—March .. ..	76·3	69·0
June .. ..	74·5	66·3
September .. ..	66·1	56·5
December .. ..	61·6	54·9
1931—March .. ..	60·1	52·1
June .. ..	49·8	41·3
September .. ..	46·8	41·6
December .. ..	55·5	54·4
1932—March .. ..	60·1	60·9
May .. ..	54·7	50·0

TABLE LXXXV.—*World Exports of Palm Oil from Producing Countries.*

(In tons.)

Source of Supply.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
British Empire countries—									
British West Africa ..	91,010	131,543	132,523	117,887	117,939	130,138	135,286	139,942	(d) 119,857
British Malaya ..	—	—	473	725	768	1,334	1,831	3,211	4,574
Total ..	91,010	131,543	132,996	118,612	118,707	131,472	137,117	143,153	124,431
Foreign countries—									
Dutch East Indies ..	—	5,118	6,962	13,069	21,270	28,384	35,300	48,552	61,265
French West and Equatorial Africa, etc. ..	25,351	33,381	34,926	34,079	32,478	24,644	33,509	38,006	(e)
Belgian Congo ..	(b) 1,949	13,881	18,396	18,152	18,079	26,082	29,812	36,397	35,997
Portuguese West Africa ..	1,596	(a) 3,188	(a) 5,112	4,158	3,940	4,156	4,003	(a) 4,437	(e)
Liberia ..	(c) 2,000	(c) 2,400	2,702	2,452	2,407	1,811	2,431	2,116	(e)
Total ..	(a) 30,896	(a) 57,968	(a) 68,098	71,910	78,174	85,077	105,055	(a) 129,508	(e)
Grand Total ..	(a) 121,906	(a) 189,511	(a) 201,094	190,522	196,881	216,549	242,172	(a) 272,661	(e)

(a) Partly estimated.

(b) Average 1912-13.

(c) Approximate estimate; no figures available.

(d) Preliminary figure.

(e) Not yet available.

The exports of palm oil from the African producing areas fall far below the estimated oil content of the fruit, an approximate computation of which is made in Table LXXXVI on the basis of the exports of palm kernels. The margin of non-exported oil, which is highest in the case of Sierra Leone where it represents about 97 per cent. of the estimated oil content, represents domestic consumption, waste, or residue impossible of extraction by the methods employed.

By contrast, the exports of palm oil from the new producing areas in the Dutch East Indies and British Malaya coincide much more closely with the reported production and in fact in the case of the



Dutch East Indies the exports in certain years exceed the production figures(\*). In the new producing areas, domestic consumption of palm oil is negligible and furthermore the methods of extraction are very efficient and result in little waste.

TABLE LXXXVI.—*Comparison of the Exports and Estimated Yield of Palm Oil in the chief African Producing Areas.*

(Average annual amounts in thousands of tons, 1924–1930.)

Producing area.	Exports of Palm Kernels.	Estimated Palm Oil content of palm fruit (a).	Exports of Palm Oil.	Balance (b).	Percentage of estimated Palm Oil content of fruit exported.
British West Africa.					
Nigeria .. ..	255.7	432.7	125.2	307.5	29.0
Sierra Leone .. ..	62.7	106.1	3.1	103.0	2.9
Gold Coast .. ..	6.5	11.0	1.0	10.0	9.1
Gambia .. ..	0.7	1.2	—	1.2	—
Total .. ..	325.6	551.0	129.3	421.7	23.5
French West and Equatorial Africa, etc. ..	119.8	202.7	33.0	169.7	16.3
Belgian Congo .. ..	67.5	114.2	23.0	91.2	20.1
Portuguese West Africa	19.8	33.5	4.1	29.4	12.2
Grand Total .. ..	532.7	901.4	189.4	712.0	21.1

(a) Estimated on the basis of a fruit content of 13 per cent. palm kernel and 22 per cent. palm oil, this being the ascertained palm kernel and palm oil content of the Nigerian fruit which is the most widely grown type in West Africa. (See Table I.)

(b) Balance is domestic consumption, waste or residue impossible of extraction.

British countries still furnish slightly more than one-half of the aggregate volume of palm oil entering world trade but the proportion has been consistently decreasing owing to the fact that the new producing areas which are accounting for the bulk of the current growth in

(\*) It has been ascertained that the production figures are incomplete, since certain estates are not included.

supplies are for the most part foreign countries. In consequence, the share of the British countries in the world supply has fallen from about 75 per cent. in the pre-war quinquennium to about 70 per cent. in 1924 and 53 per cent. in 1930. British West Africa, the Dutch East Indies, French West and Equatorial Africa and the Belgian Congo are the principal producing areas and in 1930 these four areas accounted for over 96 per cent. of the world's palm oil exports. The aggregate share of these areas has not varied appreciably since before the War, but the individual shares have changed substantially, those of British West Africa and French West and Equatorial Africa decreasing and those of the Dutch East Indies and the Belgian Congo increasing.

The rise in importance of the Dutch and Belgian Colonies and British Malaya as palm oil producers is, indeed, one of the outstanding features of the palm oil industry. Before the War these areas together provided less than 2 per cent. of the world's exports of palm oil; in 1924 their share was 10 per cent. and in 1930 they provided over 32 per cent. The significance of the rapid increase in the volume of palm oil exported from these areas and of their growing share in world trade lies in the fact that their production is well planned and scientific and the product is secured with the minimum of waste and the maximum of quality.

The remaining areas, comprising Portuguese West Africa and Liberia, supply the relatively insignificant balance, which now represents a slightly smaller share of the whole than before the War. Table LXXXVII on page 126 indicates the share of the individual producing areas in the total world supplies in the pre-war quinquennium and annually since 1924.

Before the war the United Kingdom was by far the principal importer of palm oil. Although the exact figures are not available it is clear that about two-thirds of the palm oil exported from the producing areas in the pre-war quinquennium was consigned to the United Kingdom. The United States has since supplanted the United Kingdom as the principal importer and in the period 1929 to 1931 its imports of this commodity represented nearly one-half of the available world supplies, and were well above double the United Kingdom imports. Germany and Italy have also increased their share of the imports, but all the other importing countries, and notably the United Kingdom, are now taking a smaller percentage of the whole than in the past.

TABLE LXXXVII.—*Share of the Individual Producing Countries in the World Supply of Palm Oil.*

(In per cent.)

Source of Supply.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.
British Empire countries:								
British West Africa ..	74.7	69.4	66.0	61.9	59.9	60.0	55.9	51.3
British Malaya ..	—	—	0.2	0.4	0.4	0.6	0.8	1.2
Total .. ..	74.7	69.4	66.2	62.3	60.3	60.6	56.7	52.5
Foreign countries :								
Dutch East Indies ..	—	2.7	3.5	6.8	10.8	13.2	14.6	17.8
French West and Equatorial Africa, etc. ..	20.8	17.6	17.4	17.9	16.5	11.4	13.8	14.0
Belgian Congo ..	(b) 1.6	7.3	9.1	9.5	9.2	12.1	12.3	13.3
Portuguese West Africa	1.3	(a) 1.7	(a) 2.5	2.2	2.0	1.9	1.6	(a) 1.6
Liberia .. ..	(c) 1.6	(c) 1.3	1.3	1.3	1.2	0.8	1.0	0.8
Total .. ..	(a) 25.3	(a) 30.6	(a) 33.8	37.7	39.7	39.4	43.3	(a) 47.5
Grand Total .. ..	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

(a) Partly estimated.

(b) Average 1912-13.

(c) Approximate estimate ; no figures available.

The large decrease in the palm oil imports of the United Kingdom is mainly due to the virtual elimination of the re-export trade. The principal consuming countries, such as the United States of America, Germany and Italy, are securing increasing proportions of their requirements direct from the producing areas. This factor, coupled with the growing utilisation of palm oil in those countries and the decreased utilisation in the others, has brought about a radical change in the volume of palm oil entering the various channels of world trade.

The following table shows the net imports of palm oil into the principal importing countries and indicates approximately the consumption of the commodity outside the areas of production. It will be seen that the United States of America is the most important consumer of this commodity, and is followed at some distance by the United Kingdom, Germany and Italy.

TABLE LXXXVIII.—*Net Imports of Palm Oil into the Principal Importing Countries.*

(In tons.)

Countries.	1909-13 (Average).	1924.	1925.	1926.	1927.	1928.	1929.	1930.	1931.
United States of America ..	27,342	45,437	62,131	58,369	71,388	75,548	116,882	128,345	115,248
United Kingdom ..	(a)	57,758	68,455	63,353	54,344	48,110	56,304	46,924	46,322
Germany ..	12,119	8,778	17,832	13,123	16,458	19,683	19,598	28,969	36,001
Italy ..	7,603	15,231	15,690	18,386	15,031	22,500	15,727	21,567	25,713
France ..	15,180	19,368	16,827	19,611	11,044	15,246	8,274	11,155	8,967
Netherlands ..	(a)	23,079	14,944	10,550	9,101	7,984	8,840	9,020	7,558
Belgium ..	(a) (b)	5,000	5,484	6,402	6,995	7,026	6,010	5,044	3,108
Portugal ..	1,840	2,962	3,363	3,284	4,012	3,629	2,471	3,153	3,858
Sweden ..	972	759	1,123	855	867	978	1,715	1,193	(d)
Czechoslovakia ..	—	3,223	1,108	1,189	1,125	1,062	1,618	1,082	825
Total of above countries ..	(a)	(c) 181,595	206,957	195,122	190,365	201,766	237,439	256,452	248,793

(a) Not available.

(b) Approximate estimate.

(c) Partly estimated.

(d) Not yet available; assumed same as 1930 in Total.

(e) Approximately estimated on the basis of exports from producing areas.

The aggregate net imports of palm oil into the ten principal consuming countries outside the areas of production increased by about 70,000 tons, or nearly 40 per cent. between 1924 and 1930, and the major part of this increase occurred in 1929 and 1930 in the United States of America. The utilisation of palm oil in that country has indeed come to be the most important factor affecting the industry. A slight decrease in the aggregate net imports occurred in 1931, the reduction of 13,000 tons in the imports of the United States not having been entirely counterbalanced by the increased imports of Germany and Italy.

Consumption in the post-war period is generally on a higher level than in the pre-war period in those countries for which comparable figures are available, but France is a notable exception. In the United States, the increase between the average apparent consumption in 1909-13 and that in 1924-31 was about 200 per cent.; in

Germany it was about 50 per cent. ; and in Italy about 150 per cent. There has also probably been a substantial increase in the United Kingdom, but the pre-war figures are not available. In the case of France there has been a slight decrease.

The continued expansion in the aggregate consumption of palm oil may be attributed in large measure to the development of the soap industry and to a smaller extent to the growth of the tinplate, margarine and edible fat industries. As regards the soap industry, world production has grown substantially since the war, but although palm oil is an important constituent in the manufacture of soap, substitutes in the shape of other vegetable and marine fats are now being largely employed and an increased production of soap does not necessarily signify a corresponding increase in the utilisation of palm oil. Such details as are available regarding the degree of substitution that is occurring in the soap industry in the United Kingdom indicate that the use of animal and marine fats is appreciably increasing, while the use of vegetable oils is decreasing. But it is probable that in the United Kingdom, as in the other consuming countries, palm oil still finds its principal outlet in the manufacture of soap and that its increased consumption depends mainly on the development of that industry. In this connection it will be recalled that the increase in the apparent consumption of palm oil in the United States, Germany and Italy was coincident with an increase in the production of soap.

A further field of utilisation of palm oil is the tinplate industry, and this is largely extending as a result of the growth of the food-canning industries which absorb considerable quantities of tin-plate in the manufacture of cans. In the manufacture of tin-plate, palm oil has come to be recognised as the most suitable product in the so-called "pickling" process. Other oils and fats have been tested, such as tallow, hardened whale oil and hardened cotton oil, but palm oil has been found to give the best results as it withstands the high temperature of the molten tin and does not stain the plates. The canning industry since the War has developed principally in the United States and in recent years marked progress has also been made in the United Kingdom and in many European countries. The extent to which palm oil is utilised to-day in the tin-plate industry is not known, but it is probably relatively small ; in the United States the consumption for this purpose was estimated in 1920 at

5,000 to 10,000 tons per annum, and is now about 15,000 tons.<sup>(a)</sup> In the United Kingdom, the South Wales tin-plate industry absorbed 3,500 tons of palm oil per annum, according to an official report of 1912,<sup>(b)</sup> and trade estimates adopt much the same figure for current consumption.

The utilisation of palm oil in the manufacture of margarine and edible fats is relatively small. Details of the amount of palm oil consumed by the oleo-margarine industry in the United States show that about 550 tons per annum were utilised for this purpose in 1929 and 1930; and that the average for the three preceding years was 350 tons. The recent increase was due to the modification of the legislative regulations controlling the manufacture of margarine in America, which now permit the use of coloured oils. But the palm oil so absorbed is, it will be seen, relatively insignificant and much the same is true of the consumption for margarine production in the United Kingdom and elsewhere.

In certain other industries, consumption of palm oil has definitely declined. The candle industry which at one time absorbed appreciable quantities of palm oil has largely substituted paraffin wax in its place and the utilisation of palm oil as a lubricant particularly by railway companies has largely disappeared owing to the substitution of cheaper mineral greases.

A new field for palm oil may be provided by its utilisation as a fuel for Diesel and semi-Diesel engines. Experiments have been attended with some success but no commercial development has ensued where other fuels are available at low cost. In the Belgian Congo, where petrol is relatively dear, palm oil has been successfully substituted for utilisation in special motors, and much satisfaction has been evinced at the results obtained in the case of heavy transport vehicles. Not only has the cost of transport been thereby substantially reduced but the inconvenience attaching to the use of highly volatile fuels in countries of high temperature has been obviated. As yet, this form of utilisation is still largely in an experimental stage, and has no great commercial importance. Its potentialities should, nevertheless, not be overlooked, and it may possibly provide in the near future an important outlet for palm oil consumption.

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(a) See United States Tariff Commission Report to the Congress on Certain Vegetable Oils, Whale Oil and Copra. Report No. 41, Second Series.

(b) See Cd. 6394/1912.

The cultivation of the oil palm will no doubt continue to expand steadily as the new areas in British Malaya and the Dutch East Indies are brought into full bearing and as improved methods of cultivation and harvesting materialise in the older areas in West and Central Africa. The future supplies of oil palm fruit are therefore assured and the outlook for the industry will depend mainly upon the growth of demand for palm kernel oil and palm oil. The demand for these products in turn mainly depends on the one hand on the growth of the soap and candle and of the margarine and other edible fat industries and on the other hand on the competition of other vegetable oils and fats and animal and marine fats utilised in these industries.

The expansion of these industries, more particularly that of soap, should continue with the general increase in population and with the continued rise in the standard of living. As regards the substitution of one fat for another in these industries the prospects are not so easy to define. Substitution is primarily dependent upon the special properties which the competing fats possess and with the widened uses for inferior oils brought about by improvements in technical processes. But price considerations also play an important part and over a relatively short period the price factor is probably the more potent. In this connection the efforts that are being made to improve the productivity of the oil palms and to increase the oil content of the fruit should result in a lowering of the cost of the product, while the increasing importance of factory production which now accounts for about 25 per cent. of the volume of palm oil entering world trade as compared with less than 5 per cent. in 1920 should also tend in the same direction. But it remains to be seen whether the reduction will be sufficient to permit of more effective competition with other oils and fats such as coconut oil, groundnut oil, cottonseed oil and whale oil, which are the principal oils entering into competition with the products of the oil palm.