

Composit Book.

1. Report of the Committee appointed to consider measures for the improvement of milk supply in large cities in the Bombay Presidency.
X9(2311:71):732.231.N2t E6 16330
2. Report of the travelling commission of enquiry into the cost of production of milk.
X9(2311:71):26.3.N19t E9
3. Final Report of the committee on the production and distribution of milk.
X9(2311:71):20k732.3.N19t E9
4. Report of the Departmental Committee on the Decline of Dairying in Ireland.
X9(2311:71):34.N20t F0
5. A. Paper on the milk supply of Lahore in 1921.
X9(2311:71):732.23693.N21 F4
6. 16339

REPORT

OF THE

108

Committee appointed to consider measures for the improvement of the Milk Supply in large cities in the Bombay Presidency.

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POONA:

PRINTED AT THE YERAVDA PRISON PRESS.

1916.

X9 (311:71) 1732.231. N164

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16339

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**Report of the Committee appointed to consider measures
for the improvement of the milk supply in
large cities in the Bombay Presidency.**

INTRODUCTORY.

1. The economic side of the question was considered with particular reference to Ahmedabad, Surat, Poona, Sholapur and Hubli, which were taken as typical large cities of this Presidency. The matter was not considered in detail with regard to Bombay City since it was recognised that the conditions of Bombay were special, and it was understood that a separate Committee was considering the matter with reference to Bombay. Certain aspects of the Bombay milk trade, however, received attention.

The economic enquiry fell under the following main headings :—

- (1) The supply of milk to large cities as regards —
 - (a) Quantity,
 - (b) Quality—
 - (i) cleanliness ;
 - (ii) purity (freedom from adulteration).
- (2) The effective demand for milk on the part of the different classes, and the uses to which milk is put.
- (3) The sources and agencies of the present milk supply.
- (4) Methods to increase the supply and improve the quality of the milk.

The technical considerations fell under the following main headings :—

- | | | |
|--|---|--------------|
| <ol style="list-style-type: none"> (1) Breeding (2) Feeding (3) Housing (4) Tending | } | Milch cattle |
| <ol style="list-style-type: none"> (5) Preserving milk by— <ol style="list-style-type: none"> (a) sterilising, (b) pasteurising, (c) refrigerating, (d) cooling, (6) Transport of milk. | | |

CHAPTER I.

THE EXISTING SUPPLY OF MILK AND THE MANNER OF ITS CONSUMPTION.

2. *Quantity.*—As regards the quantity of milk available in large towns the following estimates have been made, based either on figures of animals in milk, collected on a particular day, or on special enquiries that were made for the purpose of this Committee.

Ahmedabad.—Population (inside the city walls) (172,000.)

<i>Source.</i>	<i>Daily supply,</i>
From 1,548 buffaloes and 573 cows kept within the city.	23,000 lbs. (55%)
Brought into the City from outside.	19,000 „ (45 „)
Total	42,000 lbs.

Surat.—Population—114,000.

<i>Source.</i>	<i>Daily supply.</i>
From 1,000 buffaloes and 250 cows kept within the city.	12,000 lbs. (28%)
Brought into the city from outside	30,000 „ (72 „)
Total	42,000 lbs.

Bombay City—Population—979,000.

<i>Source.</i>	<i>Daily supply.</i>
From 18,000 buffaloes and 3,000 cows kept within the city.	220,000 lbs. (83%)
Milk brought into the city from outside.	45,000 „ (17 „)
Total	265,000 lbs.

Poona.—Population—117,000.

<i>Source.</i>	<i>Daily supply.</i>
From 1,338 buffaloes and 1,350 cows kept within the city.	20,000 lbs. (80%)
Brought into the city from outside	5,000 „ (20 „)
Total	25,000 lbs.

Sholapur.—Population—95,000.

<i>Source.</i>	<i>Daily supply.</i>
From milk animals, almost entirely buffaloes, kept within or close to the city.	13,000 lbs. (100%)

Hubli.—Population—60,000.

<i>Source.</i>	<i>Daily supply.</i>
From 800 buffaloes and 400 cows kept within the city.	9,000 lbs. (90%)
Brought into the city from outside	1,000 „ (10 „)
Total	10,000 lbs.

Goats' milk has not been considered, though goats are to be found to a greater or less extent everywhere.

According to these estimates the available supply per head of population works out at—

Ahmedabad	24 lb.
*Surat	36 „
Bombay	27 „
Poona	21 „
Sholapur	13 „
Hubli	16 „

* N. B.—There is a considerable export of sweetmeats from Surat.

Apart from the greater supply of milk available in Gujarat, this difference is noticeable between the conditions of milk supply in Gujarat and the Deccan that whereas in Gujarat over half the milk is brought into the city from outside villages, in the Deccan the great bulk of milk is produced within the city itself.

No attempt has been made to estimate the amount of butter, ghee or *mava* (dessicated milk) that is brought into towns, but it may be mentioned that a certain amount of butter-milk or of soured curd made from milk, from which the whole or part of the cream has usually been removed, is brought into most cities and consumed by the poorer classes of the population.

3. *Quality*.—As regards the quality of milk there is a general complaint from all sides that the conditions under which a large part of it is produced and handled are insanitary, that much of it is dirty and most of it adulterated. It is a matter of common knowledge that the condition of most cattle-sheds is such that milk drawn in them is very liable to contamination, and that little or no care is taken to secure the cleanliness of the animal or of the milker before milking is commenced, or to protect the milk from contamination during transit or before sale. The work done in Bombay by Dr. L. L. Joshi indicates the presence in commercial milk of manurial and other contamination (*vide* paper read by Dr. Joshi at the All India Sanitary Conference, 1914, and the paper by Dr. Joshi in the "Journal of Dairying and Dairy Farming in India" for October 1915). The contamination of milk has been little studied in other cities.

As regards adulteration of milk in Poona, analyses made by Dr. Mann of samples purchased in the milk market gave the following results:—

- (i) One sample bought at 4 sers per rupee was genuine.
- (ii) Of three samples bought at 5 sers per rupee two had water added to the extent of 10% of the original milk.
- (iii) Of three samples bought at 6 and 7 sers per rupee all were adulterated to the extent of one-half of added water.
- (iv) Of three samples bought at 8 and 9 sers per rupee all were adulterated to the extent of 135 parts of water for every 100 parts of original milk.

In the case of milk retailed in the Poona milk shops the extent of adulteration is even worse. These figures refer to milk brought into the city from outside villages. In Gujarat the milk trade of cities is in the hands of Ghanchis, or milk sellers, who advance money to villagers to secure their daily milk supply. These Ghanchis are said to make periodic tests of the milk brought them by villagers, and in this way secure the milk unadulterated to a very great extent; but the public do not therefore get the benefit of pure milk. On the contrary, the Ghanchis systematically adulterate the whole milk either with separated milk or with water, and since they hold a practical monopoly of the sale of milk from outside, the only way to obtain pure milk is to come to special terms with a Ghanchi. In this way a regular customer, who is prepared to pay, can secure milk without risk of any further adulteration than may have been done by the producer.

In view of these deficiencies in cleanliness and purity it is everywhere recognised that the best way to obtain clean and pure milk is for a man to keep his own cow or buffalo, and this accounts for the large number of such animals kept in large cities for domestic milk supply. Failing that, the next-best way is to make permanent arrangements with a gowli for a daily supply of milk and to see the milk drawn. In some towns it is the custom for gowlis to bring their buffaloes round to customers' houses, in others to definite milking stands, and in others again the customers go to the gowlis' sheds to personally superintend the milking and carry off the purchase. In such ways pure milk can be obtained by regular customers who are prepared to pay high and take trouble. It is the casual purchaser who buys milk in the market, shops or streets who is the chief sufferer.

4 *Price.*—It is recognised everywhere that there are at the same time and place different prices for milk which in the main denote the extent of the adulteration; but for approximately pure milk the retail prices may be taken roughly as follows:—

	lbs.	per rupee.
Ahmedabad	13 to 16	" "
Surat	13 to 16	" "
Bombay	7	" "
Poona	8	" "
Sholapur	10	" "
Hubli	12	" "

The tendency everywhere is for milk to be cheaper during the months of August to October when the supply of green grass makes it more plentiful; but many regular purchasers arrange with gowlis to supply it at the same rate throughout the year, and many milk sellers affect to sell it even to casual customers at the same price throughout the year, increasing the adulteration as the milk supply decreases.

5. *Demand for milk at current prices.*—Apart from the demand for domestic consumption which accounts for the great bulk of the supply there are other sources of demand which have been roughly estimated as follows:—

Ahmedabad—

Tea shops	3,500 lbs. a day.
Sweetmeat makers	4,500 " "
Curd makers	2,000 " "
	10,000 " "
	(24% of the whole supply.)

Surat—

Tea shops	1,000 lbs. a day.
Sweetmeat makers	8,000 " "
Curd makers	2,000 " "
	11,000 " "
	(26% of the whole supply.)

Poona—

Tea shops	4,000 lbs. a day.
Sweetmeat makers	1,000 " "
Gymnasts	600 " "
	5,600 " "
	(22% of the whole supply.)

Sholapur—

Tea shops	300 lbs. a day.
Sweetmeat makers	1,000 " "
	1,300 " "
	(10% of the whole supply.)

Hubli—

Tea shops	750 lbs. a day.
Sweetmeat makers	750 " "
	1,500 " "
	(15% of the whole supply.)

6. *Distribution of milk amongst the different classes and the use made of it.*—In para. 2 (a) an estimate was given of the supply of milk per head of population in the different large cities. It must not be supposed, however, that this in any way represents the distribution of the milk amongst the various classes of the town populations. On the contrary, it is well known that at present prices a large portion of the population, estimated by Dr. Mann at 60%, are unable to afford milk at all, except in very small quantities which they purchase for their children. The demand for milk amongst the various castes has been estimated at Poona to work out roughly as follows:—

Brahmans are the largest individual consumers, adults consuming about $1\frac{1}{2}$ lb. and children 1 lb. daily amongst the richer families, and about half this amount amongst the poorer.

Prabhus consume appreciably less.

Lingayats very little.

Marathas—Well-to-do families consume somewhat less than *Brahmans*. Poorer *Marathas* can afford none except for the children; and the same is the case with the great majority of the families of low caste.

Amongst *Brahmans* in the Deccan about 50%, and amongst other castes less proportion of the domestic supply is consumed in a soured and curdled state. The methods by which this is prepared vary amongst different classes and in different localities, but it is a common practice in the Deccan to extract a large part of the cream before the milk is used. The remainder of the domestic supply is used in tea or is drunk whole by adults and children. The cream which is removed in the process of making sour curd is made into ghee.

The poorer classes use practically no ghee at all.

7. *Infant feeding.*—A consideration which in Western countries gives much importance to the subject of milk supply is the widespread practice of feeding infants by artificial means, a practice which has increased much in recent years; and Major Hutchinson, Sanitary Commissioner, emphasised the great importance of breast-feeding to the health of children, as opposed to artificial feeding. The facts as regards this Presidency appear to be that breast-feeding of infants is almost universal, but in a fair number of cases, and in particular amongst the upper classes the supply of mothers' milk is deficient either in quantity or duration. In such cases breast-feeding is supplemented by artificial feeding. For this purpose cows' milk is preferred by the upper classes and goats' milk by the lower classes, but the poorer people have to be content with any kind of milk that they can get. When children are over six months of age rice kanji and soaked bread are fed to them. It is believed that in some localities artificial feeding of infants is becoming more common amongst the upper classes and even amongst the poorer classes when women work in mills or engage in work which keeps them away from their homes. We have not made detailed enquiries on this point, but Rao Saheb G. K. Kelkar expressed an opinion that in Poona 60% of infants amongst the upper classes and 20% amongst the lower classes receive artificial feeding to a greater or less extent.

8. *General considerations.*—There is apparently a belief that the supply of milk in large towns is now-a-days less than was formerly the case. There is, so far as we are aware, no evidence that there has been any reduction in the actual quantity available, and we see no reason to believe that this is the case, but it is certain that the price of milk has largely increased of late years along with the price of other articles of food, and it is quite likely that the growth of population in large towns and the increase in tendency to tea drinking may have increased the demand for milk without proportionately increasing the supply, and so may have accentuated the difficulty.

Contrasting the milk supply of large cities in this Presidency with cities in England the striking fact is that the price in each case is about the same though in India the price of food generally is much lower than in England and the spending capacity of the people much less. The reasons for this will be considered later on, but the result is that in Indian cities milk as an article of ordinary food is beyond the reach of the poorer classes.

CHAPTER II.

SOURCE OF SUPPLY.

9. *Milch animals.*—Before considering the various agencies for the production and distribution of milk it will be desirable to consider the question of the animal best suited to the milk supply of towns. In villages goats are an economical source of milk, so far as the owner is concerned, and afford a useful supply of milk which is consumed mainly by children. They cannot, however, be kept on a large scale in cities, and do not lend themselves to milk supply on a commercial basis; and we have, accordingly, excluded them from our consideration. The choice, therefore, remains between cows and buffaloes. It is found that of the milk supply of large cities the great bulk of the milk comes from buffaloes; and the reason for this is that for commercial production the buffalo is the most effective animal. So far as the Indian public are concerned they value the milk mainly for the fat contained in it, and consequently prefer buffaloes' milk which is much richer in fat; but apart from this they prefer the taste of buffaloes' milk, and it is only for children that they prefer cows' milk and require it to a limited extent. Gowlis depend almost entirely upon buffaloes, and though a few cows will frequently be found amongst their herds they are said to find them less economical as milk producers and to keep them only in order that they may meet, or affect to meet, the demand for cows' milk for children, or explain any deficiencies that may be found in the quality of the milk supplied by them. It will be noticed that in some towns, and particularly in Poona, the number of cows kept is very considerable, but it is believed that this is attributable to the fact, not that the owners prefer cows' milk or find the cow a more economical animal, but that these owners are private individuals who simply keep a milk animal for their domestic milk supply and find that it involves far less trouble to their family to keep a single cow than to keep a single buffalo. As regards the actual economy, under varying conditions, of cows and buffaloes, we have not got much positive evidence, but the following figures obtained during the past year at the Agricultural College Dairy at Poona show the *feed cost* (fodder and concentrated food) necessary to produce 100 lbs. of milk and one lb. of butter fat from cows and buffaloes, respectively. In each case four selected animals were taken of the breeds which have been found most profitable in Poona, *viz.*, the Sindhi breed in the case of cows and the Surti breed in the case of buffaloes.

	Live weight	Annual yield of milk.	Per-centage of butter fat.	Total butter fat.	Cost of fodder.	Cost of concentrates.	Total cost of feeding.	Feed cost to produce 100 lbs. of milk.	Feed cost to produce 1 lb. of butter fat.
	lbs.	lbs.		lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
<i>Sindhi cows.</i>									
Begum	1,000	2,345	5.8	124.28	88 6 7	54 14 8	138 4 10	5 14 4	1 1 9
Zankar	600	3,344½	4.2	140.44	83 6 7	68 10 7	147 1 2	4 6 4	1 0 9
Flora	800	3,201½	5.0	160.07	83 6 7	76 2 0	159 8 7	4 15 9	0 15 11
Changuni	800	2,786½	4.8	31.3	83 6 7	68 6 5	151 18 0	5 8 9	1 2 5
Total.		11,627½		556 11	338 10 4	268 1 8	596 11 7	5 2 8	1 1 2
								Aver age.	
<i>Surti buffaloes.</i>									
Agaj	1,200	3,294½	7.5	274.12	121 18 1	85 11 10	207 8 11	6 14 9	0 18 5
Lawanji	1,170	2,906½	7.7	228.80	121 18 1	80 5 6	202 2 7	6 15 8	0 14 5
Sajani	1,200	2,250	7.8	175.50	93 7 1	64 0 7	157 7 8	7 0 0	0 14 4
Sbitap	1,100	3,452½	7.4	253.22	121 18 1	81 12 6	208 9 7	5 15 4	0 12 10
Total.		11,908½		926.64	458 14 4	311 14 5	770 12 9	6 7 7	0 18 8
								Aver age.	

These figures show that in the matter of milk production, irrespective of the quality of the milk, the cow is more economical than the buffalo by 29%, while in the matter of butter fat production the buffalo is 21% more economical than the cow. The general experience of the Military Dairy at Poona which works with Sindhi cows and Delhi buffaloes is similar; and though these figures cannot, of course, be taken as applicable to all breeds, they may be taken as indicating the relative value of cows and buffaloes to a man who is working with good animals of a good breed. The Agricultural Department have not worked with many breeds at the College Dairy but have tried Deccani buffaloes and if the figures for Deccani buffaloes (the poorest milkers of the lot) were to be substituted for Surti buffaloes, it would be found that the Sindhi cow was the more economical animal not only for milk production but also for fat production. It would, however, obviously not be fair to compare the best breed of cows with the worst breed of buffaloes, and it is probable that if it were possible to compare the figures for the generality of cows with the generality of buffaloes it would be found that the advantage of buffaloes over cows would be much greater than the above figures indicate, for there are some breeds of cows which afford no milk beyond that required for the calf, and many cows of many breeds which give a very small surplus quantity. It may well pay a milk producer who caters for a public which prefers cows' milk or which is satisfied with a fat content of 4 to 5% to keep cows in preference to buffaloes, but so far as the general Indian public is concerned, both on grounds of economy and on grounds of preference, the buffalo appears to be the animal to which we must look for the main milk supply. We understand that on the military dairy farms they are now effecting a great increase in the milking capacity of cows by the importation of English bulls of good milk strain, but in view of the fact that these bulls are delicate and that both they and their progeny are very susceptible to disease, we consider that this expedient is not at present suited to ordinary Indian conditions, and have excluded it from our consideration.

10. *Milk Supply Agencies.*—In paragraph 2 we have indicated in general terms the extent to which the milk consumed in cities is produced within the cities or is brought into the cities from outside. The milk produced within the cities comes from animals which are kept either by private individuals for their own use or by gowlis on a commercial basis. The conditions of many Indian cities are such that some persons within city limits have gardens or yards of considerable size and have adequate facilities for keeping an animal or two. Such an arrangement accords with the convenience and sentiments of the owners, and subject to absolute sanitary necessities (discussed hereafter), we see no reason why such persons who keep one or two animals for the domestic supply of milk to themselves and their friends should be interfered with in any way in the production, handling or sale of such milk. The great bulk of the town population, however, have no such facilities, and it is possible that if a good milk supply were otherwise obtainable, some of the persons who now go to the trouble of keeping their own milch animals in the cities would cease to do so.

11. The town gowli who keeps a herd of animals in or close to the town corresponds to the town dairyman in England, who has now almost disappeared as a result of the effective arrangements that are there made to bring milk into cities from a distance. As an institution he has his merits and his defects, but in the absence of effective arrangements for the transport of milk he is a necessity. His merits are that he meets a demand for milk which, under present arrangements, could not otherwise be met and makes it possible for a customer who takes the trouble to see the milk drawn to satisfy himself that he is getting pure milk. His defects are :—

(i) By keeping a large number of animals in a densely populated area his operations are in some cases inimical to the sanitary requirements of the locality and conduce to the contamination of his milk by pathogenic bacteria.

(ii) Being a dairyman, pure and simple, and not a farmer, he has to purchase all the fodder and concentrated food for his cattle at the enhanced

prices which such articles always fetch in towns, and is seldom in a position to obtain any considerable amount of grazing, free or otherwise, for his cattle. The expenses thus incurred necessarily send up the price of the milk which he retails, and sometimes drive him to feed his cattle on foul horse litter.

(iii) The animals are kept in unnatural conditions with accommodation which is often insufficient and inferior to that which is usually provided in rural parts. This is apt to react unfavourably on the animals, prevents regularity of breeding and makes it unprofitable to rear the calves that are born in such conditions.

(iv) Much of the manure produced by the city herd fails to find its way back to the fields where it is needed.

12. In connection with these matters which we have considered in some detail we are prepared to express the following opinions. It has been proposed in some cities to induce or compel town dairymen to remove their cattle beyond the limits of the city, and the Sanitary Commissioner expressed his objections to the presence of cattle in cities on the ground that they cause overcrowding, that in some cases they habitually feed on human excrement in the town latrines or in the outskirts of a city, and that they add to the excremental contamination of the soil. We quite agree that it is desirable to take steps to prevent milch cattle from feeding on excrement and to exclude herds of cattle from densely populated town areas; but there are often areas within city limits which are not densely populated and we think that in such places the presence of milch animals may be permitted, provided that ordinary rules of sanitation are obeyed, and would point out that within city limits the existence of an adequate water supply will often provide facilities for cleanliness which do not occur outside the city, and that sanitary regulations can be more easily enforced inside a town than outside. The great advantage that the town gowli obtains is that he can market his milk at his own door and is saved the expense of transport of milk. It is obvious, therefore, that it will penalise him considerably if he is moved to a considerable distance, and it is unlikely that in the vicinity of a large town he will be able to obtain much compensation in the way of free grazing. The success of any scheme for moving gowlis outside a town will depend greatly on the choice of the localities to which they are moved. If a site can be found which does not make the marketing of the milk too laborious and which at the same time provides better accommodation and some degree of grazing facilities, such a scheme has much to recommend it; but if these objects are not secured, the result will be to make the gowlis' business less remunerative, and so to raise the price of his milk. Subject to the above considerations we agree with the principle of excluding herds of cattle from densely populated areas.

13. A very unsatisfactory feature of the town gowlis' business arises from the unnatural conditions under which he keeps his animals. Except in Upper Gujarat the gowli is not essentially a cattle breeder, but usually purchases buffaloes in milk and keeps them as long as they remain in milk. In some cases he has no facilities or no desire to get the animals covered when they come in season. It is thought by some that the conditions under which she-buffaloes are kept by town gowlis tend to produce irregularity of breeding, but whether or not the animals come in season under such conditions with as much regularity as they do under normal conditions, the period is less likely to be noticed, and consequently the animal less likely to be covered, even if a bull is available for the purpose, than would be the case if the animals were out at grass. The result is that many good milk buffaloes finish their period of lactation without having been covered and must therefore remain dry for a period of at least 10 months, possibly much more. The town gowli is seldom in a position to keep dry animals economically, and therefore will be likely to sell such an animal for what she will fetch. It is thought by some that, as a result of this, good milk buffaloes go to the butcher, which under normal circumstances would continue to breed. The tendency must be in this direction, and this used to be a common feature of the business of town dairy men in England. There are, however, everywhere a number of old and unprofitable animals

which are fit for nothing but slaughter, and except in the case of Bombay City we have no evidence that the number of she-buffaloes slaughtered exceeds the normal number of animals which need to be cast. If by locating the gowlis outside cities and organising them in any way, a means can be found to provide them with good bulls and with some facilities for the grazing of dry animals, it will do something to mitigate this evil in so far as it exists in the mofussil. In Bombay City the case is different. We understand that the number of she-buffaloes to be found in Bombay at any one time is about 20,000 which probably means that in the course of the year about 30,000 she-buffaloes are brought to Bombay, mainly from Gujarat and Kathiawar. Of these 30,000 it might normally be expected that about 3,000 would be cast; but in point of fact we find that a much greater number than this are slaughtered in Bombay. The figures for 1914-15 show that the following numbers of she-buffaloes, all said to come from Bombay City, were slaughtered:—

Bandra slaughter-house	...	8,500
Kurla	...	5,000
(The flesh of the animals slaughtered at Kurla is said to be used for the Burma dry meat trade)		

Total 13,500

This indicates that the conditions of Bombay result in the annual slaughter of some 10,000 profitable milch-buffaloes. Apart from the reasons already mentioned there appear to be in Bombay some special causes of this, *viz.*, there is in Bombay a large demand for buffalo meat for the food supply of certain classes of the population and for use on ships, and we understand that the rules of the Bombay Municipality prohibit the slaughter of male buffaloes, or the import of meat to the city and port except from the Bandra slaughter house. These rules artificially enhance the value for slaughter of dry buffaloes in Bombay, and must tend to accentuate this undesirable feature of the town dairyman's business. The number slaughtered is not, of course, a large proportion of the stock in Gujarat and Kathiawar, and we believe that the very best animals are not sent to Bombay, and that of the animals which do go to Bombay the gowlis make arrangements to send back some of the best milkers to Gujarat when they are dry, while a class of dealers make a regular practice of buying up dry buffaloes cheap in Bombay and taking them to the grazing grounds of the Konkan and the Deccan; still, seeing that there is in many rural areas in close connection with Bombay an abundance of unprofitable buffaloes useful only for slaughter, it is unfortunate that any she-buffaloes of value as milch animals should be slaughtered, and we consider that steps should be taken to minimise the evil. This might be done by—

- (1) organising or facilitating the export of valuable dry buffaloes from Bombay to grazing districts,
- (2) arranging for the import of buffaloes' meat into Bombay,
- (3) locating the milk animals outside the city, and importing milk from a distance.

14. Another evil connected with the town gowlis' business relates to the treatment of the calves, and this is far more serious since it applies not only to Bombay but to all large towns. The town gowli wants the buffaloes' milk and he does not want the buffalo calf, which he is unable to rear profitably. As a result he allows the calf to die of neglect, or in some places hastens matters by throwing it alive into a dust bin. This means the loss to the country every year of large number of calves of the best milk buffaloes. It is a natural result of the circumstances of the town gowli and will disappear in proportion as the town gowli disappears.

15. The last source of the milk supply of large cities consists of the supply obtainable from villages where the cultivators keep one or more milch animals apiece. This source of supply has been developed to a considerable extent in

Gujarat but very little in the Deccan. We have no hesitation in saying that such animals are kept under the most natural conditions and that in this way milk can be produced most economically. We believe that if this supply is properly organised and developed it will be found ample for the supply of large cities.

16. We propose to discuss in the next chapter the best method of making this supply available, and under the present heading it only remains for us to deal with one more matter. It has been suggested in recent years that what is needed to improve the city milk supply in this country is individuals or companies which will take up the matter on a large scale and with modern appliances. In this connection it is desirable to mark the difference between dairy farming concerns which aim at producing the supply of milk which they propose to put on the market and dairying concerns which merely aim at buying milk in the country and putting it on the town markets by improved methods. As regards dairy-farming concerns we understand that there are a few such in the Presidency, but the production of milk on these lines is necessarily costly, particularly so when such concerns are situated in a town. The experience of the Military and Civil Dairies in Poona has been that the cost of producing pure milk on sanitary lines works out very high under such conditions. It is found that in Poona milk can be produced at a profit by such an agency and sold at the rate of 2 annas a lb. (delivered) containing 5 per cent. butter fat. If a large dairy-farming concern is situated in the country and can command good grazing facilities it can doubtless produce the milk at a cheaper rate, but it is believed that the difficulty of obtaining large blocks of suitable grazing land without detriment to the rights of the existing inhabitants of the locality is considerable. It is not to be expected that milk can be produced in this way as cheaply as it can be produced by the small cultivator, and it is doubtful whether much relief can be expected from this source.

17. As regards dairying the matter is different, and we believe that much can be done by individuals, societies or companies in the direction of establishing milk buying agencies in suitable districts and in arranging for the handling and transport of the milk to cities by suitable methods. As an example of this we may mention the case of the "Indian Dairy Supply Company" which has established a buying agency at Nadiad and aims at placing on the Bombay market (at a distance of 281 miles) 1,000 gallons of pasteurised whole milk and 500 gallons of pasteurised separated milk daily. We believe that by such methods the supply of milk to cities can be greatly improved and we propose to deal with the possibility of such developments in the next chapter.

CHAPTER III.

THE BEST METHODS TO INCREASE THE SUPPLY AND IMPROVE THE QUALITY OF THE MILK OF LARGE CITIES.

18. This consideration involves two distinct questions which are, however, so dependent on each other that it is necessary to consider them together. The problem may be considered in two different lights, in one of which milk appears as a valuable and desirable food and the other in which it appears as a dangerous source of infection. In Europe there are two matters which give special importance to the milk problem, *viz.*, the extensive practice of artificially feeding infants, and the presence of bovine tuberculosis. In India the first is of much less importance and the latter is certainly uncommon. Considering milk as a food, the Sanitary Commissioner emphasised the necessity of breast-feeding for infants as opposed to artificial feeding. He regarded milk as a valuable food for older children but noted that it was bulky and expensive, and regarded it as a question whether proteid could not be better obtained for older children and for adults from cereals and pulses, than from a dear and doubtful milk supply. He stated that the fat in milk was a very valuable food but was dear, and that the fat obtained from vegetable oils was equally effective though not so palatable; while the mineral constituents of milk

can be obtained equally well from yolk of egg, rice, wheat, fruit and vegetables. Finally he expressed the opinion that the faulty methods under which milk is habitually produced and handled in this country detract much from its value as a healthy food and constitute a danger to health, though he had no evidence of any connection between bad milk and the high mortality of children from dysentery, which mortality he attributed to excremental contamination of the soil producing indirect contamination of food and water. Accepting the view that milk is dear and liable to contamination, the fact remains that it is a very valuable food and one much desired by all classes of Indians. We believe that the price of milk in cities can be reduced by the adoption of effective methods, and we are of opinion that such measures as conduce to this end should be taken.

19. It is possible also to suggest measures calculated to improve the quality of the milk supply and to obviate the risk of contamination. Unfortunately the adoption of some such measures has a tendency in the first instance, at any rate, to enhance the price of milk, and so to neutralise the efforts at cheapening it which we regard as of primary importance; and we consider that any general measures which have this tendency must be postponed until the milk supply of towns has been established on a firm basis, when we believe that it will be possible to introduce sanitary control without any disastrous effect on the supply. We recognise that in taking this attitude we lay ourselves open to the charge that we are proposing to put upon town markets a large supply of milk without being able to guarantee its purity or control the conditions of its production. We admit this, but consider that, speaking generally, its value as a food outweighs its dangers as a source of infection. There is little evidence that at present much disease in Indian cities can be traced to milk though a large part of the supply is undeniably impure. We quite recognise the value of sanitary measures which enlightened public opinion will accept and which can be uniformly enforced, but when the people ask for cheap milk it is no substitute to offer them dear milk coupled with sanitary regulations. In any case we believe that the very general practice in this country of boiling milk before use greatly minimises the risk of its conveying disease.

20. We have already stated in Chapter II that the most promising source of milk supply for towns lies in the villages where cultivators keep their animals under natural and economical conditions. It is from such sources that an adequate supply of milk has been secured for the cities of other countries. The transport of milk is, no doubt, a more difficult matter in hot countries than in cold owing to the rapidity with which milk goes bad; but such difficulties are overcome in high temperatures in the United States, and for some time past pasteurised milk has been sent without difficulty from Poona to Bombay (distance 119 miles). It is lack of organisation which prevents the adoption of such measures in India. We believe that the village milk supply of Gujarat is ample to provide for the cities of Gujarat and Bombay City, and in parts of the Deccan conditions appear to be most favourable, though each case must be considered on its own merits.

21. Take the case of Poona which at the present high price of milk (8 lbs. per rupee) consumes only 25,000 lbs. of milk a day, but which would take a much larger quantity at a cheaper rate. Only 1/5th of this milk supply is brought in from outside, and that is brought in by hand by some 350 men who carry about 16 lbs. apiece. Comparatively little comes from a distance of over six miles and none from a distance of more than 9 miles. By train a negligible quantity of 120 lbs. a day is all that comes. Now Poona is surrounded by villages containing considerable grazing areas, and the main crop grown in the neighbourhood is Jowari, which supplies good fodder. There are good irrigation facilities on two sides, and the town is served by eight good roads and two railway lines. Seeing how high the price of milk is in Poona it might be expected that many cultivators in the neighbouring villages would see their way to make a good profit by producing milk for the Poona market. The fact that they do not do so can be attributed only, we believe, to the cost of transporting a small quantity daily to the

market and the worry of retailing the same. We believe that if collecting agencies were organised at suitable places, which would enable cultivators to market their milk without difficulty near their own homes, and would arrange for the effective and economical transport of the milk to the cities, a good supply could be obtained at a cheaper rate. We are informed that at Talegaon which is 20 miles distant from Poona and connected with it by good railway service there is a good supply of milk available at 20 lbs. per rupee or (roughly) 10 pies a lb. and that in the villages round the fort of Sinhagad at a distance of 12 to 15 miles from Poona, and connected with it by the Satara and Sinhagad roads, a good supply of milk can be obtained at rates which now stand at 24 lbs. per rupee from January to June and at 32 lbs. per rupee from July to December. This milk is now used mainly for making *mava* (dessicated milk), since with the present arrangements whole milk cannot be brought from such distances to the market. Turning to more distant sources of supply it has been brought to our notice that the south of the Satara District and the country round Sangli (distance from Poona 166 miles) already maintains a dairying industry of considerable magnitude, some of the villages keeping 400 or 500 good milk buffaloes. At present the great bulk of this milk is used for ghee making, and Rs. 5 lakhs worth of ghee is said to be exported annually from Sangli Station alone. The present price for rich milk in the villages of this tract is said to be 20 to 22 lbs. per rupee according to the season.

22. Now it may be argued that when a buying agency is established in any tract it will send up local prices. This is no doubt the case, and has occurred in the tracts of Gujarat where such agencies have been established, to the great advantage of the cultivators, who produce milk; but it has also been found that the presence of a buying agency which facilitates the marketing of small lots and pays a somewhat better price, increases the supply of milk; and we wish to lay emphasis on the fact that the supply of milk in any locality depends largely on the demand, and can usually be much increased at will. The prices of *ghee* and *mava* do not admit of a better price than about 32 lbs. per rupee being paid for milk, and although in the case of ghee-making the buttermilk remains with the cultivator, this is a very unprofitable way to market milk if any method of selling whole milk is available. We believe that the marked difference in prices which is found in the towns and in the rural parts, respectively, will, in suitable localities, admit of such buying agencies being established and worked at a profit, while operating so as to increase the supply and reduce the price of milk in towns and to pay the milk producers a better price than they now obtain.

23. It has been suggested that in tracts which do not admit of easy marketing of milk and where *ghee* is now produced, steps may be taken to manufacture a half-dry curd and put it on the town markets. From 100 lbs. of separated milk about 40 lbs. of half-dry curd can be prepared, and the latter would be more portable and less perishable than the former. We understand that this is already done to some extent, but that the curd is not much appreciated since it lacks the flavour of the preparations of this nature which contain the whey. We cannot say how far larger quantities of such curd would find a ready market but the matter is worth consideration, as the curd would contain the bulk of the albuminoid parts of the milk and would constitute a valuable food for the poorer classes if it could be sold cheap.

24. Where the private enterprise of individuals or companies suffices to take up dairying work, nothing is called for on the part of public bodies except such general or special assistance as they may be able to afford from time to time; but where such enterprise is not found, we would suggest that the Municipality interested should promote the matter by offering some assistance. The exact nature of the assistance required will depend on local circumstances, but we note the fact that Government have expressed their willingness to make advances to Municipalities which contemplate action of this kind [*vide* G. R. No. 7706 of 25-10-1913, G. D., and G. R. No. 5644 of 18-7-1914, G. D. (para. 21)].

25. It is a matter of common knowledge that in other countries striking developments in the dairying business have been effected by the agency of co-operative societies, and we are of opinion that much progress may be made in this country by means of the same agency. In such matters as the financing of the milk producers, the joint purchase of feeding stuffs and the collection of small lots of milk there is no doubt that a co-operative society can be of much use. There is evidence that a co-operative society can undertake on a small scale the marketing of its own milk in a neighbouring town where the distance is not great; but doubts have been expressed whether a co-operative society is a suitable agency to undertake the more difficult task of handling milk for long transport or the work of retailing milk on a large scale, which demands a degree of care and activity not often found except where the retailer's personal interests are concerned. Co-operation cannot be regarded as a substitute for efficiency, and if efficiency is to be secured, the enterprise in each case must be large enough to afford the cost of capable management. The question how far co-operative societies should go in this matter, must, therefore, depend on the degree of efficiency which they can command and the question whether there are other agencies available to continue the work at the point at which they might feel disposed to leave it. We append a report of the Assistant Registrar, Co-operative Societies in the Bombay Presidency showing the work of this kind which has been done in this Presidency, and a report of the Registrar of the Co-operative Societies in United Provinces showing the work which has been done there (appendices A and B). We also append an estimate prepared by Mr G. H. Frost, Assistant Director, Military Dairies, Southern Circle, showing the cost of establishing a collecting station for about 2,000 lbs. of milk daily, for pasteurisation and despatch by train or motor to a distance not exceeding 50 miles (appendix C); and we believe that this is the smallest amount of milk which could afford the cost of the superintendence necessary for an enterprise of the kind contemplated.

26. Turning now to the consideration of measures for the improvement of the quality of the milk sold in cities, we believe there is in many towns a limited demand for superior milk at a price somewhat above the normal. Where this is the case and the Municipality has a Health Officer and a staff capable of undertaking the work, we recommend the following scheme for putting on the market a "Certificated milk," which is calculated to pave the way for a general system of milk control in cities.

Rules for Certificated Milk Suppliers.

(1) Every Municipality which is furnished with a Health Officer and a man capable of analysing milk may certify milk the producers of which voluntarily submit to inspection and control.

(2) Every producer who wishes that his milk shall be certificated shall apply to the Chief Officer of the Municipality, who will inform him of the conditions which have to be fulfilled before such certification can be given.

(3) The conditions of certification would be something like the following:—

(a) The producer's stables, dairy and milk to be subject at any time to inspection by municipal officers;

(b) The stables to conform to the standard laid down by the Municipality in point of construction, space and ventilation;

(c) The stables to be kept in clean and wholesome condition;

(d) The milch animals to be certified as healthy by competent veterinary authority;

(e) The milking vessels to be scalded before milking, the udders of the animals cleaned and the whole operation conducted under clean conditions;

(f) The milk to be transferred and delivered in vessels into which dust and dirt cannot penetrate, and of the character prescribed by the Municipality. If the milk is sold from a shop, the shop to be subject to inspection ;

(g) A test to be made from time to time against adulterants and preservatives of all kinds ;

(h) A simple dirt test to be made from time to time ;

(i) A purity test to be made from time to time to ensure that the milk comes to the following standard, *viz.*,

	<i>Fat.</i>	<i>Total milk solids.</i>
Buffaloes' milk	5½ per cent.	14½ per cent.
Cows' milk	3½ per cent.	12 per cent.

Inasmuch as the bulk of city milk supply comes from buffaloes, it is desirable to guard against fraud on the part of milk sellers who might adulterate buffaloes' milk heavily and then claim that it was cows' milk, and so avoid any penalty. In cases, therefore, where a man is found selling milk of a low grade which he claims to be cows' milk it will be for him to give satisfactory evidence that it is really cows' milk and not adulterated buffaloes' milk.

It will be noticed that this scheme is permissive only both to the Municipality and to the milk seller. The certificate would be to the producer and not to any particular lot of milk, and would be withdrawn if the producer were found not to be conforming to the conditions. The list of certificated producers might be announced publicly, either by the Press or otherwise, and any withdrawal of certification announced in the same public manner.

27. While we have expressed our opinion that under existing circumstances a system of "certificated milk" can be introduced for people who are prepared to pay rather higher for a pure article, we would again refer to our opinion already expressed that it is imperative to do nothing to further enhance the general price of milk, since a large part of the town population cannot afford it at present prices. In view of the evidence which has been given of the gross adulteration practised in towns both by the producers and by the milk sellers we think it incumbent on us to suggest a general standard of purity which Municipalities *may* adopt as a condition of selling milk in towns, but we wish it to be clearly understood that we do not recommend its adoption by any Municipality until such time as it has secured a good supply of milk established on a safe basis and until it has a competent and trustworthy staff to enforce the rules without unnecessary friction. Subject to these considerations, we recommend that the standard of purity set forth above in No. 3 (i) of the rules for certificated milk be adopted as a general standard. Though a purity standard may not at present be suitable for general adoption, we believe that the organisation of city milk supply on the lines which we have indicated by collecting agencies which pay for the milk on a purity basis will do much to check adulteration, and that in time it will be found possible to adopt a purity standard as a condition of selling milk in towns.

28. Under the existing law powers to control the milk supply are contained in sections 48 and 142 of the Bombay District Municipal Act. If the above recommendation is accepted, it will be necessary to amend these sections so as to give Municipalities the power to enforce a general purity standard. We think that any such amendment should follow the lines of the English enactment which provides that when milk is found to contain less than X per cent. of milk fat or less than X per cent. of milk solids other than fat, it shall be presumed that the milk is not genuine by reason of abstraction therefrom of milk fat or milk solids, or the addition of water. Failure to comply with the standard would then entail prosecution. It is necessary also to make it clear that all milk sold shall be presumed to be unadulterated milk from which fat has not been removed, and it must not be open to any one to escape from the regulations simply by stating that he does not profess to sell pure milk. Any

Municipality, however, should have the power to license definite people to sell separated milk, or such special preparations of milk as may be considered desirable.

29. It was suggested that Municipalities should have the power to trace their milk supply to its source, and we recognise that there is much to be said for the "permit system" in force in the United States of America, according to which permission to import milk into a town is given only to such persons, wherever situated, as will accept the municipal inspection and control of their methods of producing and handling the milk, but we consider that under present conditions in India, where it would be necessary to deal with a large number of small producers, the difficulties of introducing such a system would be insuperable. We believe, however, that it is desirable that a Municipality should have power to purchase land outside its municipal limits on which it can erect cattle sheds for gowls and over which it can exercise supervision. In cases, too, where a large supply of milk comes into any city from the immediate neighbourhood, but outside municipal limits it may be desirable to grant to a Municipality, having a strong staff, powers to inspect and regulate the cattle sheds and the methods of producing and handling the milk within this limited area. In this connection we would call attention to the fact that the principal reason for observing cleanliness in the stables is to protect the milk from contamination. Where therefore arrangements are made for clean milking sheds in which the milk is drawn, and for washing the animals and the milkers before the milk is drawn, it is not necessary to be too scrupulous about the design or extreme cleanliness of stables, unless they are so situated that they are liable to constitute a danger to the health of human beings living in the immediate vicinity. We think that Municipalities might secure sanitary advantages and facilitate the working of the proposed rules for "Certificated milk" by providing suitable milking sheds with a supply of good water; and this remark applies in particular to towns where the existing practice is to bring cattle daily for milking to definite stands, where at present the conditions are said to be anything but cleanly.

30. We are unable at present to recommend any bacteriological standard for milk; but the attention of Municipal Health Officers should be called to the desirability of making microscopic and bacteriological examination of samples of milk. When the milk of any milk seller is found to contain bacteria whose presence indicates manurial or other detrimental pollution, the matter should be enquired into with a view to further action. If such a milk seller were "certificated" his certificate should be withdrawn until the cause of infection was removed. If it were demonstrated that milk dangerous to the health of the community were being brought into towns from certain areas it would be desirable for Government to take legal powers to enable Municipalities to exclude milk coming from such areas.

CHAPTER IV.

THE TECHNICAL SIDE OF MILK PRODUCTION.

31. In dealing with the technical side of milk production the most striking fact is the very low yield of milk per animal obtained in India as compared with the yield obtained in Europe, and we propose to consider this briefly with reference to possibilities of improvement in breeding, feeding, housing and tending.

32. It is well known that in Europe pedigree strains of milch animals have been produced by careful and long-continued selection, and it is there open to any dairy farmer to increase the yield of his herd by procuring the service of a good pedigree bull. The dairy farmer in this country has no such resource since pedigree bulls are practically unobtainable. Buffaloes have been bred mainly for milk purposes, and there is on the whole less variation in the milk yield of individual buffaloes than of individual cows. In some breeds of cattle, notably the Karachi and Gir breeds, a relatively high standard of milk

production has been obtained; but even amongst these the individuals vary enormously, and without knowing the breeding of any bull there is no certainty regarding the milking capacity of his offspring. The Government dairy farms, Military and Civil, have confined themselves mainly to milk production on a commercial basis, and though they have done their best to obtain good bulls it cannot be said that they have effected any marked improvement by breeding, much less can it be claimed that they have produced pedigree stock. Indeed in the case of the College Dairy at Poona the tendency is for the animals bred on the farm to deteriorate in milk yield below the standard of their mothers, and the average of the herd is kept up only by the addition of new stock from outside. We would point out that the building up of pedigree stock requires expert knowledge and sustained effort, and we consider that a systematic start should be made in this direction. We understand that a scheme is now before the Government of India for taking up the question of breeding in different parts of India and we would urge that no time should be lost in starting it upon a sound and adequate basis.

33. In the matter of feeding we believe that in the best milk producing tracts (*e.g.*, the country round Nadiad and Sangli) cultivators feed their buffaloes very economically. It is commonly contended that extensive free grazing is necessary for cheap milk production, but such is not found to be the case in many of the best milk-producing tracts; and we believe that it is not possible to make any considerable addition to the area of common grazing. Common grazing is a great convenience to small holders, where it exists, and even as an exercising ground for the village herd the land usually set apart for cattle deserves preservation, but extensive common grazing cannot be considered an economical practice, and it is certain that good land can produce more fodder to the acre under cultivation than under the neglected and unimproved condition of the common grazing ground. The great trouble that the cultivators have is not so much to find forage during the rains as during the dry season. There can be no doubt that the milch animals habitually suffer from want of adequate fodder and water towards the end of the dry season, and even in the best milk producing districts of Gujarat, there is a drop in milk production of 20 or 30 per cent. during the months of March to June, and in other parts it is well known that the milk supply falls off largely as soon as the green grass comes to an end. To obviate this, larger storage of fodder is essential, both dry and in the form of ensilage; and we think that the Agricultural Department should do all that they can to encourage this.

34. In connection with the question of housing we do not think that the animals need elaborate accommodation. They need to be protected from the weather, made comfortable and given plenty of fresh air. Under village conditions we believe that they usually get this so far as the means of their owners will allow. In larger dairies stone or cement floors have been recommended as tending to effective sanitation. They certainly do this; but the animals find them hard, cold and slippery.

35. We believe that it is a common experience in other countries that the milch animal will tend to give better results in the hands of a careful small holder who treats it as "one of the family" than in a commercial dairy where it is simply "one of the herd." This is certainly so in India. At the College Dairy at Poona, for instance, it is found that there is a tendency for the yield of animals purchased from outside to fall off in subsequent periods of lactation. Both the feeding and housing there are superior to what the animals would obtain in the villages, and we can only attribute this falling off to bad tending. The men usually available for employment in Indian commercial dairies have, as a rule, little knowledge of cattle, and they are frequently bad milkers and careless tenders.

36. For the encouragement of breeding we consider that it will often be of use to station a good "premium" bull in a milk producing tract. In the absence of pedigree stock all that can be done is to get the best bull available. We also think that small shows of milch cattle are to be recommended, starting with single village shows in the best dairying areas or in any collecting area

which is being worked in connection with a town milk supply, and that an object of such shows should be to establish mutually advantageous relations between milk producers and dairy men.

CHAPTER V.

THE PRESERVATION AND TRANSPORT OF MILK.

37. If milk can be put on the market within four hours of milking it should require no special treatment. When the time required is somewhat longer water cooling and mechanical cleaning will increase the life of the milk to some extent. Where a considerable period of time is necessary to market the milk there are three methods possible, refrigeration, sterilisation and pasteurisation. Unless the quantity of milk to be handled is very large, the cost of refrigeration is prohibitive, since the initial cost and the running expenses are high. Sterilization is advocated on sanitary grounds, but the cost, including bottling, is very high. Apart from the cost, it is doubtful whether it would find a ready market since it is liable to have a peculiar taste, and when homogenised is not suitable for preparing butter, and can hardly be regarded as fresh milk supply. This leaves only pasteurisation to consider. Pasteurisation will give milk an eighteen hours' life and is cheap, the cost of the process in Poona being only $1\frac{1}{2}$ pies per lb. on a minimum of 3,000 lbs. It must be realised that pasteurisation is a device for prolonging the life of the milk rather than a measure to be advocated on purely sanitary grounds, since the milk is liable to reinfection by disease bacteria which may develop considerably during the prolonged life of the milk. It remains, however, the only practicable method of which we have experience in India for extending the life of the milk, and as such we advocate it. In the United States of America great stress is laid upon the regulation which provides that milk must not be kept for sale at a temperature higher than 50° F. The object of this is to check the development of bacteria. Facilities do not ordinarily exist for keeping milk down to this temperature in India; but it is possible that in some towns economical arrangements could be made with an Ice Company to store milk brought into a town until it can be sold. There are many problems connected with the preservation, handling and transport of milk which require investigation with reference to Indian conditions, and in this connection we would invite a reference to the interesting paper on the subject published in the *Agricultural Journal of India* for October 1915.

38. We have no suggestion to make regarding the transport of milk by road. The matter must be considered at any place with reference to existing conditions and facilities. As regards transport by train we append statements showing the rates quoted by the management of the G. I. P. and B. B. & C. I. Railways for the carriage of milk in bulk, and consider them to be reasonable (appendix D). Where railway facilities are available they provide the cheapest means of marketing milk from a distance, but, for economy, milk must be marketed in cans in bulk and not sent in small lots each accompanied by a man. At present 45,000 lbs. of milk daily are brought into Bombay by train in lots of about 50 lbs. or less, and each lot is accompanied by a man; so that the marketing of this milk consumes the time of a thousand men. When milk is brought into Bombay in this way it is stated that each man and each parcel of milk has to pay the ordinary rates, and that this milk gets no "concession rates" as are granted for unaccompanied milk. It was also pointed out that the men who accompany the milk have to travel by ordinary season tickets which are available for themselves only, so that, if the man for whom the season ticket is taken falls ill or for any other reason cannot travel, a full fare has to be paid, and it was suggested that the Railway Companies might be approached to grant season tickets which would cover any servant accompanying the milk sent in by a definite man. We think that the true remedy is to market the milk in bulk unaccompanied, and have no doubt that in time this will be done; but to meet the present difficulty we suggest that these matters be brought to the notice of the Railway administrations for the consideration of any relief that they may be able to afford.

CHAPTER VI.

EDUCATION IN DAIRYING AND DAIRY FARMING, AND STAFF REQUIRED FOR INVESTIGATION AND ORGANISATION.

39. We consider that Government can materially assist the development of the movement to improve the supply of milk to cities by providing facilities for dairy education and by appointing experts to investigate problems and advise the public.

If the development indicated in our proposals is to be secured three courses of instruction will be necessary.—

(1) A course is required to train Municipal Inspectors or prospective Inspectors in milk testing and general dairy sanitation. We think that one month will suffice for such a course and that it could be given at the Agricultural College, Poona.

(2) There is already a demand which is likely to grow, for active (Vernacular speaking) men who know practical dairying, and can undertake work for dairy societies or dairy companies, or who might take up independent dairying work themselves. A course of instruction is required for such men.

(3) A course is required to train men for dairy farming so that they may ultimately become Managers of large commercial dairy farms. Such a course could be given at the Agricultural College and the military dairy farms. It would probably be necessary for a man to have two years' theoretical training to be followed by one or two years' practical training on a military dairy farm or a large commercial dairy farm.

It is understood that proposals have been made for the establishment of dairy schools by the Imperial Government, and we think that it is on the lines indicated above that the courses should be projected. We are not aware of the exact nature of the measures likely to be taken in pursuance of the scheme, and are therefore not in a position to make isolated proposals; but it is essential that a satisfactory agency for giving the required instruction shall be established, since it is upon the technical skill of the operators that the success of an extended dairy industry will largely depend.

40. For investigation and organising and assisting developments in the milk trade the following staff would be required, *viz.*—

(1) A breeding expert. It is understood that in the scheme referred to above it is proposed that the Imperial Government should provide such a man.

(2) A dairy expert for investigation and giving assistance and advice to the public.

(3) Additions to the staff of the Registrar of Co-operative Societies for organising and assisting milk societies.

CONCLUSION.

41. The supply of good milk at a reasonable rate to the cities of the Bombay Presidency is thus a complicated problem, but we consider, as we have indicated, that it will ultimately be solved by the organisation of supply from cultivators or others keeping cows and buffaloes under natural conditions at a distance (often at a far distance) from the town, and by improvement of transport which will make it possible to place such milk on the market in good condition. It would seem, however, that the method of organising the supply, the part which professional gowlis should play in it, the extent to which co-operative agency can be used in doing it, the extent to which the Municipalities could and should take active steps in the removal of milch animals to more healthy surroundings

in thinly populated areas, and a number of other questions are matters on which data do not really exist for definite recommendations applicable at present to any particular case. We would, therefore, suggest that, with a view to dealing with these questions and realising more exactly the difficulties which will arise and how they can be met, a single large city should be selected, the whole question of its milk supply investigated, and the most suitable directions for its improvement worked out at the cost of Government. The Municipality should then be approached and the suggestion be made that it should undertake the organisation of its milk supply on the lines laid down in the report of this Committee, and as indicated in detail by the investigation made. Since such a trial would be largely experimental, and would serve to clear the way for other Municipalities which may afterwards take up the matter, we suggest that Government should, by grant or guarantee, take upon itself part of the cost or risk of such a pioneer undertaking.

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HAROLD H. MANN.

G. K. WALKER.

V. H. GONEHALLI.

A. H. SPEARMAN.

G. K. KELKAR.

S. V. SHEVADE.

Thos. R. LAWRENCE.

W. REEVES.

म. गो. अग्र्यकर.

{ Subject to the note
of dissent already sent
to Director of Agri-
culture.

HARILAL DESAIBHAI DESAI.

LEMUEL L. JOSHI.

APPENDIX A.

A brief note on Co-operative Dairy Societies in the Bombay Presidency.

1 Alibag Co-operative Dairy Society, Ltd. Date of registration, 23rd April 1915.

Number of members 35, of whom 28 are cultivators producing milk and marketing it through the Society.

CAPITAL Rs. 1,152-8-0

Villages from which milk is obtained; Veshwi and Mula, which are at a distance of 2 miles from the town of Alibag.

Method of collecting, transporting and distributing milk.

The Society has put up two milking sheds at a cost of Rs. 340—one at Veshwi and the other at Mula. The members keep their animals in their own houses, but bring them to the Society's milking sheds twice a day at the appointed hours in which they milk them under the supervision of the representatives of the Managing Committee. The work of supervision is done at Veshwi by the clerk of the Society and at Mula by a member of the Managing Committee. The Society keep its own milking pails, and one is given to each member for drawing the milk of his animals into it. The milk thus drawn is measured and handed over to the Society. Each member carries a pass book with him, in which the quantities supplied by him to the Society are regularly entered. All milk thus collected at each centre is put in a big brass can, which is locked and sent to the town on headload with a servant of the Society for delivery to registered customers.

Cleanliness—All the pails, cans and other utensils of the Society are kept in a perfectly clean condition. Every utensil used in handling milk is first washed in cold water, then in warm water with some washing soda in it and finally in boiling water and dried. Before milk is drawn from the animals, the hands of the drawer and the udders of the animals are washed and rubbed with muslin. Bar-soap is kept and freely used.

Total number of customers:—76; and the total quantity of milk supplied to them in September 1915 was 2,700 seers. All milk taken by the Society from the members is distributed to customers and no surplus is left on hand.

Advantages to the members.—The Society takes milk from the members at a little over nine seers a rupee and supplies it at eight seers a rupee to the customers. After deducting expense, small margin of profits (about Rs. 6) is left to the Society. Though the members are prevented from adulterating their milk with water, they get good prices and save a good deal of time, which they used to spend before joining the Society, in hawking about their milk. They are entirely satisfied with the prices which they now get. Besides, they get loans from the Society at 9½ per cent. for purchasing animals and foodstuffs.

Advantages to customers.—The public of Alibag are fully satisfied with the quality and the rate of price of the Society's milk.

Other remarks.—The Society is now arranging to keep a good buffalo breeding bull for serving the members' she-buffaloes. It has also secured some grazing land from the Collector for the use of the members' she-buffaloes, which with the bull proposed to be obtained from Gujarat are to be constituted into a herd.

2. Belgaum Co-operative Dairy Society, Ltd.—

This Society consists of 24 members, of whom 20 are milk-producing gowlis and supply their milk to the Society. The gowlis at present keep their animals in the town and bring them to two milking centres for milking them under the supervision of the manager. The arrangements as regards cleanliness and the collection, transport and distribution of milk are similar to those of the Alibag Dairy Society. The Society has applied to the Municipality for building a shed outside the town for housing the animals of the members of the Society. The Belgaum Dairy Society markets about 3,500 seers of milk a month. The public of Belgaum are entirely satisfied with the quality and price of the milk.

3. Thana Co-operative Dairy Society, Ltd.—

The Society has got a shed in which some animals of the members are kept; other members keep the animals in small huts near the Society's shed. Milk is drawn in the presence of the manager. The arrangements as regards cleanliness and transporting and distributing milk are exactly on the lines of the Alibag Society. The total quantity of milk marketed by the Society every month is about 6,000 seers. The Thana people are fully satisfied with the quality of milk. In this Society, some of the producing members are gowlis (Bhayyas) and others non-gowlis. The Society has got more than 200 families as its customers.

4. The Gomatipur Co-operative Dairy Society near Ahmedabad—

This Society has only very recently begun to supply pure and unadulterated milk to the city of Ahmedabad. The producing members are cultivators.

A proposal for starting a dairy Society of cultivators at Asarwa for supplying pure milk to Ahmedabad has been received.

5. The Bhandup Co-operative Dairy Society for supplying pure milk to Bombay is in formation.

6. Proposals for establishing co-operative dairy society at Gadag and Hubli for improving the milk supplies of those towns are under consideration.

7. Similarly, there are proposals for establishing dairy societies at Kotrud and Talegaon for supplying pure milk to the city of Poona.

30th October 1915.

V. H. GONEHALLI,

Assistant Registrar, C. S. B. P.

APPENDIX B.

Copy of a letter No. 128 c, dated 25th September 1915, from the Registrar, Co-operative Societies, United Provinces, Lucknow, to the Director of Agriculture, Poona.

With reference to your letter No. A-17647, dated the 14th August 1915, I have the honour to state that there are at present three co-operative dairies in this Province. A dairy on a limited liability basis was started in the suburbs of Benares about four years ago. The members are *ahirs* professional milk sellers. There is a separate credit society on the unlimited liability basis for these members. The premises of the dairy are situated about 5 miles from the city of Benares. The dairy has got a fairly decent shed for the cattle and also for the stocking of feeding stuffs &c. The dairy society has rented shops in different parts of the city of Benares for the sale of milk and the capital has been raised partly by shares and partly by loans from a public spirited landholder and also from a Central Co-operative Society at Benares. The cattle belong to the members themselves who sell the milk at a fixed price to the society and the society sells the milk again at fixed price for cash to purchasers at the different shops. This dairy did very good business at the beginning and made small profits every year. On the other hand the supply has diminished because owing to a severe fodder famine which has prevailed in the locality for the last two years, the cattle have not been properly fed and the members have also not been able to repay the loans that had been made to them for the purchase of cattle and are consequently debarred from getting fresh loans in substantial amounts to purchase new cattle. Motor transport has been considered but could not be adopted because it has not been possible to guarantee a large minimum supply daily to make the use of a motor remunerative.

(2) A second co-operative dairy on different principles has been established at Lucknow during the last two years. In this instance the site is fairly central and lies between the civil station, the city and cantonments of Lucknow. Sheds have been erected for the cattle and also quarters have been provided inside the dairy premises for the residence of the members against whom the cost of each set of quarters is debited in the accounts. The society is on an unlimited liability basis as it not only buys the milk produced by the cattle belonging to the members separately and sells the same either as milk or in the form of butter and cream but also lends money to the members for the purchase of cattle and other requirements. This dairy is financed partly by shares contributed by the members and partly by loans granted by the Municipal Board of Lucknow. During the last two years the society has shown profits in its work. It is too early yet to say whether this institution will be entirely successful but it is a promising experiment.

(3) In Allahabad there is a milk selling society of which the members belong to three small hamlets close to the civil station. There are separate credit societies in these hamlets which are open to the members of the milk society as well as to the other residents. The milk society has got a shop and compound where the owners bring their cattle twice every day. The milking is done in the presence of the Manager and the milk is immediately sold to the purchasers. The members here as in the first two cases supply milk to the society at a fixed rate. This society has been going the last three years. Its organisation is simple and the cost of contingencies and establishment are kept as low as possible.

(4) A fourth society was tried at Gorakhpur on the lines of the Benares Society. In a fifth case in the town of Basti a society has been organised on behalf of the consumers of milk who were to keep cows of their own and sell to the members. This society was closed before formal registration.

2. Our experience has been that the milk selling community as a class are exceedingly intractable and form a very unpromising material for the inculcation of business methods and discipline. It is not proposed to form any more milk societies or co-operative dairies in this province until further experience has been gained in the existing societies.

APPENDIX C.

Note on the cost of establishing a collecting station for about 2,000 lbs. of milk to be pasteurised and watercooled, for despatch by train or motor to a distance not exceeding 50 miles with suitably timed trains.

	Rs.
Dairy buildings with tiled roof, patent stone floor, gauzed windows and doors, 12' x 16' with wash-up-room 10' x 8' and office 10' x 8' or plinth area 26' x 20' = 520 at 3.	1,560
Water tank, drains, small pump &c.	440
Total Buildings	2,000
Boiler vertical cross tube 5' x 6" x 3' = 80 lbs. pressure complete with fittings, mounting and No. 4 Injector and 20 ft. chimney	700
Lawrence Water Cooler	80
"Direct Motor" steam driven pasteuriser size "C", elevating type	550
Milk tank 4' x 3' x 1½'	80
Gerber Butyrometer Lux, 4 Test Complete	60
Milk Recorder with Pail and Tripod	35
24 "Firststeel" cans, 17 galls., 15 galls., and 10 gallons	500
1 set measures, 1 gallon, ½ gallon, 2½ lbs. and 1 lb.	10
1 Hygea Filter with 500 spare mediums	40
1 Steaming Block	15
1 Washup Tank	50
1 Set Seals and Pincers	80
Miscellaneous Contingencies, i. e., stationery, small safe, soap, soda, Lactometers, Thermometers, &c.	300
Total	2,500

G. H. FROST,

*Assistant Director, Military Dairies,
Southern Circle.*

APPENDIX D.

Copy of a letter No. B. 2514, dated 13th October 1913, from the General Traffic Manager G. I. P. Railway, Bombay.

With reference to your letter No. 2315 of the 5th ultimo, I am prepared to introduce the following rates for the carriage of milk in cans by passenger trains:—

Distance —	Rate per maund.			Rate per maund for return of empty cans.		
	Rs.	a.	p.	Rs.	a.	p.
Not exceeding 25 miles	0	2	0	0	2	0
26 to 50 miles	0	3	0	0	2	0
51 to 75 miles	0	4	0	0	2	0
76 to 100 miles	0	5	0	0	2	0
101 to 150 miles	0	6	0	0	3	0
151 to 200 miles	0	7	0	0	4	0

These rates will be subject to a minimum charge of two annas per maund. I shall be glad to hear if these rates will suit you.

2. As regards the question of the provision of insulated vans, the question was discussed at the recent Railway Conference. The North-Western Railway are making some experiments in the matter, and it is proposed to wait the result of those experiments before taking further action.

Copy of a letter No. Commercial—E.-2714/2, dated 10th December 1913, from the Traffic Manager, Commercial, G. I. P. Railway.

Rates for milk in cans and return empty cans by passenger train for a distance of 350 miles.

In continuation of my letter No. E.-2714 of the 6th instant, I have the honour to inform you that I propose to quote the following rates subject to Railway Board's sanction for the carriage of milk in cans and return empty cans for distance of 201 to 350 miles:—

	Rate per maund for milk in cans.	Rate per maund for return empty cans.
	Rs. a. p.	Rs. a. p.
For distance exceeding 200 miles but not exceeding 250 miles	0 8 0	0 5 0
For distance exceeding 250 miles but not exceeding 300 miles	0 9 0	0 6 0
For distances exceeding 300 but not exceeding 350 miles	0 10 0	0 7 0

Bombay Baroda and Central India Railway.

LOCAL RATE ADVICE No. 14.

GENERAL.

Rates for milk and return empty cans by passenger trains.

Para 2. of Local Rate Advice No. 75 of 23rd December 1913. On and from the 15th April 1914, the following will be the rates for the carriage of milk in galvanised iron or sink cans only and return empty cans by passenger trains over the B. B. & C. I. Railway at owner's risk:—

	Rate per maund for milk in cans.	Rate per maund for return empty cans.
	Rs. a. p.	Rs. a. p.
Not exceeding 25 miles	0 2 0	0 2 0
Exceeding 25 miles but not exceeding 50 miles	0 3 0	0 2 0
Exceeding 50 miles but not exceeding 75 miles	0 4 0	0 2 0
Exceeding 75 miles but not exceeding 100 miles	0 5 0	0 2 0
Exceeding 100 miles but not exceeding 150 miles	0 6 0	0 3 0
Exceeding 150 miles but not exceeding 200 miles	0 7 0	0 4 0
Exceeding 201 miles but not exceeding 250 miles	0 8 0	0 5 0
Exceeding 251 miles but not exceeding 300 miles	0 9 0	0 6 0
Exceeding 301 miles but not exceeding 350 miles	0 10 0	0 7 0

The above rates do not apply to cream.

Bombay, 6th April 1914.

FREDERICK W. HANSON,
General Traffic Manager

[To be attached to the Report of the Committee appointed to consider measures for the improvement of the milk-supply in large cities in the Bombay Presidency]

A Note of dissent to the report of the Milk-supply Committee

I am afraid that it would take a very long time for the suggestions of the Committee to be acted upon. I, for one, want that pure natural milk should be obtainable in every town, when one is willing to pay a reasonable price. The only means by which this can be done is not to send milkmen outside a city and to import a chemical compound styled as milk from outside but to allow or encourage milkmen to live in towns in thinly populated areas. Power should be given to municipalities to control the sale of milk in public or private places and to force milk-vendors to milk their cattle in public spaces provided by such municipalities. If this plan be adopted people would get unadulterated milk, besides there would be no necessity to keep a large staff for examining and certifying milk and there would be more cleanliness regarding pots, the udder and milkmen. The standard of fat fixed by the committee, *i.e.*, 5½ per cent. for buffaloes' milk, is very low for the highest figure is 11 per cent. fat and ordinarily it is more than 8 per cent. If the milk-supply of a city is therefore imported from outside it would afford greater facilities for adulteration and removal of fat. There is also another disadvantage in importing milk from long distances for such milk requires pasteurisation which destroys bacille beneficial to human bodies. There is also the danger of the development of other bacteria in imported milk as it is impossible in India to keep milk even at a temperature of 50° F. without the aid of ice. The present war would entail so heavy a burden on Government that it would not be able to give financial help to municipalities for a number of years, and I do not think that there are more than two or three municipalities in the Presidency which would be able to employ a qualified health officer and to maintain a strong staff for examining and certifying milk, for supervising production and for prosecuting defaulters. The three instances of co-operative dairy societies given in the appendix of the report go to show that milkmen are willing to bring their cattle for milking to the sheds provided for them. A municipality may allow the import of milk from outside if it finds the supply within the town to be insufficient, and then the tests recommended in the report may be applied to such milk. Thirdly a municipality may have the power to give a monopoly for selling milk within its limits if a person or company is willing to furnish a substantial security, and if it is also ready to sell pure and natural milk at a specified rate throughout the year. There are many milkmen in Poona who would supply such milk throughout the year at 10 lbs. a rupee which is higher by 2 lbs. than the present rate.

(II) The Committee has recommended that steps should be taken to prevent the slaughter of good milkers. I shall make a positive proposal that all cows and buffaloes before they are slaughtered should be certified by a veterinary doctor that they could not be covered and unless such a certificate is forthcoming, no cow or buffalo should be slaughtered. The European members of the Committee regard this question from an economic point of view and advise that useless cattle should at once be slaughtered, but the Hindu is shocked at such a proposal. He generally regards cattle as members of his family and supports them as long as it is possible. Therefore the practice in Europe of fattening a dry animal and selling it to a butcher is not possible in India. So if the milk-supply is to be increased a prohibition for slaughtering milch cattle should be enforced or a tax of Rs. 50 per head should be imposed for slaughtering them.

(III) There is an indirect way of increasing the milk-supply. The export of milch cattle, hide, skins, bones and horns from India should be stopped. The trade in these articles has doubled during the last twelve years and their prices too have risen. The people in Sind fear that the export of Karachi cows is likely to interfere with their breeding operations. Mahárs and other low castes in villages poison cattle or slaughter them, for the price of the hide and bones covers the cost of the animal while they get flesh and fat free. Ninety per cent. of the raw hides go to Austria and Germany and if their export is stopped as is done at present a great danger to the life of cattle would be removed.

(IV) In large cities persons who keep their cattle for milk find it very expensive to maintain dry cattle. It is one of the main reasons why many citizens do not keep cattle of their own. This difficulty can be overcome by the Government or the municipality securing some pasture land near a city for the maintenance of dry cattle at a moderate cost. A provision should also be made there for covering them. At present there are six million acres in the Presidency which are not occupied by the people or the Forest Department. The Milk Committee has acknowledged that where there are great facilities for grazing there the milk-supply is plentiful. I would therefore request Government to give such land to private persons or companies which are willing to convert it into pastures within a certain number of years. By this means *mal* land would be planted with bábul and other trees and in a few years grass would begin to grow under their shade. This land could then be converted into pastures where breeding operations could easily be conducted. The Irrigation Department does not at present give a continuous supply of water near their canals, even for fodder crops for dairies. Many dairymen in Poona are willing to

pay a higher rate for such water, but the Irrigation Department does not hear this reasonable request. I request Government to give water facilities for dairymen to raise fodder crops.

(V) A recommendation is made by the Committee asking Government to change section 272 of the Indian Penal Code so as to make the addition of water to milk an offence. I would go a little further and ask for the same concession with regard to *ghee* which is now adulterated with bovine fat and mineral oils and is openly sold as such in the market. A Hindu, who never eats beef, is now forced to eat such *ghee* and there is no remedy for it at present.

(VI) Former emperors of India undertook breeding operations as a duty and there were great herds of cattle owned by the State. Though the present Government does not regard the cow as sacred, it may take up breeding operations from the economic point of view.

म. गो. अम्यंकर.

Poona, 5th December 1915.

Dairies.

Report of the Committee appointed to consider measures for the improvement of the milk supply in large cities in the Bombay Presidency.

GOVERNMENT OF BOMBAY.

REVENUE DEPARTMENT.

Resolution No. 3239.

Bombay Castle, 23rd March 1916.

Letter from the Director of Agriculture No. A.—11833 dated 23rd December 1915:—

"In accordance with the orders issued in Government Resolution No. 8263 dated 2nd August 1915, I have the honour to state that the Committee appointed to enquire into the milk supply of large towns met in Poona in the month of September and sat for two days. It then adjourned for a month to facilitate the collection of further information and met in the month of October, when it sat for three days, when it adjourned till November 22nd to admit of the drafting of the report.

"In addition to the members nominated by Government the following gentlemen attended the meetings and gave us the benefit of their valuable advice, viz.—

Major W. G. Liston, Director, Bombay Bacteriological Laboratory.

Mr. G. H. Frost, Assistant Director, Military Dairy Farms, Southern Circle.

Evidence was heard, the most important witnesses being Major F. H. G. Hutchinson, Sanitary Commissioner to the Government of Bombay;

Mr. B. M. Desai

Rao Sahab M. A. Kulkarni

Mr. D. H. Tagare

Mr. M. G. Athalye

Mr. K. V. Joshi

} of the Agricultural Department.

Notes submitted by members of the Committee and others interested in the subject were considered and recorded. The sittings of the Committee were advertised in the Press as open to the public, and a certain number of gentlemen attended and made suggestions from time to time.

"The report of the Committee is attached herewith."

RESOLUTION.—The thanks of Government are due to the Committee for the thorough manner in which they have discharged the task assigned to them and for their lucid and careful report.

2. Having regard to the existing financial stringency and to the necessity of subjecting the report to public criticism, Government do not propose to pass any general orders on the Committee's recommendations. They will be glad, however, if the Director of Agriculture can arrange for an experiment in the organization of the collection of milk from cultivators and its transport to urban areas on the lines indicated in paragraph 4 of the report. Possibly Poona would be a suitable site for the experiment.

A. POPE,

Under-Secretary to Government.

To

The Commissioner in Sind,

The Commissioner, N. D.,

The Commissioner, C. D.,

The Commissioner, S. D.,

} With copies of the Report.

[P. T. O.]

All Collectors, including the Deputy Commissioner, Upper
 Sind Frontier,
 The Surgeon General with the Government of Bombay,
 The Sanitary Commissioner for the Government of Bombay,
 The Director of Agriculture,
 The Superintendent, Civil Veterinary Department, Bombay
 Presidency,
 The Superintendent, Civil Veterinary Department: Sind.
 Baluchistán and Rajputána,
 The Registrar of Co-operative Societies,
 All Conservators of Forests, including the Deputy Conser-
 vator of Forests in charge Sind Circle
 The Oriental Translator to Government,
 The Accountant General,
 The Private Secretary to His Excellency the Governor,
 The Municipal Commissioner for the City of Bombay,
 The General Department of the Secretariat,
 The Financial Department of the Secretariat,
 The Political Department of the Secretariat,
 The Public Works Department of the Secretariat,
 The Editor of Government Publications,
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 V. H. Gonehalli, Esq.,
 A. H. Spearman, Esq.,
 Ráo Sáheb G. K. Kelkar,
 Professor S. V. Shevade, B.Sc., Dip. Agre:
 (Canab.),
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 M. G. Abhyankar, Esq.,
 Ráo Sáheb Harilál Desáibhái Desái, B.A.,
 LL.B.,
 Dr. L. L. Joshi, M.D., B.Sc.,
 The Government of India and all other Local
 Governments and Administrations,
 The Quarter Master General in India,
 The Agricultural Adviser to the Government
 of India.

With copies of
the Report.

By letter.

No. of 1916.

Copy forwarded for information and guidance to

MINISTRY OF FOOD.

REPORT

OF THE

TRAVELLING COMMISSION OF
ENQUIRY INTO THE COST
OF PRODUCTION OF MILK.

Presented to Parliament by Command of His Majesty.



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REPORT OF THE TRAVELLING COMMISSION OF ENQUIRY INTO THE COST OF PRODUCTION OF MILK.

1. *Appointment of the Commission.*—The Astor Committee on the Production and Distribution of Milk, when recommending that a flat price of 2s. 3d. per gallon should be paid to producers of milk from 1st October 1918 to 30th April 1919, drew attention to the unfairness necessarily occasioned by the adoption of this principle, and recommended that a Sub-Committee should be appointed to consider the possibility of setting up some scheme of differential prices.

This Sub-Committee, after holding three meetings, presented an interim report on the 12th November 1918, in which it was recommended that:—

- (i) Differential rates should, if possible, be fixed for milk sold wholesale by producers.
- (ii) Committees of Enquiry should be set up to ascertain the cost of production of milk in the different areas of Great Britain.

These recommendations were endorsed by the Main Astor Committee and by it submitted to the Food Controller, who decided in December 1918 to appoint a Travelling Commission to investigate locally the cost of milk production in Great Britain.

2. *Terms of Reference.*—The terms of reference of the Commission in their original form were:—

“To report upon the cost of milk production in various areas of Great Britain during winter and summer periods, and upon the different methods of production prevailing in different areas, and upon the approximate quantities of milk produced at different times of the year in those areas by each method of production.”

Those terms of reference were afterwards extended to cover enquiries into the cost of cheese production, and the making of recommendations as to the prices to be fixed for milk in the summer and winter of 1919.

3. *Constitution of Commission.*—The Commission was constituted as follows:—

C. B. FISHER, Esq., C.B.E., Chairman. Agricultural Adviser to the Ministry of Food.
J. MACKINTOSH, Esq., Board of Agriculture and Fisheries, and Ministry of Food.
J. D. SCOTT, Esq., Board of Agriculture for Scotland.
MAJOR WARD, Ministry of Food (Costings Section).
C. S. ORWIN, Esq., Institute of Research into Agricultural Economics, Oxford.
J. WYLLIE, Esq., West of Scotland Agricultural College.
Mrs. COTTRELL.
G. WILSON, Esq. } Consumers' Council.
W. H. WATKINS, Esq. }
A. BATCHELOR, Esq. } Central Agricultural Advisory Council.
W. CUMBER, Esq. }
E. W. LANGFORD, Esq.
Miss COWPER, Ministry of Food (Secretary).

4. *Agricultural Costings Committee.*—The Travelling Commission held its first meeting on the 16th January 1918. In the meantime a larger scheme for setting up machinery for obtaining and analysing costs of production on farms in Great Britain and Ireland was in contemplation, and on the 21st December 1918 the Agricultural Costings Committee was set up jointly by the Ministry of Food and the three

Departments of Agriculture, but up to the date of the completion of the enquiries of the Travelling Commission no actual Costings Statistics were obtained by this Committee. At the first meeting of the Agricultural Costings Committee held on the 8th January 1919, it was decided that it would be advisable that the Travelling Milk Commission should report to the Food Controller through this Committee, and the Commission concurred in this arrangement.

5. *Procedure Adopted.*—The Travelling Commission has held in all 27 meetings, the first of which took place on 16th January and the last on 29th May 1919. The first two meetings, held on the 16th and 22nd January, were spent chiefly in discussion as to the procedure to be adopted in obtaining information and the lines on which farmers should be asked to make their returns.

It was agreed that the enquiry should be held in the areas of the Divisional Food Commissioners throughout Great Britain, the Commission sitting whenever possible at the Headquarters of the Commissioner, though in cases of the South Western, the Midland and the North Wales Divisions other towns which appeared to be more suitable centres for investigation were chosen.

It was also arranged that forms of return, similar to those used in the 1918 enquiry, should be issued to farmers through the Divisional Food Commissioners.

The question of the basis on which the returns should be made was discussed at a joint meeting with the Agricultural Costings Committee, held on the 22nd January, when it was decided that owing to the impossibility of obtaining accurate figures as to the cost of production of home-grown feeding stuffs farmers should be asked to enter these items at market value minus the cost of marketing, and that deductions for manurial value in respect of these foods should be made during the official tabulation of the forms, and on a basis agreed upon by the Commission.

6. At the fourth meeting held on the 20th February 1919, Sir William Beveridge asked for the advice of the Commission with regard to the fixing of prices for milk in the summer and winter periods of 1919. After some discussion the following resolution was passed unánimously:—

“That this Commission, which is now considering the cost of production of milk, recommends that maximum prices should be fixed for milk both for summer 1919 and winter 1919–1920, and is of opinion that it is essential, in order to obtain supplies, that the maximum price fixed should be such as to afford a reasonable profit; and further recommends that an immediate announcement on these lines should be made by the Food Controller.”

7. *Returns.*—Between the 13th January and the 7th February approximately 7,500 forms were sent to the Divisional Food Commissioners for distribution to producers through the local branches of the various Agricultural Associations; farmers were also invited by means of advertisement in the local press to apply to the Divisional Food Commissioners for forms, and to give evidence before the Commission, in support of their statements of costs.

The response made by milk producers generally was by no means satisfactory. A comparatively small number of returns was received, many of which were incomplete, and others so obviously incorrect as to be useless for the purpose of the inquiry. The chief reason for this was that milk producers are not, as a rule, accustomed to keep accurate accounts. Many witnesses stated that they had had no idea as to the cost of production of milk until they had worked it out for the purpose of giving evidence.

In some districts the agricultural organisations failed to induce their members to submit statements of costs. In Gloucestershire and Wiltshire the County Branches of the Farmers' Union advised their members not to send in individual returns, and arranged that one or two composite returns should be put in for the county as a whole. This proceeding proved to be a serious hindrance to the work of the Commission with regard to the counties in question, and is much to be deprecated.

8. *Itinerary.*—The Commission began its actual inquiries into the cost of production of milk on the 17th February, and between the 17th February and the 24th March held 14 meetings throughout Great Britain, hearing in all 328 witnesses, including 280 actual producers of milk.

A detailed schedule, showing the number and occupation of the witnesses heard, is appended to the Report (Appendix A).

The itinerary followed by the Commission was :—

Division.	Place of Inquiry.	Date.	No of Witnesses heard
North Midland - - - -	Derby - - - -	17th-18th February -	40
Home Counties, South - - - -	London - - - -	20th February - - -	9
South Western - - - -	Exeter - - - -	24th-26th February -	52
South Midland - - - -	Reading - - - -	28th February-1st March	37
South Wales - - - -	Cardiff - - - -	3rd-4th March - - -	22
Midland - - - -	Birmingham - - - -	5th March - - - -	17
North Wales - - - -	Rhyl - - - -	6th-7th March - - -	28
Scotland - - - -	Edinburgh and Glasgow -	12th-15th March - - -	41
Northern - - - -	Newcastle-on-Tyne -	17th March - - - -	16
North Eastern - - - -	Leeds - - - -	18th-19th March - - -	25
North Western - - - -	Preston - - - -	20th-21st March - - -	19
Eastern - - - -	Cambridge - - - -	24th March - - - -	12
Home Counties, North - - - -	London - - - -	27th March - - - -	10
Total - - - -	- - - -	- - - -	328

9. The Commission wishes to state that it has not found it possible to adhere strictly to its terms of reference. It is extremely difficult to obtain at such short notice figures with regard to the cost of production of milk. This is due to the fact that the keeping of records of the quantities and cost of foods used is extremely rare among milk producers. Hence, in the majority of cases the statements submitted to the Commission were largely estimates, which from the nature of things were not likely to be under-estimates.

The Commission had neither the time nor the means to check the accuracy of the statements submitted. Its members were compelled therefore to regard themselves as arbitrators, and having weighed the evidence contained in the returns as against the results of the cross-examination of witnesses to come to their own conclusions.

It would have been impossible to obtain the third item of information required, *i.e.*, "the approximate quantities of milk produced at different times of the year by each method of production" without taking a general census of milk production throughout Great Britain, a course which was obviously impossible for the Commission. The information given under this head has therefore been based upon the results of the milk census for the week ending 2nd June 1918, and of that for the week ending 7th December 1918.

10. *Cost of Production.*—The following were the results of the tabulation of the figures submitted by farmers as to the cost per gallon of the production of milk in the period 1st May to 30th September 1918.

Items.	Cost per gallon 1st May—30th Sept. 1918.	
	s.	d.
1. Foods (including grazing) - - - -	0	8·89
2. Labour - - - -	0	2·4
3. Proportion of rent and rates - - - -	0	0·36
4. Depreciation--		
(i) On cows (including loss) - - - -	0	3·59
(ii) On plant and machinery - - - -	0	0·16
5. Repairs and miscellaneous - - - -	0	0·85
6. Distribution, <i>i.e.</i> , transport to seller's station or buyer's premises - - - -	0	0·55
Gross total - - - -	1	4·8
Deduction (calves only)* - - - -	0	0·6
Net total - - - -	1	4·2

* No deduction was made for the manurial value of home-produced foods in this period.

These figures were, as has been stated, obtained from the tabulation of those of the returns regarded by the Commission as most reliable. Nevertheless, while the Commission is not prepared to correct the figures in detail, it is of the opinion that there is an element of profit included in the item "Cost of Foods" owing to the influence of market prices on the farmer's judgment, and further that the amounts entered under the heading "Depreciation" are in most cases too high, having regard to the present state of the market. The Commission decided therefore to make a deduction of 2d. from the total arrived at, and to base its recommendations as to summer prices on an estimated net cost of 1s. 2·2d. per gallon, to which is added 1d. per gallon in respect of increased cost of labour, and 3d. per gallon to cover interest on capital, management charges, and net profit.

11. *Cost of Cheese-making.*—The evidence received as to the cost of cheese-making was not based on accurate cost accounts, but there was practical unanimity of opinion that the manufacturing cost was approximately 2d per lb. in addition to the cost of milk. It was generally stated that one gallon of milk produced on the average 1 lb. of cheese.

12. *Prices recommended for the period May 1st to 30th September 1919.*—The question of the prices which should be fixed for milk in the period from the 1st May to the 30th September 1919, has already been dealt with in the Interim Report presented to the Agricultural Costings Committee on the 4th April 1919.

The prices recommended were as follows:—

Month.	Price in England Wales.	Price in Scotland.
May - - - - -	1s. 4d. per gallon.	1s. 6d. per gallon.
June - - - - -	1s. 3d. "	1s. 4d. "
July - - - - -	1s. 6d. "	1s. 4d. "
August - - - - -	1s. 8d. "	1s. 7d. "
September - - - - -	1s. 10d. "	1s. 10d. "
Average - - - - -	1s. 6½d. "	1s. 6½d. "

These prices were for milk delivered to the producer's railway station, or the buyer's premises, and were based on the assumption that the only item of expense which would be likely to show a material increase in the summer of 1919 as compared with the summer of 1918, was that of labour, the additional charges for which, according to the recent award of the Agricultural Wages Board, would, it was estimated, increase the cost of milk production by approximately 1d. per gallon. The Commission emphasised the fact that its recommendations as to prices were based upon the assumption that the rates of wages and hours agreed upon would remain in force during the summer period.

The prices recommended in the Interim Report were accepted by the Food Controller, the Boards of Agriculture, and the Central Agricultural Advisory Council, and were brought into operation by the Milk (Summer Prices) Order, 1919. No recommendation was made by the Commission to the effect that ½d. per gallon should be deducted from the price paid to the producer in the case of milk not cooled and delivered twice daily, nor to the effect that the allowance for collection should be increased from a minimum of ½d. to a fixed rate of 1d. per gallon.

Further recommendations made in the Interim Report were that:—

- (i) The price paid to the producer for milk in the Counties of Cornwall, Devonshire, Somerset and Dorset should be 2d. per gallon lower throughout the year than that paid in the rest of England and Wales.
- (ii) That the price paid to the producers in the industrial area of the West Riding should be 2d. per gallon higher than that prevailing in the rest of England and Wales.

These recommendations were also put into effect by the Milk (Summer Prices) Order, 1919.

13. *Cost of Production (Winter).*—The following were the results of the tabulation of the figures submitted by farmers with regard to the cost per gallon of the production

of milk in the period 1st October 1918 to 31st January 1919, home-grown feeding stuffs having been charged at the following prices :—

Hay - - - - -	7l. 15s. per ton.
Roots - - - - -	2l. per ton.
Cabbages - - - - -	50l. per acre, or 2l. 10s. per ton.
Oat straw - - - - -	3l. 10s. „

Items.	Cost per gallon 1st October 1918 to 31st January 1919.	
	s.	d.
1. Foods—		
(i) Home-produced - - - - -	1	4·04
(ii) Purchased - - - - -	0	6·88
2. Grazing - - - - -	0	0·73
3. Labour - - - - -	0	3·83
4. Depreciation and loss on cows - - - - -	0	3·92
5. Proportion of rent and rates - - - - -	0	0·47
6. Keep of bull - - - - -	0	0·4
7. Depreciation of machinery and utensils - - - - -	0	0·2
8. Repairs - - - - -	0	0·18
9. Miscellaneous - - - - -	0	0·6
10. Distribution, <i>i.e.</i> , transport to seller's railway station or buyer's premises - - - - -	0	0·71
		<hr/>
Gross total - - - - -	2	9·96
Deduction (calves only) - - - - -	0	1·68
		<hr/>
Net total - - - - -	2	8·28

The Commission, on considering these figures, made the following adjustments :—

- (1) Allowance was made for the manurial value of home-produced foods by deducting 1·5d. per gallon.
- (2) The amount charged under the heading "Depreciation" was reduced by 0·92d. to 3d. per gallon.
- (3) The amount charged under the heading "Keep of Bull" was deleted.

The figures as finally amended were :—

Items.	Cost per gallon 1st October 1918 to 31st January 1918,	
	s.	d.
1. Foods (including grazing) - - - - -	1	11·65
2. Labour - - - - -	0	3·83
3. Proportion of Rent and Rates - - - - -	0	0·47
4. Depreciation—		
(i) On cows (including loss) - - - - -	0	3
(ii) On plant and machinery - - - - -	0	0·2
5. Repairs and Miscellaneous - - - - -	0	0·78
6. Distribution, <i>i.e.</i> , transport to seller's railway station or buyer's premises - - - - -	0	0·71
		<hr/>
Gross total - - - - -	2	8·64
Deductions (calves and manurial value of home-produced foods) - - - - -	0	3·18
		<hr/>
Net total - - - - -	2	5·46

The Commission feels, however, that even these amended figures include a certain element of profit, owing to the fact that home-produced foods have been charged at market value less the cost of marketing, and recommends that this fact should be taken into consideration in utilising them as a basis for the fixing of prices for the winter months of 1919-1920. Owing to the uncertainty as to the quantity and cost of home-produced foods likely to be available next winter, and the price of purchased feeding stuffs during the same period, the Commission is not prepared to recommend prices for the winter of 1919-1920 at a time so far in advance of their being brought into operation.

14. *Information obtained as to Methods of Production.*—The Commission finds that the three main methods of production of milk in Great Britain are:—

1. *Production on Country Farms.*—The most general method of herd management on these farms is to change from a fifth to a third of the herd annually, relying for replenishment on home-bred or purchased stock. Large quantities of home-produced foods are used. By far the largest proportion of the milk produced in Great Britain is produced under these conditions, with slight variations according to the different districts.

2. *Production on Suburban Farms.*—On these farms a larger proportion of the herd is changed annually. Only a small quantity of home-produced food is grown, and consequently artificial feeding stuffs are more largely used. This method of production is found in the immediate neighbourhood of many of the large towns such as London, Glasgow, Birmingham, Manchester, and the industrial centres of the North Midlands generally.

3. *Production under the Town Dairy System.*—No home-produced foods are grown by the town dairyman. The cows are kept in all the year round and 75 per cent. to 100 per cent. of the herd is changed annually.

This method of production is chiefly found in Edinburgh, Leith, Dundee, and Liverpool. In the last-mentioned town almost all the producers are also retailers. The town dairy is of importance in that it provides for these towns a supply of milk which they would otherwise have difficulty in obtaining at the present time. The Commission, therefore, in the Interim Report recommended the continuance of the system at present in force by which the Food Commissioner for Scotland is empowered to grant to the town dairymen of Edinburgh, Leith and Dundee special licences to sell at a higher price than the producers' price in the rest of Scotland. It must be admitted, however, that the town dairy is a system which is wasteful of cow-life, and therefore in the long run uneconomic.

Somewhat similar conditions are to be found in the industrial area of the West Riding of Yorkshire where one of the main forms of agriculture is the production of milk for local consumption, although local conditions such as atmospheric pollution and the high cost of labour render milk production so costly that it does not appear to be a suitable system of farming for the district.

Milk producers in this area have on the recommendation of the Commission been permitted from the 1st May to the 30th December 1919 to charge for milk a maximum price of 2d a gallon higher than that prevailing in the rest of England and Wales.

The Commission feels, however, that measures such as those recommended in its Interim Report, are merely palliative and temporary, and that the whole question of milk production in the towns and districts referred to and in parts of Lancashire where somewhat similar conditions prevail, should be made the subject of a special enquiry by the department which is to be responsible for the milk industry in conjunction with the local agricultural and public health authorities with a view to the arranging for a supply of milk to the towns where the Town Dairy system is now in force from country districts where milk can be produced more cheaply, and the gradual introduction into industrial areas of a system of farming other than milk production.

15. *The amount of Milk produced in different Periods.*—The statement in the following paragraph (for detailed figures see Appendix B.) with regard to the amount of milk produced at different periods is based on the results of the Milk Census for the week ended 2nd June 1918, and for the week ended 7th December 1918 (part of the Live Stock Census of the 4th December 1918).

It was found necessary in the tabulation of these census returns to classify most of the farms in England and Wales, though not in Scotland, as "Good" and "Bad"; and in the case of the "bad" farms, only the total quantity of milk and the amount sold wholesale and sold retail has been extracted. Out of a total of 244,705 farms returned in England and Wales, 30,822 or 12·6 per cent. have been classified as "bad."

In December 1918 there were in the whole of England and Wales 1,599,749 cows in milk, which had a total output (on "good" and "bad" farms) of 11,875,000 gallons of milk during the week ended December 7th. In June 1918 the corresponding figures were 1,714,254 cows in milk, producing during a single week 23,340,000 gallons. Hence as between June and December there was a decrease of as much as 49·1 per cent. in the output of milk though there was a decrease of only 9 per cent. in the number of cows in milk. Whereas in June 1918 the average yield per cow in milk was 13·5 gallons, in December 1918 the yield had fallen to 7·6 gallons per week. In the case of Scotland the yield fell from 15 gallons per cow per week in June to 8·1 gallons in December, and the actual output of milk from 4,471,000 gallons to 1,831,000, a decline of 60 per cent. as compared with a decrease of 14·7 per cent. in the number of cows in milk in the latter period. These figures agree remarkably well with the records relating to many thousands of cows kept by a large milk utilising firm, which show for the three years 1916-18 an average output per cow per week of 13·6 gallons in the month of June and about 7 gallons in the month of December. The shortage of feeding stuffs, beginning with the gradual reduction in May 1917, no doubt considerably affected the yield of milk, which was also reduced by the bad quality of the purchased foods.

In December 1918 63·4 per cent. out of the total number of dairy cows in England and Wales were in milk and 36·6 per cent. were dry. This compares with 81 per cent. in milk and 19 per cent. dry in June 1918. In December 1917 the census figures showed 60·2 per cent. cows in milk and 39·8 per cent. dry. In Scotland the corresponding figures were—December 1918, 55·2 per cent. in milk and 44·7 per cent. dry; June 1918, 85·4 per cent. in milk and 14·6 per cent. dry; December 1917, 53·2 per cent. in milk and 46·8 per cent. dry.

16. The subjects dealt with in the following paragraphs (17—21) have been included in the investigations of the Commission in the light of their bearing upon the cost of milk production, and are, for that reason, mentioned in the Report.

17. *Diseases affecting the milk supply* :—

(i) *Epizootic Abortion*.—The Commission has been impressed during its investigations by the prevalence of this disease and by its serious effect upon the yield of milk. A considerable body of evidence has been received with regard to the use of the Board of Agriculture vaccine, and this evidence was almost without exception favourable. It was found, however, that in many districts the fact that this vaccine could be obtained free of charge was not generally known, and we therefore recommend that farmers should be more widely informed on the subject.

The Commission was informed at Exeter that this disease has been made compulsorily notifiable by the Devonshire County Council, and that Devonshire is the only county in England in which this action has been taken. The Commission considers that the results of this action call for its extension to the rest of the country, and for the enforcement of the necessary preventive and curative treatment.

(ii) *Tuberculosis*.—The Commission finds that the use of the tuberculin test as a step in the direction of obtaining a herd free from tuberculosis is comparatively rare, although its value is much more fully realised in some districts than in others. The evidence of veterinary surgeons and of farmers was generally to the effect that herds free from tuberculosis were also less subject to other diseases, and attained a higher standard of health. The Commission feels that there is great need for the further instruction of farmers with regard to this matter, and it is therefore recommended that a scheme should be inaugurated for :—

- (i) The free application of the tuberculin test on an absolutely reliable basis.
- (ii) The production of non-reacting young stock.

The Commission recognises that any such scheme must be introduced gradually in view of the difficulty of obtaining non-reacting animals.

We consider that the grading of milk is a step in the right direction and should be continued and extended, and that farmers should receive every encouragement to keep non-reacting herds.

We consider that the conditions under which milk is produced in many districts are unsatisfactory in consequence of the lack of hygienic housing accommodation for dairy herds.

(iii) *Udder Diseases*.—The Commission has also found that diseases of the udder were very prevalent in many districts, and that these diseases were also seriously affecting the yield of milk.

We would recommend with regard to diseases generally, the appointment of a full-time veterinary officer in charge of a county or group of counties. This has been done in Scotland in the counties of Lanark and Ayr; and the making of the appointments has already been fully justified by the results. We would also recommend the making of grants to the veterinary colleges for the purpose of further research into the diseases of animals.

18. *Labour*:—

(i) *Increasea Cost and Difficulty of obtaining*.—The Commission has taken into account in suggesting maximum producers' prices for the summer of 1919, the effect of the recent increases granted by the Agricultural Wages Board on the cost of milk production. The situation with regard to agricultural labour is, however, still uncertain. The unrest in the dairy industry is not due altogether to the scale of wages obtainable, but to the length of the hours worked, and the fact that so much Sunday labour is necessary. It cannot be expected that men and women will work seven days a week if they see any alternative method of obtaining a living. The shorter hours, the weekly rest days, and the higher wages obtainable in factories, have drawn workers from the dairy farms. The statutory half-holidays now in force, though it alleviates the position of the labourers, has increased the farmers' difficulties, since it is necessary in many cases to engage additional hands in order to carry on the work by a system of shifts.

The Commission considers that those farmers who have in recent years sold out their cows, and gone out of the dairying business have, on the whole, done so rather on account of the difficulty of obtaining labour than because the prices fixed for milk were unremunerative.

(ii) *Employment of Women*.—There would appear to be a distinct opening for the employment of women as milkers in England as is already done in Scotland, and on large farms where accommodation is available and big herds are kept the extended utilisation of female labour would be advantageous.

(iii) *Use of Milking Machines*.—The Commission received a considerable volume of evidence with regard to the use of milking machines and their value for the saving of labour. The evidence with regard to the efficiency of these machines was conflicting, though there was general agreement that the successful working of a mechanical milking plant depends almost entirely on the operator who must be rather above the general level of intelligence and reliability.

It appeared from the evidence that the installation of a milking machine led to economy of labour in cases where the buildings were so planned as to permit of a reduction in the number of men employed in the cleaning of the cows and cow sheds. This was particularly the case in Scotland where the satisfactory arrangement of the buildings also led to a lessened initial cost of installation.

The general opinion of the farmers as shown by the evidence was that though the results of good hand-milking are preferable to those obtained by the use of a milking machine, the work of the machine is more satisfactory than that of inefficient milkers.

We would recommend that grants should be made either to the Dairy Research Institute or to one of the Dairy Colleges, with a view to further research and experiment in the use of mechanical milkers and to the provision of short courses of instruction for intending operators.

19. *Milk Records*.—A general feature of the evidence given was that the yields of milk were on the whole higher in the districts where milk recording has been carried out to any extent. The Commission would therefore strongly recommend the extension of milk recording, and the attempt to improve the milking strain by the elimination from dairy herds of cows showing poor milk records.

20. *Collection and Distribution*.—This Commission is impressed with the necessity for the re-organisation of the methods of collection and distribution now generally adopted in the milk industry, and is of opinion that the present heavy loss of milk through souring is unnecessary and avoidable, and that milk of a better quality and

of no greater price could be provided, were it chilled soon after milking, preferably at the farms, or if this were impossible at country depôts located at centres conveniently situated for producers and with good railway communication to towns and cities. The following further advantages would arise from the adoption of this policy :—

- (i) *The quantities of milk sent to towns could be regulated according to the daily needs of the retailers.* Under the existing system, while the demand for milk is comparatively uniform throughout the year, the winter supply of milk on many farms is less than 40 per cent. of the summer output. In some cases dealers contract for uniform amounts from the producers, leaving the summer surplus to be dealt with at the farms. In other cases, they purchase all the milk, themselves undertaking to dispose of the surplus. In either case this surplus is a source of anxiety and loss.
- (ii) *The gross milk production of the country would probably be increased,* as the farmer would be assured of a market for milk produced at all seasons of the year.
- (iii) *Collection by means of a service of motor lorries could be arranged for,* thus obviating the waste of individual delivery by farmers to stations or retail premises.
- (iv) *Surplus milk could be dealt with near the source of production,* thus avoiding unnecessary transport and the consequent deterioration of the milk as raw material for manufacture.
- (v) *It would be possible to arrange for the payment for milk on the basis of the fat content,* which would ensure the giving of a better price for good quality milk.
- (vi) *It would be possible to arrange for the bacteriological examination of the milk received at the depôts from the various farms.* We consider a bacteriological test the most satisfactory method of ascertaining the condition of milk. Under the present system an Inspector may be satisfied with the actual condition and arrangement of premises in which milk production is carried on in a very negligent manner, and the Inspector's report may therefore be misleading. If a bacteriological test proved the milk to be unsatisfactory the source of contamination could then be further examined. It is thought that it would be possible to train in a comparatively short time assistants capable of conducting a simple bacteriological test, which would be sufficient for the purpose. It would then be possible to combine this method of testing for purity with the inspection of cow-houses as it is carried out at present.

21. The Commission was impressed by the extraordinary variation in the quantities of feeding stuffs, especially fodder and meals, given to dairy cows. There is clearly much room for instruction in the most economical rations for milk production. The Commission is strongly of opinion that a considerable extension of systematic instruction in the feeding and general management of dairy herds is essential to the more economical production of milk and milk products.

22. In conclusion, the Commission wishes to express its thanks to the Divisional Food Commissioners and their Assistant Commissioners for Milk, without whose co-operation the work accomplished would have been impossible. Thanks should also be given to the Agricultural Departments of Leeds University and to the West of Scotland Agricultural College for the help given by their members to farmers in the filling up of their forms, and for the valuable evidence received from Mr. Ruston and Mr. Wyllie. Among the other expert witnesses who were kind enough to attend and to give to the Commission the benefit of their opinion and advice particular mention should be made of :—

Dr. Stenhouse Williams, University College, Reading.
 Mr. K. J. J. Mackenzie, Agricultural Department, University of Cambridge.
 Mr. Begg, Veterinary Inspector to the County of Lanark.
 Professor Mathieson, Royal Dick Veterinary College, Edinburgh.
 Mr. Symon, North of Scotland Agricultural College.
 Mr. Bland, Agricultural Organiser for Oxfordshire.
 Mr. Bedford, Agricultural Organiser for Berkshire.
 Mr. Malcolm, Veterinary Officer to the City of Birmingham.
 Mr. Eaton Jones, Veterinary Officer to the City of Liverpool.

The Commission wishes to express its appreciation of the services of these gentlemen, and of the many other witnesses who attended, sometimes at great personal inconvenience.

C. B. FISHER (<i>Chairman</i>).	C. S. ORWIN.
H. BATCHELOR.	J. WARD.
JOHN D. SCOTT.	W. H. WATKINS.
M. E. COTTRELL.	G. WILSON.
W. J. CUMBER.	J. WYLLIE.
E. W. LANGFORD.	M. COWPER (<i>Secretary</i>).
J. MACKINTOSH.	20.5.19.

In respect of contagious abortion we are of the opinion that the Commission has not taken sufficient evidence to warrant a recommendation in favour of compulsory notification,

WM. J. CUMBER.
JAMES WYLLIE.
JAMES MACKINTOSH.

Whilst agreeing with the lines upon which the report has been drawn and also with the general principle of differentiation adopted in the recommendation, we think the following additional observations upon the work of the Commission are due from us as representatives of the Consumers' Council, and therefore of the consuming public as a whole.

1. *Cost of Production*.—In order that the admitted unfairness of the payment of a flat rate to producers of milk in all parts of the country might be remedied the Commission was charged with the duty of ascertaining the cost of production in various areas. The circumstances attending the enquiry have prevented any trustworthy statement of such costs from being presented. With regard to the statement of costs rendered by producers no means of checking their accuracy were available and this has been frankly admitted. Even so, by comparison of quantities stated to be consumed, it was apparent that in many cases the quantities fed were in excess of actual need and the necessary cost of production thereby exceeded.

At the outset it was decided at a joint meeting of the Commission and the Agricultural Costings Committee that enquiry as to cost, should be made on the form adopted in a previous enquiry which asked in respect to the consumption of home-grown feeding stuffs that rather than the cost of production of such stuffs there should be entered their market price less cost of marketing from which the manurial values could be deducted later. This procedure which in normal times would have resulted in the exaggeration of the cost of milk produced to an appreciable extent, must clearly enhance reputed cost very considerably in a period when the market prices of hay, roots, corn and other feeding stuffs are unprecedentedly high.

The importance of these considerations is manifest when the proportion of the food item of cost to the whole cost is regarded, and especially in this the case with production in the winter period.

Similarly with the other items of cost, they could not be verified, whatever doubt might arise as to their accuracy. Comparison with the actual prices paid to milk producers before the war supports the conclusion that the form supplied to producers lends itself easily to exaggerated statement of cost.

We desire therefore to lay great emphasis on the reservation made in the report that its figures as to cost of production contain elements of profit which should be taken into consideration if such figures are in any way to be regarded as a basis of prices for the coming winter.

2. *Differentiation*.—We stated in our addendum to the interim report of the Commission that we were of opinion that the differentiation applied to the south-western counties could be extended to the other divisions then mentioned. Maturer consideration of the evidence available confirms us in the opinion then given.

M. E. COTTRELL.
W. H. WATKINS.
GEORGE WILSON.

TRAVELLING MILK COMMISSION.

APPENDIX A.

Number of Witnesses examined.

Division	Producers.	Experts	Local Food Control Committee Representatives.
1. North Midland (Derby) -	34	1 veterinary surgeon - - - - 1 representative of wages committee. 1 county agricultural organiser.	3
2. Home Counties (London) -	19		—
3. South Western (Exeter) -	45	1 deputy clerk of the Crown and Peace - 1 chief constable (re abortion).	5
4. South Midland (Reading) -	28	1 veterinary surgeon - - - - 2 members of staff of University College, Reading. 2 county agricultural organisers.	4
5. South Wales (Cardiff) -	21	1 veterinary surgeon - - - -	—
6. Midland (Birmingham) -	14	1 veterinary surgeon - - - -	2
7. North Wales (Rhyl) -	23	1 medical officer of health - - - - 1 veterinary surgeon. 1 member of the staff of University College, Bangor	2
8. Scotland, N. and E. (Edinburgh).	22	1 professor of pathology at Royal Veterinary College. 1 county agricultural organiser. 1 veterinary surgeon. 1 professor of dairying, West of Scotland Agricultural College.	1
9. Scotland, S.W. (Glasgow) -	13	1 member of wages committee - - - -	—
10. Northern (Newcastle-on-Tyne).	15	1 veterinary surgeon - - - -	—
11. North-Western (Leeds) -	22	1 member of staff of Leeds University - 1 veterinary surgeon. 1 member of wages committee.	—
12. North-Western (Preston) -	15	1 veterinary surgeon - - - -	3
13. Eastern (Cambridge) -	9	1 member of staff of Cambridge University. 1 veterinary surgeon.	1
Total - - -	280	27	21

Full total, 328.

April 11, 1919.

APPENDIX B.

Area.	County.	No. of Cows in Milk.		Milk Production.		Average Output per Cow per Week		Percentage of Total Cows.			
		During Week ending Dec. 7.	During Week ended June 2.	Week ending Dec. 7.	Week ending June 2	Dec. 7.	June 2.	In Milk.		Not in Milk	
								Dec. 7.	June 2.	Dec. 7.	June 2.
1	Northumberland	18,417	18,859	155,695	252,404	Gallons, 8 4	Gallons, 14 5	65.7	83.4	34.3	16 6
	Durham - -	23,507	22,222	198,185	222,913	8.4	13.5	72.1	83.1	27.9	16.9
	Total - -	41,924	41,081	353,880	475,317	8.4	14.0	69.0	83.3	31.0	16.7
2	Yorkshire -	150,720	141,594	1,369,888	2,014,666	9.1	14.3	66.4	79.8	33.6	20.2
3	Cumberland -	29,012	37,903	197,095	286,179	6.8	13.7	56.7	80.5	43.3	19.5
	Westmorland -	16,279	18,839	104,367	158,560	6.4	14.0	50.4	79.8	49.6	20.2
	Total - -	45,291	56,742	301,462	444,739	6.6	13.8	52.6	80.3	47.4	19.7
4	Lancashire -	96,927	94,392	729,872	779,884	7.5	13.2	75.1	74.0	24.9	26.0
	Cheshire -	74,206	53,405	469,096	849,406	6.3	18.5	62.0	70.8	38.0	29.2
	Total - -	171,133	147,797	1,198,968	1,629,290	7.0	15.5	68.7	72.8	31.3	27.2

Area.	County	No. of Cows in Milk.		Milk Production.		Average Output per Cow per Week.		Percentage of Total Cows.			
		During Week ending Dec. 7.	During Week ended June 2.	Week ending Dec 7.	Week ending June 2.	Dec. 7.	June 2.	In Milk.		Not in Milk.	
								Dec 7.	June 2.	Dec 7.	June 2.
5	Lincoln - -	31,105	31,828	225,840	271,934	7.3	15.7	21.8	81.0	48.2	19.0
	Leicester - -	34,745	36,017	299,005	480,901	8.6	15.4	67.0	82.1	35.0	17.9
	Northampton - -	19,594	20,063	166,931	164,666	8.5	14.2	59.1	77.6	40.9	22.4
	Nottingham - -	20,625	20,705	179,673	225,428	8.7	15.0	64.8	79.8	35.2	20.2
	Derby - -	60,065	60,649	489,199	451,495	8.2	14.3	72.5	82.8	27.5	17.2
	Rutland - -	1,974	1,576	13,919	14,454	7.1	14.6	56.4	76.9	43.6	23.1
	Total - -	168,108	170,838	1,374,867	1,608,880	8.1	14.9	64.1	81.3	35.9	18.7
6	Hereford - -	10,772	12,039	60,985	126,644	5.6	16.6	44.0	56.9	56.0	43.1
	Salop - -	44,183	57,173	291,771	699,361	6.6	15.1	49.6	93.1	50.4	6.9
	Worcester - -	15,922	17,234	138,890	178,232	8.7	13.9	57.1	75.7	42.9	24.3
	Warwick - -	30,649	31,090	284,885	356,808	9.3	14.4	63.8	81.8	36.2	18.2
	Stafford - -	68,653	78,688	532,215	879,634	7.8	14.2	65.7	83.4	34.3	16.6
Total - -	170,249	196,224	1,308,746	2,240,679	7.7	14.6	57.9	82.6	42.1	17.4	
7	Anglesey - -	8,510	11,735	50,793	76,270	6.0	7.6	69.4	84.1	30.6	15.9
	Carnarvon - -	13,637	16,346	80,328	123,695	5.9	8.5	68.2	76.7	31.8	23.3
	Merioneth - -	8,589	10,261	44,029	94,517	5.1	9.7	62.3	81.8	37.7	18.2
	Denbigh - -	17,834	24,096	98,369	226,085	5.5	11.2	64.3	82.4	45.7	17.6
	Flint - -	12,745	16,492	78,079	179,110	6.1	11.8	55.4	77.0	44.6	23.0
	Montgomery - -	11,770	18,160	48,716	113,183	4.1	7.8	43.0	78.9	51.0	21.1
Total - -	73,085	97,090	400,314	812,860	5.5	9.7	58.0	80.0	42.0	20.0	
8	Carmarthen - -	27,319	45,620	138,852	585,857	5.1	12.9	48.8	87.4	51.2	12.6
	Glamorgan - -	16,583	19,617	108,535	181,270	6.5	10.9	61.4	83.0	38.6	17.0
	Monmouth - -	9,629	12,028	64,551	97,108	6.7	11.4	53.5	80.0	46.5	20.0
	Radnor - -	3,107	3,678	12,488	28,765	4.0	8.3	38.8	84.0	61.2	16.0
	Brecknock - -	5,303	8,396	18,938	40,941	3.6	8.2	42.1	80.1	57.9	19.9
	Pembroke - -	20,610	26,479	112,588	220,555	5.5	11.5	56.5	85.3	47.5	14.7
	Cardigan - -	12,586	18,055	42,116	116,241	3.3	12.0	50.7	90.2	49.3	9.8
Total - -	95,137	133,933	498,068	1,270,727	5.2	11.8	50.6	85.4	49.4	14.6	
9	Cambridge - -	10,326	11,101	94,995	77,756	9.2	14.8	60.7	81.5	39.3	18.5
	Bedford - -	7,442	7,764	70,084	50,487	9.4	13.8	62.0	79.7	38.0	20.3
	Huntingdon - -	3,632	3,782	38,472	45,267	14.3	14.0	51.6	77.4	48.4	22.6
	Norfolk - -	26,640	27,357	223,089	245,977	8.4	14.3	65.0	85.0	35.0	15.0
	Suffolk - -	19,083	20,362	170,126	164,029	8.9	13.9	65.8	83.5	34.2	16.5
Total - -	67,123	70,366	596,766	583,516	9.0	14.2	63.2	83.0	36.8	17.0	
10	Middlesex - -	6,370	6,892	61,166	83,955	9.6	14.1	70.5	83.3	29.5	16.7
	Essex - -	27,396	28,576	263,454	325,260	9.6	14.0	67.3	82.4	32.7	17.6
	Bucks - -	21,711	22,108	210,554	229,235	9.3	13.1	70.5	82.1	29.5	17.9
	Hertford - -	12,453	12,280	117,863	142,615	9.5	14.5	68.0	83.0	32.0	17.0
Total - -	67,930	69,856	653,037	781,065	9.6	13.8	69.7	82.5	30.3	17.5	
11	Kent - -	25,550	24,087	237,907	252,575	9.3	13.7	64.7	78.9	35.3	21.1
	Surrey - -	16,224	20,110	167,011	227,747	10.0	14.4	69.3	81.5	30.7	18.5
	Sussex - -	30,929	41,815	385,366	473,063	9.4	14.2	68.6	81.0	31.4	19.0
Total - -	82,703	86,012	790,284	953,385	9.5	14.1	67.5	80.4	32.5	19.6	
12	Hants - -	31,064	33,151	264,490	365,636	8.5	13.3	67.5	84.2	32.5	15.8
	Oxford - -	13,225	14,454	109,077	151,416	8.2	13.9	64.5	82.4	35.5	17.6
	Berks - -	17,336	18,139	166,707	211,336	9.6	13.9	69.5	83.9	30.5	16.1
	Wilts - -	60,104	64,822	525,163	839,720	8.7	14.5	72.3	86.3	27.7	13.7
	I of Wight - -	7,009	7,332	54,191	74,668	7.4	13.3	69.9	86.2	30.1	13.8
Total - -	128,887	137,898	1,119,648	1,642,776	8.7	14.0	69.7	85.0	30.3	15.0	
13	Cornwall - -	51,762	54,104	298,653	446,913	5.0	11.9	65.5	81.6	34.5	18.4
	Devon - -	76,396	71,488	461,059	671,184	6.0	12.0	64.2	78.8	35.8	21.2
	Dorset - -	44,453	49,382	318,854	507,214	7.2	14.5	64.1	87.1	35.9	12.9
Total - -	172,611	174,974	1,078,566	1,625,311	6.2	12.6	64.6	82.0	35.4	18.0	
13A	Somerset - -	91,847	157,016	553,177	1,070,515	6.0	13.4	66.6	84.0	33.1	16.0
	Gloucester - -	33,945	32,833	277,023	292,355	8.2	14.3	65.0	68.4	35.0	31.6
Total - -	125,792	189,849	830,200	1,362,870	6.6	13.6	66.3	80.8	31.7	19.2	
Scotland - -	226,903	296,948	1,831,322	4,471,228	8.1	15.1	53.3	85.3	44.7	14.7	
England and Wales, Total - -	1,560,695	1,714,254	11,874,694	17,446,079	7.6	13.5	63.4	81.0	36.6	19.0	

Production and Distribution of Milk.

52139

FINAL REPORT
OF THE
COMMITTEE ON THE PRODUCTION
AND
DISTRIBUTION OF MILK.

Presented to both Houses of Parliament by Command of His Majesty.



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COMMITTEE

ON THE

PRODUCTION AND DISTRIBUTION OF MILK.

TO THE PRESIDENT OF THE BOARD OF AGRICULTURE AND FISHERIES.

I. POLICY AND WORK OF THE COMMITTEE.

1. *Appointment of the Committee.* This Committee was appointed on the instruction of the Cabinet in April, 1917, by the President of the Board of Agriculture and Fisheries (Lord Ernle) with the concurrence of the Food Controller (Lord Rhondda.).

2. *Terms of Reference.* The terms of reference of the Committee were as follows:—

“To report on the production and distribution of milk, including the consideration of the steps which should be taken:

- (i) to stimulate production;
- (ii) to conserve milk supplies during any period of excess;
- (iii) to provide for the special needs of children in urban centres;
- (iv) to effect economies in the cost of production and distribution;
- (v) to organise supplies by administrative action, so as to reach all sections of the community; and
- (vi) other kindred subjects.”

3. The main Committee have held in all 39 meetings, the first of which was held on the 21st May, 1917, and the last on the 22nd October, 1919, and have met representatives of all sides of the milk industry.* The Committee have, however, neither found it possible nor thought it desirable to do the whole of their work as one body, and, accordingly, Sub-Committees were set up to investigate special aspects of the problem, such as:—

- (1) Agricultural questions.
- (2) Labour in dairy farming.
- (3) Education in dairying.
- (4) Handling of milk.
- (5) Pasteurization.

87 meetings in all were held by the various Sub-Committees. The reports of those mentioned above will be found on pages 28-54 of the Appendix. Other reports have already been published. (C.D. 9095 and C.D. 315.)

4. *Changes in Membership of the Committee.* Since the Committee was set up two of the original members have resigned, *viz.*, Prof. T. B. Wood and Mr. J. O’Grady, M.P., Mr. J. F. Blackshaw, O.B.E., Mr. Wilfred Buckley, Mr. C. T. Cramp, Sir Douglas Newton, K.B.E., and Sir Beville Stanier, M.P., have been appointed members. On the appointment of Lord Astor as Parliamentary Secretary to the Ministry of Food, Col. W. E. G. A. Weigall, M.P., was appointed Deputy Chairman.

5. *Interim Reports.* The duties of the Committee have been two-fold:—

- (a) To advise as to measures for dealing with problems arising immediately out of war conditions;
- (b) To consider the general conditions of the dairying and milk distributing industries apart from the war, with a view to their being placed on a more satisfactory basis for the future.

6. The Committee’s 1st and 2nd Interim Reports (C.D. 8608 and C.D. 8886) issued respectively on the 8th June and the 30th November, 1917, dealt almost entirely with questions of immediate urgency, and were chiefly devoted to the problems of keeping up the supply of milk and providing for its equitable distribution in the winter of 1917. Various measures were recommended to and adopted by the Ministry of Food. Among these were the granting of priority in supply of feeding stuffs to dairy cattle, and the preserving of surplus supplies of summer milk in order to form a reserve for use in winter months. A priority scheme for the supply of milk was put forward by the Committee, as it was agreed that a scheme of rationing such as those which had been applied to certain other articles of food was impracticable in the case of milk.

7. In the 3rd Interim Report (C.D. 315) published in November, 1918, more attention was given to problems which, though not due only or mainly to war conditions, had nevertheless been disclosed and emphasised during the war, examples of such problems being the effect on dairy farming of the Corn Production Act, 1915, the desirability of the keeping of proper farm accounts, and the provision of further instruction for agriculturalists as to more modern and economical methods of feeding dairy cattle.

8. *Scope of Final Report.* The present and final report accordingly deals chiefly with matters affecting the milk industry and its development in the future, including both the period of post-war abnormal conditions which must continue for some time, and the subsequent period when the temporary effects of war will no longer operate.

II. PRESENT STATE OF THE MILK SUPPLY.

(a) PRODUCTION.

9. *Numbers of Dairy Stock during the War.*—During the war the numbers of dairy stock in the United Kingdom have shown a slight increase in spite of the lessened area under pasture and the diminished supplies

* For a list of the names of the witnesses interviewed, see Appendix, page 27.

of concentrated foods. The following table shows the numbers of cows and heifers in milk and in calf in Great Britain and the United Kingdom in June for the last eight years:—

Year.	Great Britain.	United Kingdom.
1912	2,784,389	4,400,816
1913	2,695,391	4,317,957
1914	2,937,923	4,595,128
1915	2,883,696	4,494,750
1916	2,870,458	4,499,321
1917	2,906,596	4,514,803
1918	3,030,255	4,603,841
1919	3,008,775	

10. *Changes in the Rate of Milk Production.*—While the above figures are important as indicating that the national dairy herd has increased in numbers, the Committee are aware that in spite of this increase there has been a decrease in the total quantity of milk produced, particularly in winter. The reasons for this decrease are given in para. 16

The principal materials at present available for estimating changes in the rate of milk production are:—

- (1) The Census of Production figures for 1908-9 in Great Britain.
- (2) The preliminary figures of the Irish Census 1912-13.
- (3) Ministry of Food Census figures for 1918.
- (4) Information obtained from the statistics of Milk Recording Societies and large commercial milk producers.

11. *Milk Production in Great Britain.*—The 1908-9 census for Great Britain gave a yield of 550 gallons per annum for each cow in milk, exclusive of milk used for calf-rearing. The corresponding figure given by the Ministry of Food Census for 1918 was 436 gallons.

The statistics obtained from Milk Recording Societies show for 1910-11 to 1914-15 a considerable increase in the yield. A large part of this was probably due to the selection of cows in the societies, but there appears to have been an increase also in the average yield. In the early years of the war, 1915-16, the figures show a decrease, which was accentuated in 1917 and 1918, owing to the shortage of feeding-stuffs and of skilled labour.

12. The evidence available suggests the following variations in the yield per cow in milk:—

	Gallons.	Index.
1908-9	550	100
1909-13	560	102
1914	575	105
1915	550	100
1916	525	95
1917	495	90
1918	436	80

The number of cows in milk remained substantially unaltered except for a temporary increase in 1915-1916. On the rates given above, the total annual production of milk in Great Britain, less milk used for calf-rearing, was approximately as follows:—

1909-13 (average)	1,231 million gallons.
1914	1,253 " "
1915	1,241 " "
1916	1,164 " "
1917	1,086 " "
1918	955 " "

13. *Milk Production in Ireland.*—Data supplied by the Irish Department for 1912-13 show an annual total yield of 414 gallons per cow. Irish production is characterised by summer dairying, so that it did not suffer so much from the shortage of concentrated feeding-stuffs, neither was the scarcity of skilled labour so marked. On the other hand, annual production was more liable to be affected by weather conditions in the summer months. In the absence of definite data, the rate of 414 gallons has been retained up to 1916. The year 1917, by common consent, was a very bad year for milk production in Ireland, and for that year the rate has been written down to 375 gallons, a reduction of 10 per cent. A further decrease in 1918 was indicated by reports from the Irish Department and by statistics of the export of dairy produce, into which a very large proportion of Irish milk is converted, and the rate for 1918 has been taken at 350 gallons.

Up to 1917 the numbers of the dairy herd remained very steady, and the decrease in 1918 was very slight. At the rates quoted above, the annual production, inclusive of milk fed to animals, was as follows:—

1909-13	664 million gallons.
1914	671 " "
1915	669 " "
1916	663 " "
1917	601 " "
1918	550 " "

14. *Milk Production in the United Kingdom.*—On the figures set out above the total yield for the United Kingdom may be estimated at:—

1909-13 (average)	1,895 million gallons.
1914	1,924 " "
1915	1,910 " "
1916	1,827 " "
1917	1,687 " "
1918	1,505 " "

* The figures of the Irish Census for 1919 are not yet complete.

15. *Seasonal variation of yield.*—The index given below indicates the monthly variation in percentages, according to the daily average, of the total milk supply during the years 1917-18. It has been calculated from returns of production from various sources, and takes account of the seasonal variation in calving:—

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
5.9	6.0	6.9	8.1	10.8	11.8	10.3	9.8	9.1	8.3	7.1	5.9 = 100.0

16. The decrease in output shown by the tables in paragraphs 12, 13 and 14 may be attributed to three main causes:—

- (a) the scarcity and high price of feeding stuffs;
- (b) the deterioration in the quality of cakes and meals;
- (c) the lessened efficiency of milkers.

These factors exercise the greatest influence during the winter. In addition, it is probable that the proportion of cows in milk during the winter has been less than under pre-war conditions. Although the total number of cows shows an increase, there is evidence to show that the numbers have been considerably reduced in districts and on farms which formerly specialised in winter milk production. In these districts the production of milk was largely dependent on purchased concentrates and soiling crops, hence the cost of production has risen much more than in districts where retentive soils and pastures and a moister climate reduce the use of soiling crops and purchased foods to a minimum.

(b) CONSUMPTION.

17. *Importance of Milk as Food*—The Committee have already put on record their opinion that the average consumption of milk in the United Kingdom is much lower than is desirable in the national interest.* Milk contains all the nutritive constituents required by the body—protein, fats, and carbohydrates—in a readily assimilable form, which makes it a valuable food for all classes of the community and especially for children. For infants who may have to depend on artificial feeding it is essential. Milk ought, therefore, to be available in greater quantities than are obtainable at present.

18. *Growth-promoting Substances.*—In addition to the above-mentioned constituents, milk has been shown to possess special properties which promote growth, and are necessary for maintaining the body in a healthy condition. These qualities of milk were first made known by Professor F. Gowland Hopkins at Cambridge, and have since been the subject of research by numerous investigators, notably Professors T. B. Osborne, and L. B. Mendel of Yale University, and Professor E. V. McCollum of the Johns Hopkins University. The exact nature and composition of these growth-promoting substances, or vitamins, as they are provisionally termed, is at present unknown, but their existence is inferred from the effects produced in respect of growth and health by feeding animals on special and carefully controlled diets.

The investigations into this subject so far as they have proceeded at present indicate the existence of at least three growth-promoting substances or vitamins, all of which are present in milk. These have been termed:—

- (i) The ricket preventing vitamin (or fat soluble A), which is necessary to promote growth and to prevent rickets in young animals.† The fat of cream and butter are amongst the richest known sources of this vitamin.
- (ii) The anti-neuritic vitamin (or water soluble B growth substance of American investigators), which is also necessary to promote growth, and in addition is essential to prevent the occurrence of the disease known as beri-beri. This vitamin is found in the germ and in the bran or outer layers of certain grains and in milk, but not in association with the fat of the milk.
- (iii) The scurvy-preventing vitamin, which is essential to prevent the disease known as scurvy. This vitamin is found in fresh untreated cows' milk and in fresh fruits and vegetables in quantities suitable for the satisfactory nutrition of the young.

There is no evidence that the heating of milk destroys to any serious extent the vitamins described in (i) and (ii) above. The scurvy-preventing vitamin (paragraph (iii) above) is, however, sensitive to exposure to heat or to drying, and pasteurised, boiled, dried, or condensed milk may be regarded as inferior in varying degrees to raw milk in scurvy-preventing properties. When milk prepared in these ways is utilised for the feeding of infants over long periods, it is desirable to supplement its scurvy-preventing properties by the addition to the diet of small quantities of vegetable or raw fruit juices, preferably orange juice, which is very rich in this particular vitamin. The very great difficulty of procuring clean milk in this country, and the risk of infection with tuberculosis and other diseases from the use of raw milk, have frequently led to the use of pasteurised, sterilised, dried, or condensed milk for infant feeding.

Skimmed or separated milk is deficient in the ricket-preventing vitamin, and the development of rickets may follow from its extended use in the feeding of young children unless the deficiency is made good by the addition of cream or cod liver oil.

19. Attention may here be called to the inferiority in this respect of margarine to butter as a source of fat in the diet, especially of growing children. Margarine is usually manufactured largely from vegetable oils; these are deficient in the anti-rachitic vitamin, which is characteristic of many animal fats, and the nutritive value of margarine made from such oils is, therefore, inferior, especially for children.

20. Although vegetable oils and fats are generally deficient in the ricket-preventing vitamin, which is also essential for growth, yet the green parts of plants are the chief ultimate source of this vitamin; for, as far as is at present known, animals are unable to build up this or any vitamin within their own bodies, but obtain them directly or indirectly from the vegetable kingdom. For this reason the diet of cows, especially of those whose milk is to be used for infant feeding, should itself contain an abundance of all the

* 1st Interim Report (Cd. 8608), page 1, and 3rd Interim Report (Cd. 315), page 12

† E. Mellanby, Journ. Physiol. (Proceedings) 52, 11 and 12, 1918. *Lancet*, March 15th, 1919.

necessary growth-promoting substances. The green parts of plants contain all the above vitamins in abundance, and there is evidence* showing that the milk given by cows in the summer, when the diet consists of fresh green pasture, is richer in vitamins than in the winter, when the chief foods are hay, straw, roots and concentrates.

21. *Present-day Average Consumption.*—That enough liquid milk is not consumed is shown by the returns in the following table obtained in January, 1918, through Local Food Control Committees:—

<i>Food Division Area.</i>	<i>Consumption per head per day.†</i>
1. Northern	0·19 pts. liquid milk.
2. North Eastern	0·22 " " "
3. Home Counties (S)	0·29 " " "
4. " " (N)	0·27 " " "
5. Eastern	0·18 " " "
6. North Western	0·27 " " "
7. London	0·31 " " "
8. South Western	0·28 " " "
9. South Midlands	0·27 " " "
10. Midlands	0·24 " " "
11. North Midlands	0·23 " " "
12. North Wales	0·20 " " "
13. South Wales	0·16 " " "
<i>Scotland.</i>	
Edinburgh	0·22 " " "
Glasgow	0·25 " " "
Inverness	0·10 " " "
Average per head per day for Great Britain	0·25 pts. liquid milk.

22. From the above table it will be seen that the consumption of milk per head per day in Great Britain varied in January, 1918, from $\frac{1}{10}$ of a pint in Inverness to $\frac{1}{4}$ of a pint in London; the average for the country was $\frac{1}{4}$ pint per head per day. Working-class consumption has been put by the Board of Trade‡ at 1·8 pints per head per week, which also works out to $\frac{1}{4}$ pint per head per day. This is less than half the normal average consumption of the City of New York. Consumption in Great Britain is uneven and varies, according to the available returns in the large towns, from '63 pints per head per day in Hornsey to '08 pints per head per day in Dudley, and in the smaller towns from '67 pints per head per day in Winchester to '06 pints per head per day in Llanelly. Though there must be some uncertainty attached to the returns of retail sales on which these figures, particularly those relating to rural and small urban areas, are based, it is clear that the average daily consumption of milk throughout Great Britain is much lower than is desirable.

23. *Production and Priority Requirements.*—The diagram on the opposite page shows in block form the requirements of the various classes of the population under the priority scheme put forward in the Second Interim Report (Cd. 8886),§ together with curves of the total supply of liquid milk available, and the supply available for consumption as liquid milk.

It will be seen that if children up to 6 years of age had taken the full quantities necessary to them no milk would have been available for use by adults in the months of November, December, January, and February, and the supply would not even have sufficed for the children of 6 to 14 years of age. In practice, unfortunately, children do not get enough milk. In many industrial centres there are known to be whole streets where no fresh milk is taken.

24. *Milk Supply in Rural Districts.*—The position of the rural inhabitant requires special mention. It is often more difficult for people living in the country to obtain milk than it would be if they were living in cities. This is mainly due to the fact that it is easier for farmers to sell the whole of their milk output to one large contractor than to retail it themselves over a scattered population. This difficulty could be avoided by an arrangement whereby the local consumers would register themselves with the village shop-keeper, who would buy the necessary number of gallons of milk from the farmer and retail it as required. Such a scheme is in successful operation in several villages in England, and obviates the objection of the farmer to the sale of milk in small quantities at the farm itself, while it ensures that fresh milk shall be available for all those who have taken the trouble to register their requirements. The extension of the keeping of goats would also do much to provide a supply of milk for rural areas. Goats can support themselves on the roughest grass, are easily tethered and kept, and are quite hardy. Many small-holders in certain districts on the Continent get all their milk from goats kept in small sheds and fed on wayside strips of grass.||

* Barnes and Hume, *Lancet*, August 23rd, 1919.

† The actual consumption per head would be slightly above the figures given, as milk produced and consumed on farms, etc, does not appear in the returns, whereas the figures include the rural population. This error would be most marked in preponderantly rural areas. The London figures are approximately correct.

‡ Report of another Enquiry by the Board of Trade into Working Class Rents and Retail Prices, together with the Rates of Wages in Certain Occupations. (Cd. 6955.) 1913.

§ *Group 1.*—(a) Children from birth to 9 months to receive not more than 1½ pints a day under a medical certificate, stating that the infant cannot be breast fed or can only be partially breast fed.

(b) Children from 10 to 18 months 1½ pints a day.

(c) Milk on a medical certificate.

Group 2.—Children 19 months to 5 years 1 pint per day.

Group 3.—Children from 6 to 14 years 1 pint per day.

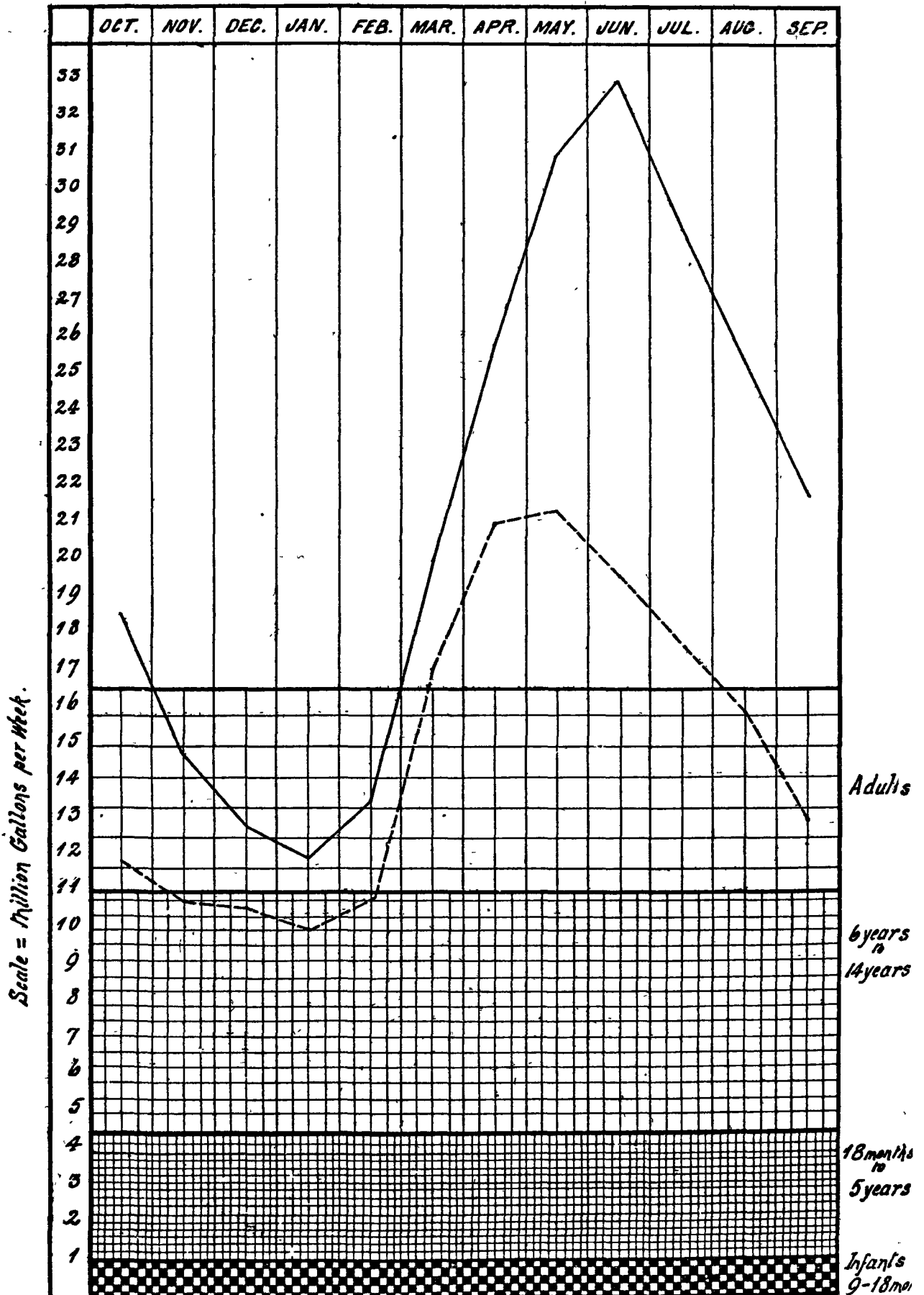
Group 4.—All other persons ½ pint per day, or according to supplies available.

|| For Report of Sub-Committee on Goats, see page 17 of 3rd Interim Report. (Cd. 315.)

ESTIMATES OF SUPPLIES & REQUIREMENTS FOR GREAT BRITAIN 27

= Weekly production of milk for all purposes.
 = Weekly consumption of liquid milk.

The horizontal blocks represent the total amounts which the committee estimated each age group ought to get.



25. *Growth of Human and Cow Populations and of Imports of Dairy Produce.*—As may be seen from the following table, the production of milk in Great Britain in recent years has not kept pace with the increase in the human population, nor with the demand by the latter for milk products.

	1871.	1914.	Increase per cent.
Population	26,100,000	41,700,000	60
Number of cows and heifers ...	2,091,000	2,937,000	40
Weight of cheese imported (cwts.) ...	1,216,400	2,373,091	95
" " butter imported (cwts) ...	1,334,783*	3,882,116	304
" " margarine imported (cwts.) ...		1,501,520	
" " condensed milk imported (cwts.) ...	352,332†	771,239	128
" " dried milk imported (cwts.) ...	(1888)	30,601	(since 1888)
Total weight of dairy produce imported (cwts.)	2,551,200	8,558,567	235

An increase in the human population since 1871 of 60 per cent., with an increase in the number of cows and heifers of only 40 per cent., as compared with an increase in the weight of imported dairy products of 235 per cent., cannot be considered satisfactory. The increased importation of condensed and dried milk should be particularly noted.

26. *Value of Imported Dairy Products.*—The value of dairy products imported into the United Kingdom has risen steadily for the last 50 years, until in 1914 it had reached a total of £38,000,000. Of this total, over £27,000,000 was paid to Denmark and Russia for butter, and to Holland for margarine, cheese and condensed milk, while the balance (something over £10,000,000) was paid to Australia and New Zealand for butter, and to Canada and New Zealand for cheese.

27. *Comparison of British and Continental Dairy Farming.*—Holland and Denmark have no natural advantages of climate or soil which are not possessed to an even greater degree by large sections of the United Kingdom, which also offers to the British dairy farmer the advantage of proximity of markets.

28. A table given below shows the density of population, numbers of live stock per 100 acres of cultivated land and proportion of permanent grass land to the total cultivated area in the United Kingdom and in the more progressive European countries.

Table showing proportion of permanent grass land, density of population and number of livestock per 100 acres of cultivated land in the United Kingdom and other European countries.

Country	Total Cultivated Area.	Permanent Grass.		Density of Population.		Number of Live Stock per 100 Acres Cultivated.						
		Total Area	Percentage of Total Cultivated Area.	Per Square Mile.	Per 100 Acres Cultivated.	Total Cattle	Dairy Cows	Other Cattle.	Pigs	Sheep.	Horses	Goats
Belgium	Acres 4,472,382	Acres. 1,223,979	Per cent. 27.3	658	167.7	40.9	20.9	20.0	30.1	—†	5.8	—†
Holland	5,343,452	2,996,291	56.7	479	112.7	33.1	20.1	18.0	23.7	16.7	6.1	4.1
Denmark	6,910,922	778,106	11.2	180	40.5	32.5	18.5	14.0	21.2	10.5	7.7	5
Sweden	12,252,566	3,224,901	26.3	32	45.0	21.9	15.0	6.9	7.7	7.7	4.8	5
Switzerland	5,503,160	—	—	243	69.0	26.2	14.5	11.7	10.3	2.9	2.6	6.6
Germany	78,632,139*	19,463,884†	24.7	311	82.6	24.5	12.7	11.8	26.6	7.0	5.7	4.3
Ireland	14,673,778	9,685,227	66.0	135	29.8	33.0	10.8	22.2	9.0	26.6	3.7	—
United Kingdom	46,669,802	27,020,948	57.8	381	97.0	25.4	9.4	16.0	8.5	61.8§	4.2	—
Scotland	4,821,334	1,496,307	31.0	156	98.3	24.5	9.0	15.5	3.3	145.2§	4.0	—
England and Wales	27,174,690	15,839,414	58.2	633	135.8	21.4	8.6	12.8	9.1	66.4§	4.5	—
France	90,369,368	24,938,627	27.5	193	44.2	16.2	8.6	7.6	7.6	18.0	3.5	1.5

* Excluding rough grazing.

† Including rough grazing.

‡ Not enumerated since 1895.

§ Sheep kept on mountain land not classed as cultivated are included in these figures.

England and Wales, though almost as densely populated as Belgium, had in 1912 some 58 per cent. of the total cultivated area under permanent grass and maintained 8.6 cows per 100 acres as compared with Belgium's 27.3 per cent. of permanent grass and 20.9 cows per 100 acres. Holland alone showed a percentage (56.7) of permanent pasture approaching that of England and Wales, and Holland maintained 20.1 cows per 100 acres. Denmark, with a comparatively sparse population, but with easy access to British and German markets, maintained 18.5 cows per 100 acres with only 11.2 per cent. of permanent grass land. The outstanding feature of this comparison is the greater attention given to dairying as indicated by the greater proportion of cows kept in all these countries (with the exception of France) than in the United Kingdom.

There seems no good reason why the United Kingdom should have per 100 acres only (i) 45 per cent. cows as compared with Belgium, (ii) 47 per cent. compared with Holland, (iii) 51 per cent. compared with Denmark, (iv) 62 per cent. compared with Sweden, (v) 65 per cent. compared with Switzerland, and (vi) 74 per cent. compared with Germany.

29. The reasons for the relative importance of dairying probably differ from country to country. In Holland, and to a lesser degree in Switzerland, the possession of suitable grass land and of breeds of stock of great dairy capacity has made the development of a great dairy industry natural and easy. In Denmark, on the other hand, previous to the Prussian War of 1864, the chief type of farming was corn-growing, and in the subsequent period of reconstruction, when the financial position of the country necessitated the utmost economy and the best use of the land, dairying, associated with bacon production, gradually came to be recognised as the most reliable and profitable branch of farming.

* No separate statistics for butter and margarine before 1888.

† No separate statistics for condensed or dried milk in 1888.

30. *Value of the Cow as a Producer of Human Food.*—In addition, however, to particular reasons in individual countries there has undoubtedly been a widespread recognition on the Continent of the great value of the dairy cow as a producer of human food. As land, labour, and feeding stuffs have increased in price, the dairy cow has more and more displaced the strictly meat-producing farm animals as an economical agent for the conversion into human food of those field crops which are not suitable for direct human consumption. The relative economy of the different classes of farm animals for this purpose received but little study in this country before 1916, and the position of the cow in such a comparison is not yet generally realised.

31. In a recent Report* it is stated that:—

“Considerable economy in fodder can be effected by varying the kind of animal to which it is fed.

All animals are by no means equally good ‘converters,’ as is shown by the following figures:—

Lb. starch equivalent in fodder required to produce 1,000 calories in the form of—							
2.9	...	...	...	...	...	...	Milk from good cow (800 gallons).
3.0	...	...	...	...	...	...	Pig meat.
4.7	...	...	...	...	...	...	Veal.
4.7	..	.	..	..	..	..	Milk from bad cow (300 gallons).
5.3	..	.	..	..	..	..	Mutton.
7.0	..	.	..	..	..	..	Eggs.
7.0	..	.	..	..	..	..	‘Baby’ beef.
9.0	..	.	..	..	..	..	‘Steer’ beef.

These figures justify the agricultural policy of most Continental countries which rely on dairy products, pig meat and veal, for a very large proportion of their supply of animal food. A given supply of fodder is capable of producing a far greater amount of protein and calories in these forms than if it is used to a very large extent, as in Great Britain, for the production of mutton and beef.”

Much might be written in qualification of these figures, such as the dependence of the pig on foods which are suitable for direct human consumption, the importance of the sheep as a source of wool and as a factor in the successful cropping of light arable land, and the greater labour required by cows, but in spite of all possible qualifications it is indisputable that a good cow surpasses all other farm animals in ability to convert the crops of the field into human food. Further, the supplies of human food from the pig, steer, and sheep are obtained only after these animals are killed, whereas the cow produces more human food from the same amount of fodder while alive, and still has a food value when killed.

32. *Some Reasons for the Slow Development of Dairying in Great Britain.*—Other factors which have contributed greatly to the development of dairying and associated branches of farming on the Continent are (1) the national system of education, including technical education and research in dairying, (2) co-operation, (3) peasant occupancy, (4) systems of credit for farmers, (5) State assistance.

The important part played by these various agencies in the development of Continental dairying which has taken place during the last 50 years has been described fully in numerous reports issued from time to time in this country. It is, therefore, unnecessary to discuss the subject further here. For a variety of reasons the factors which made for the development of dairying on the Continent did not operate to the same extent in Great Britain. From 1870 onwards, although the population of this country increased rapidly, there was not a corresponding increase in the production of milk and dairy products. Milk production did increase to a certain extent, and this may be taken as a recognition of the importance of the dairy cow as a producer of food, but this increase, as indicated in the table in paragraph 25, fell very far short of meeting the national requirements in respect of dairy products.

The system of tenancy instead of ownership must bear a share of the responsibility for the slow and inadequate development of dairying in Great Britain. During the agricultural depression of the eighties and nineties, when tenant farmers were threatened with ruin, landlords reduced rents to enable their tenants to carry on, but these reduced agricultural rents impoverished the landowners, and rendered many of them unable to assist in transforming buildings on grain-growing farms or in erecting new buildings for the purposes of dairying. The slow development of co-operation amongst farmers in this country also hindered the development of British dairying. Further, the defective system of agricultural and dairying education, and the almost total neglect of research in dairying subjects have severely handicapped the British farmer. His competitors in other countries have had scientific discoveries of great value brought to their knowledge years before similar information was made available in this country. Lastly, a large share of the responsibility must be attributed to the lack of any constructive Government policy.

The Committee, while fully realising the essential difference in national temperament between the population of the United Kingdom and the populations of Continental countries, are convinced that the dairying industry here would be greatly benefited by the adoption, with whatever modifications may be thought necessary, of methods which have brought about excellent results in other countries, and they make recommendations accordingly in later sections of this Report.

III.—RELATION BETWEEN PRICE AND CONSUMPTION.

33. *Variation in Supply and Price in Winter and Summer.*—During the war the increase in the cost of production of milk, and consequently in the cost to the consumer, has been so great that the consumption is unlikely to be higher than in pre-war times, and during the winter is probably considerably lower. Changing war conditions have caused successive Food Controllers to make more frequent alterations in the prices of milk than were previously brought about by ordinary commercial influences. In pre-war days the farmer made yearly or half-yearly contracts, winter prices being from 2d. to 3d. per gallon above those ruling in the summer. It was not contended that this variation represented the difference in the cost of production between the two periods, in fact, the difference in cost was as a rule considerably more than 2d. per gallon, but the stability of the cost of labour, imported feeding stuffs, &c., was such that many farmers were content to produce milk in winter at little or no profit, with the knowledge that during the summer there would be a satisfactory margin. At the same time, the price to the consumer, and consequently the consumption, remained practically uniform in winter and summer.

* The Food Supply of the United Kingdom. Report drawn up by a Committee of the Royal Society at the request of the Board of Trade. (9725) 1916.

34. The Committee adhere to the opinion expressed in the 2nd and 3rd Interim Report* that it would be in the ultimate interest of the consumer, if it were to become the recognised practice to charge a higher price for milk in winter when the cost of production is high than that charged in summer when the cost of production is low. They believe that this would assist in the provision of an adequate supply of winter milk, though such a fluctuation in price would, at least so long as high prices continue to rule, probably lead to variation in the consumption.

35. When the prices of feeding stuffs of all kinds rose rapidly during the war, the normal difference between winter and summer costs of production was accentuated. In order to safeguard the supply of winter milk, a much greater increase in price was necessary for that period than for the summer, consequently the price to the consumer instead of remaining uniform in winter and summer varied with the cost of production. This change in price has necessarily resulted in a greater variation in the consumption than was formerly the case.

36. The Committee believe that conflicting interests of producers and consumers in relation to supply can be co-ordinated by the intervention of an intermediary. This intermediary may be either the farmers' own depôt or factory, run on co-operative or other lines, or the large companies which are at present in existence, or the work might be undertaken by some public body.

37. *Growth of Wholesale Trade.*—One of the greatest changes which have taken place in the dairy industry in the course of the war has been the increase in the quantity of milk sold for human consumption which has passed through the hands of the wholesale companies. The following figures give some indication of the extent of this change.—

1918.	Gals.	1919.	Gals.
April	20,980,996	April	24,726,505
May	27,626,911	May	32,880,785
June	28,264,901	June	30,300,027
July	25,775,083	July	32,141,379
August	25,722,331	August	32,954,082

No figures with regard to the period before April, 1918, are available.

38. The chief reasons which have brought about this marked increase have been—

- (1) the increased reluctance on the part of farmers to undertake the delivery of milk, and the readiness on the part of numerous wholesale companies to collect milk from the farmer's premises;
- (2) the fixing by the Ministry of Food of a definite margin, including a satisfactory profit, for the services rendered by the wholesaler;
- (3) the organisation, in districts where milk was not previously available for human consumption, of wholesale companies for the collection and treatment of milk and for its transportation to large centres of population.

39. *Price—Relation to Dairy Produce.*—An unduly high price for milk is prejudicial to the future of the dairy industry, for in addition to reducing, or at least preventing, any increase in consumption it must make it well-nigh impossible to increase or even to continue the home manufacture of dairy products. Condensed milk, dried milk, butter and cheese manufactured in this country, when the control of price has ceased, must be sold in competition with similar products imported from abroad.

40. At the present time, there is no competition between home-made and imported cheese as the Ministry of Food controls the price and distribution. There is, however, no such control in respect of condensed and dried milk. As the cost of raw milk, and therefore of the products made from it, is considerably less in Norway, parts of North America, New Zealand and Australia, it will be possible, when greater shipping and other facilities are available, for these products to be placed on the British market at a much lower price than similar products manufactured in this country. It is conceivable that imported condensed or dried milk may be offered at such a low price as to compete with liquid milk more acutely than has hitherto been possible. The British farmer has always considered that he was safe from foreign competition as regards liquid milk. Should the cost of milk remain at or near its present level for any considerable time, consumers will increase their purchases of condensed and preserved milk, reducing at the same time their purchases of British liquid milk. No effort or expense has been or is being spared to advertise the different forms of preserved milk. In addition, the ease with which small quantities can be obtained and kept in good condition, and the freedom from the necessity of cleaning utensils and receptacles make these preserved imported milks attractive to the average householder.

IV.—NECESSITY FOR LOWERING THE COST OF PRODUCTION OF MILK.

41. The Committee believe that the immediate and earnest attention of British dairy farmers should be directed towards improving methods of production in order that the cost of milk may be reduced, and consumption not only maintained but also increased.

42. *Variation in Cost of Milk Production.*—The extent of the variation in the cost of milk production throughout Great Britain is seldom realised. Returns from 43 farms collected and analysed by the Food Production Department in 1917 showed a variation in the net costs for the winter of 1916-17 (excluding cost of delivery) of 10d. per gallon. On six farms the cost was less than 10d. per gallon, and on six others it was over 20d. per gallon. These figures show a variation of more than 100 per cent. The increase in the prices of purchased foods since 1916-17 and the variation in the quantities used on farms following different systems of management must have increased the difference in the cost of production.

It is obvious that so long as a maximum price proves to be practically a fixed price which yields a fair profit to a large proportion of producers, the interest of these producers in more economical methods of production cannot be effectively stimulated for the reason that cheaper production will tend to lower maximum prices.

43. *British Cheesemaking.*—Reference has been made to the control of the price and distribution of cheese by the Ministry of Food. When the fixing of prices for milk was first undertaken, the relationship between the price of milk and the price of cheese was the subject of careful consideration. Under pre-war conditions, if the price per lb. which the farmer obtained for his cheese was the same as the price per gallon

* Cd. 8886, §. 17. Cd 315, §. 19.

of milk, there was little complaint; it was the custom then for the sender to pay the railway carriage, which was on the average 1*d.* per gallon, thus giving in fact a margin of 1*d.* in favour of cheesemaking. The sender does not now pay the railway carriage, but owing to the increased cost of manufacture and the difficulty of utilising whey profitably a margin of 2*d.* per gallon is necessary, that is to say, the price per lb. received for cheese should be 2*d.* above the price per gallon of milk. It is on this basis that the price for hard-pressed whole milk cheese was fixed for the months of May to September, 1919, inclusive, the average price being approximately 1*s.* 8½*d.* per lb. for first grade cheese. During the period of control the Ministry of Food, by pooling the less costly imported cheese with that produced in this country, has been able to make arrangements whereby British-made cheese is sold retail at a price lower than that paid to the maker.

In the future when the control and pooling of home-produced and imported supplies cease, the British cheesemaker cannot expect to receive prices on the level of those of 1918-19. There are indications, however, that the world's output of cheese for some years to come will not be equal to the total demand, and therefore the cheesemakers of this country should find a ready sale for their produce. The choicest qualities of the well-known English varieties have always commanded satisfactory prices, and will continue to do so, but ignorant or slovenly cheesemakers who offer a second or third grade product must expect keen foreign competition. All possible assistance by means of education and research should be provided so that the proportion of British cheese of the highest grade may be increased, and the home manufacturer thus enabled to obtain more remunerative prices.

44. *Effect of Guaranteed Prices for Cereals on the Price of Milk.*—The policy of guaranteeing prices for other farm products must affect the price of milk and milk products. In the past, farmers were content with a small profit on dairying, as this branch of farming was secure against foreign competition. Now, however, that farmers are guaranteed against serious loss in wheat production their whole outlook is altered. A guaranteed price giving reasonable assurance of some profit on one kind of farm produce tends to make farmers demand a higher profit on other produce, the price of which is not guaranteed. If the State guarantees to farmers remunerative prices for wheat, or even guarantees them against serious loss, farmers will require a larger profit than in the past on milk production, which is in many ways more troublesome. Failing this they will, so far as circumstances allow, tend to take up the production of grain and meat, and to reduce their output of milk and dairy produce.

It is pointed out in another part of this Report (page 22) that increased grain production may be brought about simultaneously with the maintenance or even the increase of milk production, but it must be remembered that if a farmer is reasonably assured of a satisfactory profit on grain, he may prefer, because of the lessened labour and worry involved, to utilise his roots and straw and to provide manure for his land by keeping cattle and sheep instead of dairy cows.

V. PRESENT STATE OF THE MILK SUPPLY—QUALITY AND CLEANLINESS.

45. *Present Regulations as to Quality of Milk.*—Not only is the amount of milk consumed in Great Britain much lower than is desirable, but it is known that the quality as regards cleanliness has been and is gravely defective. The regulations at present in force with regard to the quality of milk refer solely to the composition of the milk, and have nothing to do with its cleanliness, wholesomeness, or purity. They were issued by the Board of Agriculture in 1901 and 1912 under powers conferred by Section 4 of the Sales of Food and Drugs Act, 1899.

Certain powers relating to cleanliness and freedom from disease have been provided by means of the Dairies, Cowsheds, and Milkshops Orders issued by the Privy Council, and later by the Local Government Board under the Diseases of Animals Acts and by Section 4 of the Infectious Diseases (Prevention) Act, 1890. These measures have, however, been found to be largely ineffective, and the Milk and Dairies Act, 1914, and the Milk and Dairies (Scotland) Act were passed with a view to providing better means for regulating these matters. These Acts were, however, suspended until after the termination of the war. In the meantime the drafting of the Regulations which will have to be issued has revealed the need for amendments to the Act in several respects, and it was announced in the House of Commons on July 2nd, 1919, that the Departments concerned were considering the question of the necessary amendments. This action has been taken also as a result of the experience gained during the war by the Ministry of Food and the Ministry of Health.

46. *Lack of Cleanliness.*—Such examinations of the bacterial content of milk as have been undertaken in this country have indicated the unsatisfactory nature of the supply. In some cities in the United States, where it is the practice to judge of the cleanliness of milk by the number of bacteria which it contains, no raw milk with more than 30,000 bacteria per cubic centimetre is permitted by the Health Authorities to be sold for human consumption. In 1916-17 Professor Délépine investigated samples of milk delivered to Manchester Hospitals. Out of 30 samples, 64 per cent. contained over 1,000,000 bacteria per cubic centimetre. Under the standard obtaining in the City of New York this 64 per cent., some of which had probably been artificially treated by heat in order to reduce the bacterial growth, could only have been used for cooking and manufacturing purposes. Its sale for consumption by children would have been prohibited.

47. An examination made for the National Clean Milk Society by the Lister Institute, of milk supplied to 21 London hospitals also showed the bacterial content to be excessive, as many as 250,000,000 bacteria per cubic centimetre having been found in one sample. In the Appendix (page 77) will be found a table showing the excessive bacterial content of some of the milk supplied to mothers attending Infant Welfare Centres in London.

48 These bacterial counts do not necessarily mean that the milk contained disease germs, but they indicate a marked deterioration due to dirt, or to its being stale, or not having been kept properly cooled. Contamination of milk takes place partly at the farm, partly on the railways, where milk is often handled with extreme negligence, partly while in the hands of wholesalers and retailers, and again in insanitary houses and tenements after delivery. Detailed recommendations as to the care of milk at all stages,

will be found in the Report of the Sub-Committee on the Handling of Milk (Appendix IV, pp. 31-39). Milk with a high bacterial count containing no disease germs is not necessarily harmful to adults, but such milk, especially if taken in large quantities, may seriously affect the sensitive digestive organs of children. Milk as it comes from a healthy cow contains a negligible quantity of bacteria. It should be the endeavour of the responsible health authorities to see that milk supplied to children is as near as possible to its original condition when drawn from the clean udder of a healthy cow.

49. It has been represented to the Committee that the existing Regulations with regard to the chemical composition of milk require revision. The Committee have already drawn the attention of the Government Departments concerned to the anomalies in the existing Regulations, and they again urge that this subject should receive immediate attention.

VI.—POLICY OF THE FUTURE.

50. In the foregoing paragraphs an attempt has been made to refer to some of the more unsatisfactory conditions of the milk industry in this country, and to show that an increased consumption and production of better and cheaper milk are urgently needed. The Committee are aware, however, that this cannot be accomplished hurriedly, and that real progress will only be made by such methods as will command sympathy and co-operation from both producers and consumers. The initial steps should be such as will meet with the approval of the majority of progressive farmers, and encourage the production of milk. At the same time, measures must be taken to add to the knowledge of the consumer as to the value of milk as a food and thus lead to an increased demand. The aims of an enlightened milk policy should be.—

- (a) To bring about the utmost possible economy in production in order that:—
 - (i) prices may be kept at as low a level as possible to the consumer, and consumption thus increased to the desired standard;
 - (ii) an adequate supply may be brought within the reach of the poorest families.
- (b) To improve the hygienic quality of milk, and to ensure that that portion of the supply which requires or is subjected to pasteurisation is efficiently pasteurised under supervision.
- (c) To increase the total supply in order to meet the extended consumption that should follow improved quality and the education of the public with regard to the nutritive properties of milk.
- (d) To prevent the exploitation of the producer or the consumer by any trust or combination, either of a provincial, national, or international character.

VII.—STEPS TO BE TAKEN TO REDUCE COST OF PRODUCTION.

51. The Committee are of the opinion that dairy farmers should take steps to lessen the cost of production in order that milk may be obtainable at a lower price. The Committee have devoted much time to the consideration of this matter. In their opinion the necessary work cannot be completed at once or by any single action, but they consider that much may be done within a reasonable time if farmers respond with intelligence and goodwill and if adequate assistance is given by the Government.

The cost of milk can be lessened:—

- (1) by reorganising the system of herd management in order to:—
 - (i) reduce loss when high-priced dairy cows are sold for slaughter;
 - (ii) lengthen the milking period of the best cows;
 - (iii) obtain a better distribution of the dates of calving;
 - (iv) reduce as far as possible dependence on purchased foods;
- (2) by improving the milking capacity of dairy stock so as to increase the average yield, and thus diminish the cost of production per gallon;
- (3) by more economical and methodical feeding;
- (4) by the introduction of labour-aiding machinery and equipment, and by a gradual improvement in the arrangement of farm buildings;
- (5) by more businesslike methods of account keeping;
- (6) by greater cleanliness in the production and handling of milk so as to reduce the present waste and loss of milk through souring;
- (7) by the extension of co-operative methods in the purchase of feeding-stuffs and manures, particularly on the part of small farmers;
- (8) by the State provision of veterinary help so as to reduce the present heavy loss to dairy farmers through contagious abortion, tuberculosis, and other preventable diseases.

A further reduction in the cost can be brought about by better organisation of the collection, transport, and distribution of milk.

52. *Re-organisation of Herd Management.—The Town Dairy.*—The management of a herd includes the method of maintaining the herd, whether by breeding or purchase, and if by purchase, the period over which the cows are kept, *i.e.*, whether permanently or for the lactation period only. It also includes the regulation of the time of calving, whether with a view to the production of the maximum amount of milk during the summer or to the maintenance of a uniform output throughout the year. The general study of the cost of production throughout the country, which has become necessary during the period of control of prices, has brought out the fact that there are large cities and industrial districts which are to a great extent dependent for their milk supply on herds kept actually in the towns and managed on a system which involves the replacement of from 75 to 100 per cent. of the cows annually. This leads to very heavy annual depreciation, and so to an increase in the cost of milk production. As concentrated foods are freely used in an attempt to fatten the cows during the latter portion of the milking period, this cost is further increased. The contrast between the above-mentioned system of herd management and that which obtains in the traditional dairy districts of the country is very great. In the latter only from $\frac{1}{3}$ to $\frac{1}{4}$ of the herd is changed annually, and the numbers are kept up almost entirely by home-bred stock. Each farm supplies a proportion of home-grown foods, and the production of milk is much less dependent on imported feeding-stuffs. The abandonment or modification of the system of management followed in "town dairies" and in many suburban and industrial districts would lead to the production of cheaper milk.

53. In addition to the re-organisation of herd management on the large scale described above, there is undoubtedly great need for a closer study of detail on the part of individual farmers. The information contained in the chart on page 81 of the Appendix shows, for instance, the difference in the yields of cows of different ages.

54. *Improvement in Dairy Stock. Increasing Yield of Dairy Cows.*—Probably the greatest economy in the production of milk can be effected by increasing the yield of individual cows. If the average yield per cow in the United Kingdom could be increased by $\frac{1}{10}$ of a gallon per day, the cost of milk at present prices would automatically fall about 2d. per gallon without affecting the profit made by the farmer. The following results obtained on two farms following practically the same system and in the same district illustrate how production can be cheapened:—

	Farm A.	Farm B.
Average number of cows in milk	53	51
Total cost of food per year	£794 15s. 0d.	£774 17s. 3d.
Higher cost of food on Farm A	£19 17s. 9d.	
Total milk produced	46,221 gallons.	36,033 gallons.
Higher milk yield on Farm A	10,188 "	
Cost of food per gallon on Farm A	Winter 1913-14, 5 12d.	
Cost of food per gallon on Farm B	Winter 1913-14, 7 4d.	

55. *Widespread Development of Milk Recording Needed.*—In the opinion of the Committee, milk recording has been by far the most effective agent in the improvement of dairy stock throughout the world. Energetic measures should be taken to increase the membership of existing Milk Record Societies and to form new societies in every dairying district in Great Britain and Ireland. At present there are records of the yield of 1 per cent. of the cows in England and Wales, of 5 per cent. of those in Scotland, and less than 1 per cent. of those in Ireland. Yet in each of these countries there is a National Milk Record Scheme. The chief hindrances to development during the war appear to have been the lack of organising staff and the shortage of milk recorders. The Committee recommend that the Boards of Agriculture should make such addition to their staffs (and in the case of England should give additional assistance to the Live Stock Officers in the different provinces) as may be necessary to facilitate the formation of societies wherever farmers desire to have them. A definite course of training should be provided for intending milk recorders in England and Wales and in Ireland (it is understood that this action has already been taken in Scotland). Milk recorders of proved energy and ability should be advanced under a regular system to higher and more responsible positions.

56. *Study of the Information collected by Milk Record Societies necessary.*—The Milk Record Societies accumulate much varied information as to local methods of management. The Committee believe that the interest of farmers in milk records would be stimulated, and that the systems of management in different districts would be considerably improved if an analysis of the results obtained by a society or group of societies were made available to the dairy farmers concerned. They have had evidence that such an analysis is being carried out in Scotland, but they understand that no provision is at present made for any such study in England and Wales, or Ireland. The educational side of milk record work should be associated with the local centre for agricultural and dairy education, and the Agricultural Colleges should be asked to undertake such an examination and to publish the results in a simple and concise manner.

57. *Milk Record Schemes should encourage Tests of the Quality of the Milk of Individual Cows.*—The milk recording scheme in operation in England and Wales appears to be restricted too exclusively to the obtaining of information as to the yield of milk. The work of Milk Record Societies should be extended so as to include fat tests of herds or at least of the heaviest milkers, *v.e.*, those whose calves are most likely to be retained.

The Committee hope* that the Board of Agriculture and Fisheries will formulate and publish a scheme for the testing of samples of milk from most or all of the cows in herds of members of Milk Record Societies, and encourage the taking of fat tests at regular intervals by increasing the grant to societies which adopt and efficiently carry out a reliable scheme.

58. *Register of Dairy Cows with Authenticated High Yields.*—The Committee welcome the scheme of the Board of Agriculture for the registration of dairy cows which have authenticated records of 8,000 lbs. in one year, or an average of 6,500 lbs. for two or more years, and are of opinion that this measure will lead to a great improvement in dairy stock. This scheme, however, in its present extremely simple form, which classes Jerseys with Friesians, and heifers with mature cows, does not meet the situation adequately. They endorse the recommendation† of their Agricultural Sub-Committee that this scheme should be enlarged so as to (a) provide separate classes for the different breeds and for animals of different ages, and (b) take cognisance of the percentage of fat in the milk as well as of the total yield of individual cows.

59. *Improvement of Dairy Bulls.*—The Committee feel that yet another result which might be obtained from the keeping of milk records has been too often neglected in the past. There is need for the improvement of dairy bulls. This can best be done by giving greater attention to milk record ancestry on the female side. In selecting a bull for a dairy herd, pedigree should be taken to mean not only a list of the bull's progenitors for several generations, but should include authenticated records of the milk yield of the dam and grandams. Frequently also, in judging dairy bulls, too much attention is paid to external appearance and handling properties. In the noted dairy countries of the world, dairy bulls are seldom, if ever, judged by their external characteristics only. The real test of a dairy bull must be the power to beget offspring which will yield large quantities of rich milk. The Committee believe that until the value of this information is more generally recognised, progress in the breeding of the highest class of dairy cows will be slow and disappointing.

Further, bulls are usually disposed of before their value has been proved by the milk records of their progeny. Breeders should find means whereby bulls can either be kept in the herd or be leased to other breeders until the value of their heifers has been ascertained. In this way bulls which transmit the qualities of a large and good milk yield could be discovered before it is too late, and could then be used or sold to the mutual advantage of the owner and of the national dairy stock.

60. *More Economical Methods of Feeding.*—The keeping of milk records usually increases the interest felt by the farmer in the management of his dairy herd, and often induces him to place his system of feeding on a more economic basis.

* See Appendix, page 29.

† See Appendix, page 30.

The wasteful and extravagant practice of giving the same amount of food to all cows has been discarded by all progressive farmers, but is still too common throughout the country. There is much room for instruction in the keeping of food records and in the most economical rations for milk production. The following figures show the saving effected during the winter period in two cases where milk recording and an improved system of feeding were adopted. In both instances the adoption of a proper system of feeding was the direct result of the keeping of milk records:—

Herd A.

December, 1912.			
Cost of food per gallon of milk—7·48 <i>d.</i>			
		£	s. d.
January to March, 1913.			
Cost of food per gallon of milk—5 21 <i>d.</i>			
Saving approximately 2½ <i>d.</i> per gallon on 9,570 gallons		39	14 4
December, 1913, to March, 1914.			
Cost of food per gallon of milk—5 33 <i>d.</i>			
Saving approximately 2 <i>d.</i> per gallon on 17,392 gallons		144	18 8
December, 1914, to March, 1915.			
Cost of food per gallon of milk—6 2 <i>d.</i>			
Saving approximately 1 <i>d.</i> per gallon on 17,442 gallons		17	16 0
Total saving in feeding for three winter periods in a herd of 60 cows ..		£307	9 0

Herd B.

		£	s. d.
December, 1912, to March, 1913.			
Cost of food per gallon of milk—7 32 <i>d.</i>			
December, 1913, to March, 1914.			
Cost of food per gallon of milk—4·79 <i>d.</i>			
Saving approximately 2 <i>d.</i> per gallon on 8,521 gallons		71	0 2
December, 1914, to March, 1915.			
Cost of food per gallon of milk—4 61 <i>d.</i>			
Saving approximately 2 <i>d.</i> per gallon on 9,443 gallons		78	13 10
Total saving in feeding for two winter periods in a herd of 40 cows .		£149	14 0

61. *Improved Pasture in Relation to Cheaper Summer Production.*—In respect of summer feeding, there is ample evidence that the quantity and quality of pasture on many dairy farms could be greatly improved, and the cost of milk production thereby lessened, by greater and wiser expenditure on manuring. The following experiment in manuring for milk carried out at the Midland Agricultural College gives a illustration of the results obtainable.

In April, 1909, two plots of four acres each of poor pasture, similar in every respect, were fenced off and dressed with 10 cwts. per acre of ground lime. Plot A received no further manuring, and plot B received 4 cwts. superphosphate and 1½ cwts. sulphate of potash per acre. The effect of this dressing was measured during the summers of 1909, 1910, 1911, and 1912 by comparing the total weight of milk produced by the cows grazing on both plots, the cows being changed from plot to plot every fortnight.

The yield of milk obtained from each plot over the 4-year period was as follows:—

Year.	Yield from Plot A.		Yield from Plot B.	
	(Unmanured.)		(Manured)	
	lb.	Milk.	lb.	Milk.
1909	5,531		9,020½	
1910	6,685		10,333½	
1911	5,586½		8,921½	
1912	8,740		13,661	
Totals	26,545½		41,836½	
Yield per acre per annum	1,659		2,614	

Increase per acre per annum due to manuring, 955 lbs. = 92 gallons.

After allowing for the cost of the manure, the above increase in milk yield showed a profit of £1 19s. 0*d.* per acre per annum over four years with milk at 6*d.* per gallon.

Much of the second-rate grass land in the pastoral districts of England could, by suitable manuring, be made to produce at least 50 gallons more milk per acre annually (thus increasing the output per acre from 175 gallons to 225 gallons per annum). On this basis 40 acres of manured pasture should produce as much milk as 50 unmanured acres.

62. *Further Education in Management and Feeding of Dairy Herds.*—In view of the widespread lack of knowledge as to the best methods of feeding and management of dairy herds, the Committee recommend that this subject should receive closer attention in the courses provided by the Agricultural Colleges and in lectures and advisory work undertaken by the County Councils. Further, they believe that lectures or courses of instruction and demonstrations on appropriate subjects at suitable hours would be appreciated by cowmen and other farm workers, as well as by farmers themselves.

63. *Introduction of Labour-aiding Machinery and Equipment.*—The question of the introduction of labour-aiding machinery and equipment and improvement in the arrangement of farm buildings is becoming of increasing importance in view of the scarcity of labour and the statutory regulation of hours and wages. In many cases the housing and surroundings of dairy cattle and the conditions under which the work of milk production has to be carried out are deplorably bad. Frequently a herd of cows is divided among a number of sheds—an uneconomical arrangement, which necessitates a wasteful expenditure of labour in the conveyance of food to the animals, in the cleaning of the cowsheds, and in the carrying of the

milk to the dairy or milk-house. The workers on such farms are unnecessarily exposed to bad weather, and have to find their way about in winter in the cold and dark amid the mud and slush of the farmyard. There are available in the majority of cases, neither sufficient supplies of water for cleansing nor such equipment as would render the more arduous of the workers' duties (*e.g.*, the removal of manure) as little unpleasant as possible.

This state of affairs is due partly to the adaptation of old buildings for dairy purposes and partly to the erection of new buildings without sufficient consideration of the plan of the farmstead as a whole. The Committee wish to emphasise the fact that when new buildings are being erected a very considerable saving of the labour needed on the farm could be effected by the arrangement of the cowshed, food store, &c., on some such plan as is suggested on page 48 of the Appendix, and by the installation of the labour-aiding machinery referred to.

In this connection the Committee welcome the appointment by the Board of Agriculture of a Departmental Committee to arrange for the testing, adaptation, and improvement of machines likely to prove of value to agriculture; to examine inventions and new devices; and to advise as to what further steps should be taken to promote the development of agricultural machinery.

64. *Milking Machines.*—The Committee have found that a great variety of opinion exists amongst practical men in this country as to the efficiency and value of milking machines as a means of saving labour. According to a Report* on the Use of Milking Machines prepared for the Committee in 1917, some farmers have had machines in constant use for as long as 11 years with thoroughly satisfactory results, while in another instance out of 7 machines installed in 1916 only 2 remained in use in 1917. It is evident, therefore, that there is need for much closer study of mechanical milkers, in order that reliable advice may be supplied to users and prospective purchasers on the selection and installation of milking machines and on their daily management and cleansing. The Committee, therefore, recommend that such assistance as may be necessary should be given to one or more of the Dairy Research Institutes or Colleges to enable them to undertake investigations designed to supply information on the above points, and to carry out comparative trials on machines of different types.

65. *State Assistance for Improvement in Buildings.*—Owing to the present high cost of buildings, the Committee are of opinion that financial assistance should be given, if possible, towards the improvement of existing buildings and the erection of new ones. The Committee believe that conditions could be devised whereby such financial aid could be made available annually for a limited period for the owners and occupiers of dairy buildings only so long as a guaranteed quantity of milk was produced. Unless this is done the high price of building materials will render the very necessary improvement in the housing of dairy cattle uncertain.

66. *Tenure of Land in Great Britain.*—Many farmers realise the necessity for improving their buildings, but tenants cannot be expected to invest their capital on improving existing buildings or on the erection of additional accommodation if their occupancy of the farm is insecure. Similarly, it is often difficult to get landowners to put fresh capital into modern buildings which a succeeding tenant may not desire. Men who farm their own land are much more likely to put up and to pay for proper buildings than tenant farmers. The Committee understand that the question of the improvement of buildings is almost invariably raised by tenants who make application for licences to sell milk of the higher grades. In many instances the improvements necessary to obtain a licence are not carried out on account of the uncertainty of the occupation of the holding.

67. *Improved Methods of Account Keeping.*—In the 3rd Interim Report (Cd. 315) the Committee drew attention to the general lack of any system of farm accounting. No complete system of farm accounts has been devised yet which is universally applicable, owing partly to the widely varying character of the farms themselves and also to the divergent views on questions of principle, which are due to the fact that only a limited number of farmers have kept complete accounts, and that they have not had sufficient opportunity of exchanging views and comparing methods.

Investigations into systems of farm accounts have been made by the Institute for Research in Agricultural Economics at Oxford University, and the Institute has at the same time given help to farmers by keeping the books of those who were prepared to supply them with the minimum of information and records necessary. The Institute has prepared accounts from these records, showing the cost of production of everything sold off the farm and the profit or loss in the various sections or departments, and has returned those accounts with notes and comments to the farmers.

The Committee recommended that similar facilities should be provided for farmers throughout the country, and they, therefore, welcome the formation of the Agricultural Costings Committee which has been instituted by the Boards of Agriculture and the Ministry of Food for the purpose of obtaining costs of production of particular items of agricultural produce and for obtaining permanent information as to the costs and results of farming. They believe that the work of the Research Institute and of the Costings Committee will be of great value to dairy farmers by enabling them to conduct their business with greater knowledge as to the profit or loss accruing from different methods followed in the production and disposal of milk, and generally to improve their systems of farm management. Owing to the differences in soil and climate in the different dairying areas of the United Kingdom, they hope that the information obtained as to the results of different systems of management will be classified according to areas, and that ultimately the agricultural colleges in these districts will be enabled to have an agricultural economic branch. They believe that in this way the improvements which are found to be most desirable in any district can be most readily brought to the notice of the farmer. Further, they consider it most important that work of this nature should be associated with the Agricultural Educational Centres.

68. *Loss of Milk through Souring.*—In their first and second Interim Reports* the Committee drew attention to the very considerable loss and waste of milk through souring during the warmer months of the year. The primary cause of this loss is undoubtedly the dirt and its associated bacteria which gain access to the milk at the farm, at the dépôt, in transit, in the retailer's shop and in the consumer's house.

* See Appendix, page 54.

† (Cd. 8608 and Cd. 8886.)

Detailed recommendations with regard to the production of clean milk and its preservation from contamination at all stages have been made in the report of the Sub-Committee on the Handling of Milk which is appended,* namely:—

- (1) management of milk on the farm—Appendix, page 32;
- (2) methods of management of depots and factories—page 34;
- (3) treatment at railway stations and during rail transit—pages 34-36;
- (4) handling at city depots and methods of distribution—pages 36-38;
- (5) management of milk in the house of the consumer—page 38.

69. *Extension of Co-operative Methods in the Purchase of Feeding Stuff and Manures.*—In pre-war times, the difference between the price at which a large farmer could purchase his winter supply of concentrated foods and the price which the small farmer, with limited capital and storage accommodation, had to pay for small periodical consignments was very considerable, and in several districts farmers and small-holders found it profitable to form a co-operative society to purchase feeding stuffs and manures. The advantages of this were not confined to small farmers, and sometimes large farmers also found it to their advantage to adopt the principles of co-operative purchase. As concentrated foods have increased very considerably in price, and as the charges for the carriage and handling of small quantities have likewise increased, the advantages of co-operative purchase are even greater now than formerly. The Committee are convinced that the adoption of co-operation, particularly by small farmers, would lead to a considerable saving. In many districts the concentrated foods required for the winter feeding of cows constitute by far the largest single item in the cost of production of milk, and economy in the purchase of such foods has a very important bearing on cost.

70. *Provision of Veterinary Assistance.*—The Committee in their third Interim Report (Cd. 315) made certain preliminary recommendations for the provision of increased veterinary assistance to farmers.

They welcome the clause in the Milk and Dairies (Consolidation) Act, 1915, enabling Local Authorities to appoint veterinary officers. They would urge, however, that these officers in England and Wales should be given whole-time appointments such as those made under the Milk and Dairies (Scotland) Act.

71. *Epizootic Abortion.*—Of the diseases which cause most loss to dairy farmers, the most important are contagious abortion and tuberculosis. In the former, while affected animals do not die, there is a great loss in their market value, and a very serious indirect loss in calves and milk. The evidence which the Committee have had on this subject has been to the effect that compulsory notification of the disease has not brought about satisfactory results. The use of the vaccine prepared and issued by the Board of Agriculture has been attended with good results, and the Committee are of the opinion that more active measures should be taken to bring the value of this treatment to the notice of dairy farmers and to encourage them to adopt it. They are informed that the fact that the vaccine may be obtained free of charge is by no means generally known.

72. *Tuberculosis.*—The Committee accept the findings of the Royal Commission on Tuberculosis to the effect that:—

“Primary abdominal tuberculosis in man, as well as tuberculosis of the cervical glands, is commonly due to ingestion of tuberculous infective material”†

“A considerable amount of tuberculosis of childhood is to be ascribed to infection with bacilli of the bovine type transmitted to children in meals consisting largely of the milk of the cow”†

They are aware that subsequent work has confirmed this.

At the same time they do not desire to create unnecessary alarm by exaggerating the extent of human tuberculosis due to bovine infection for they realise:—

- (1) That much infantile debility leading to susceptibility to many diseases including tuberculosis is due to inadequate milk consumption.
- (2) That many children must be drinking some tuberculous milk without suffering evil effects.
- (3) That all reacting cows do not necessarily give tuberculous milk.
- (4) That the risk from tuberculous milk may be practically removed by efficient pasteurisation.

73. *Desirability of Increasing the Number of Tubercle-free Herds.*—The Committee think it desirable that tuberculosis should be eradicated from as many herds as possible for the following reasons:—

- (1) Safe raw milk should be available for consumption.
- (2) It is undesirable and contrary to sound hygienic principles that the use of milk containing disease germs, even when the latter are destroyed by heat, should be accepted with complacency, so long as practical means of freeing milking herds from disease are available.
- (3) The presence of reactors in a herd must involve loss—varying in degree—to the owner of the herd, just as the presence of any infectious disease must always be a cause of a potentially large financial loss, owing to the danger of such disease spreading in the herd and to the fact that incipient tuberculosis is apt at any time to develop into the advanced stage.

74. *Methods of Eradication of Tuberculosis.*—There are only two practical ways in which tuberculosis may be eradicated from a herd, namely:—

- (1) The disposal of all reactors.
- (2) The isolation of reactors and the separation soon after birth of calves born of reacting cows before they can become infected.

Both methods raise many practical difficulties. The first probably involves a larger financial loss than most farmers could be expected to face. This would be likely to increase if any considerable number of cow-keepers tried to sell their reactors simultaneously. Further, if many cow-keepers desired to purchase non-reacting stock the price would rise rapidly, as the number of such animals is very limited.

75. *Accredited Herd System.*—The Committee have been informed that there has been a considerable increase in recent years in the number of farmers anxious to eradicate all tuberculous animals from their herds, and that a scheme for this purpose would be welcomed by progressive farmers and would contribute very materially towards the eradication of this disease. Such a scheme should provide for:—

- (1) Official veterinary assistance in the work of diagnosis and eradication;
- (2) The issue of certificates in regard to those herds in which the necessary conditions had been complied with;

* See Appendix, pages 31-39.

† Report of the Royal Commission appointed to inquire into the relations of Human and Animal Tuberculosis (Cd. 5761), 1911, page 39.

- (3) Correlation with a system of milk grading which would provide an official guarantee on which a milk producer could base a claim to receive a better price for tubercle-free milk.

They wish to recommend the following scheme for the introduction of an Accredited Herd System submitted to them by a special Sub-Committee* appointed to consider the question:—

- (1) The manufacture, distribution and the use of tuberculin to be controlled by a central authority.
- (2) The method adopted in the carrying out and the interpretation of the tuberculin test to be standardised.
- (3) Facilities to be provided out of public funds for free tuberculin testing, provided that the farmer can supply satisfactory evidence that he has reasonable facilities for the carrying out of the tests, and is willing to comply with the necessary conditions laid down for freeing his herd from reactors.

A herd which had complied with the specified conditions would be recognised as tubercle free, and a certificate given to that effect. The herd would be subject to periodical retesting.

In the opinion of the Committee more would be gained by *contributing* towards the initial cost of completely eradicating this infectious disease from a limited number of herds than by giving full compensation for the slaughter of cows in an advanced state of disease to owners who were not prepared to remove all reactors from their herds nor to bear any part of the cost.

76. *Work by Landowners on Home Farms.*—The Committee believe that much could be done by landowners through their home farms. While recognising the value of much of the work which has in many instances been carried out by landowners in the past at a considerable cost, the Committee are obliged to state that too often so-called model farms are run as models of how to farm at a financial loss. Frequently the landowner has but the vaguest idea of the financial or even the agricultural results of his operations. Unless a fair financial return can be shown, farmers cannot be expected to follow these models. There is also much scope for experimental work in agricultural costing, in manuring, feeding, the equipment and arrangement of farm buildings, &c., all of which landowners could carry out, with the assistance which is obtainable from the Agricultural Colleges† and from the recently established Agricultural Costings Committee. Further, if landowners obtained the requisite licences for Grade A milk for their home farms, they would be adding to the number of tubercle-free herds and setting an example of the production of clean milk. Many would also find to their surprise that it was necessary for them to alter and improve their methods in order to reach the official minimum standard laid down for producing milk of high hygienic quality.

77. *Re-organisation of Distribution.* (1) *Collection in the Country.*—The Committee have been impressed by the waste of labour in the conveyance of milk from the farm to the railway station. It is not uncommon to see milk carts belonging to 20 or 30 different farmers delivering milk in small quantities to a single station. This might be obviated by some system of collection, either by co-operation among the farmers themselves in the haulage of milk along the different roads leading to the station or depot, or by collection by motor-lorry, as is already the practice in many districts. A better collection of milk from remote districts would make available for human consumption additional supplies now used for butter-making and calf-rearing, while the producer would benefit by securing a steady market for his produce. This would encourage him to increase milk production both in summer and in winter, as he could then readily dispose of his surplus. It has, however, been brought to the notice of the Committee that the system of collection by motor-lorry as at present organised is by no means completely satisfactory. To remedy this state of affairs we recommend that an attempt should be made to arrange for a better system of collection and distribution under the auspices of the Agricultural Organisation Society or any similar body. In the collecting areas, rival businesses establish depots and organise systems of collection each in its own interest. Further, milk to be collected by motor-lorry is often left for hours in the sun by the roadside waiting for removal. This involves unnecessary exposure and frequently leads to premature souring and deterioration of the milk. There is no co-ordination and no comprehensive view of the requirement of the district and no adjustment of claims to tap the sources of supply. Factories for the manufacture of milk products are in some cases set down in producing districts close to large consuming centres. For example, while London has to go as far as Cornwall for its milk, there are in the milk producing districts within 50 miles' radius of London at least 5 large factories buying milk for conversion into malted milk, patent infant foods, milk chocolate or margarine.

78. (2) *Railway Transport.*—There is at present a complete lack of organisation of railway transport for milk, with resulting delay in bringing supplies into consumption. For example, milk is brought 253 miles from Haverfordwest, through Cardiff, to London, while at the same time Cardiff is being supplied from Bridgewater, 60 miles distant, and Longdon (Worcestershire), 65 miles distant. The Committee realise the difficulty of altering this state of affairs, but they hope that improvements may be effected.

The Committee also desire to recommend that proper refrigerated vans should be provided on the railways for the conveyance of perishable articles such as milk. At present no such vans are used for the transport of milk in this country.‡

Milk is usually consigned by rail under conditions which prevent it from being despatched at once. Churns of milk placed on rail at a country station are often consigned to several different destinations. In the case of large urban centres, milk arrives at a single destination from an unnecessarily large number of districts, and sometimes is consigned to different termini from the same country station. This lack of organisation results in unnecessary handling and delay in distribution, with consequent injury to the quality of the milk.

79. (2) *Town Distribution.*—There is much waste of labour and transport in the conveyance of milk between urban centres and retail shops and in its retail delivery. The United Dairies, Ltd., better known as the Milk Combine, a powerful business organisation which, set up in 1915, has gradually absorbed the bulk of the wholesale and retail trade of Greater London and controls approximately 80 per cent. of the milk supply in that area, reduced their rounds from 2,744 to 1,944 and their horses from 1,217 to 517 in the process of amalgamation and reorganisation. Part of this economy was, however, rendered possible by reducing deliveries from twice to once daily in certain districts

* For the Report of this Sub-Committee, see Appendix, page 30.

† See Report of Education Sub-Committee, Appendix, page 51, §4.

‡ See Report of Sub-Committee on the Handling of Milk, Appendix, page 35, §24.

80. Such trade combinations have undoubtedly a certain value in that their organisation leads to economy in distribution, though the economies effected by their administration have hitherto mainly benefited their shareholders. They are, however, regarded with suspicion by many producers and consumers, who fear respectively that their operations, if uncontrolled, will have a prejudicial effect on the prices paid for milk to the producer, and will place the consumers in the hands of a monopoly. Some central organisation which would organise the distribution of milk so as to secure economy of transport, the prevention of deterioration and loss by souring, and, where necessary, equitable distribution between different areas would be of great national advantage.

81. In this connection the Committee welcome a recent decision of the Government that power should be taken by the necessary amendment of the Milk and Dairies Act:—

- (a) to license all dealers of milk;
- (b) to grade and to define milk according to the way in which it has been produced or treated;
- (c) to empower local authorities to undertake the supply of milk within their areas;
- (d) to fix maximum prices in case of need;
- (e) to regulate distribution in times of short supply;

and believe that this action will do much to remedy the state of affairs which has been described.

VIII.—IMPROVEMENT IN HYGIENIC QUALITY.

82. It has become generally recognised that if there is to be a real improvement in the cleanliness and hygienic quality of the milk supply of this country, it is essential to abandon the theory that all milk is of one quality, or that it is possible to raise the whole milk supply rapidly to the highest grade. The public realise that the eradication of disease or the use of more skilled labour to produce cleaner milk necessitates additional cost to the farmer, which he will only and can only be expected to bear if he gets in return either some official certificate of the better quality of his milk, which will enable him to charge a compensating price, or to receive a higher price under an official system of fixed prices. Differentiation between the different grades of milk so that producers and distributors of clean milk may be remunerated for the additional labour and expense incurred is essential. Real progress cannot be made without the co-operation of the general body of the community, but in the past they have shown in general little knowledge or understanding of the subject. The average consumer has learned by experience the importance of a pure water supply, but so long as the milk which he drank was not obviously impure he gave the question very little thought.

83. *Grading.*—The situation has shown signs of change in the last two years, and there has been apparent an increased demand on the part of the public for clean milk, accompanied by a willingness to pay a higher price for milk of guaranteed quality. This change is partly attributable to the publicity given to the subject of the national milk supply, and partly to the introduction by the Ministry of Food and the Ministry of Health of a modified system of grading.

The Ministry of Food, the Ministry of Health and the Scottish Board of Health inaugurated in August, 1918, a scheme for the granting of special licences to enable producers of milk of high hygienic quality to charge higher prices than those permitted by the Milk (Prices) Order for the time being in force. During the war, owing to the shortage of staff in all departments, no attempt was made to increase the number of applicants for licences; but the Committee hope that the Departments concerned will in future give increased publicity to the scheme and the fullest possible information and advice to farmers who wish to attain to a standard of production sufficient to qualify them to obtain a licence. When the scheme was introduced in the autumn of 1918, a considerable number of applications was received, but the number of licences granted during that year was only 14. In the course of 1919 the number has grown steadily and by November 30th, 1919, 34 licences had been granted. How much room there still is for improvement can be seen from the fact that there are in Great Britain more than 100,000 dairy farmers. The Committee are, however, informed that the interest of farmers in this subject is increasing, and that no material difficulty has been found in obtaining a market for the milk at a higher price. There are already, in fact, indications that the demand for the highest grade milk is likely to exceed the supply.

84. The Committee consider that the principle of grading is sound as it rewards the farmers who take the necessary care to produce a better and cleaner article, and offers to farmers generally an inducement to improve the quality of their milk. A system of payment by results and education of both producers and consumers so that the one shall produce and the other demand a higher grade of milk is likely to lead to the most beneficial effects. The addition of the principle of grading was advocated in 1909 by Dr. Eastwood, in a Report* presented to the Local Government Board. Since then it has received the support of the Consumers' Council (Ministry of Food), the Central Agricultural Advisory Council (Ministry of Food and Boards of Agriculture), the Travelling Milk Commission (Ministry of Food), and the Associated Milk Producers' Council.

85. *American Experience.*—The adoption in America of the principle of grading milk has resulted in a great improvement in the general supply, and has not deprived the poorer classes of milk. In the City of New York the system of grading according to cleanliness and purity has stood the test of experience for many years. A Report issued by the Board of Health of that City states that when grading was first inaugurated in January, 1912, 40 per cent. of the City's supplies fell within the definition of the lowest grade—Grade C. (Milk for cooking purposes)—but that in July, 1914, the amount of Grade C. milk sold in New York City was negligible. At the present time about one-seventh of the total supply is Grade A. milk, and about six-sevenths is Grade B. There is no longer any demand for Grade C. milk. This result was achieved not only because of the decreasing demand by the public for Grade C. milk, as they learnt to appreciate the value of higher grades, but because the dealers who had previously sold unsatisfactory low grade milk removed the unhygienic conditions which contaminated their supplies when they had to publish the fact that the milk they sold was placed in the lowest category. The steps taken to raise milk from Grade C. to Grade B. were within the capacity of all producers and dealers, and did not involve any increase in the cost of milk to the consumer. In this connection it should be noted that almost all the milk sold in English cities, if offered for sale in New York, would be classified as Grade C. The consumption

* Report on American Methods for the Control and Improvement of the Milk Supply. Reports to the Local Government Board on Public Health and Medical Matters (New Series, No. 1).

of milk in New York is approximately 58 English pints per head per day, and is almost twice the normal London consumption (*see* page 8), while the poorer districts in New York take about 40 per cent. per head more than the wealthier districts. In the United States also the educational campaigns for the all-round improvement of the milk supply have been accompanied by an increase in the actual amount of milk sold, owing to the information disseminated amongst consumers as to the value of milk as a food.

86. *Method of Grading.*—The two most useful and practicable methods of grading milk are as follows:—

- (1) Supervision through inspectors of the methods of production and handling.
- (2) Examination of the milk as sold in relation to specified chemical and bacteriological standards.
(Chemical standards usually require not less than certain definite percentages of milk fat, and solids not fat, and the bacteriological standard requires that samples shall contain not more than a specified number of bacteria per cubic centimetre)

The first of these demands a large staff of qualified inspectors, since conditions are imposed both as regards the health and housing of the cows and also the care and cleanliness shown over every detail of milk production and distribution. The second demands skilled technical workers for both methods of examination. A combination of both of the above methods would appear to be necessary in order that the nutritive quality of the milk may be guaranteed, and that it may be cleanly produced and kept free from contamination until it reaches the consumer.

87. *Education for Milk Producers.*—Attention has already been drawn to the necessity for the provision of instruction for farmers and cowmen in the management and feeding of dairy herds. The Committee wish to emphasise the necessity for supplementing this instruction by advice and information as to the best methods of handling and treating milk which is to be sold for human consumption. The Report* of the Sub-Committee on Education in Dairying draws particular attention to the defects of the dairy educational system and the lack of research facilities in this country in this respect. In the past, great efforts have been made to provide adequate training in the manufacture of dairy products, also for the production and handling of milk intended for human consumption. As 70 per cent. of the milk produced in this country is sold for the latter purpose, adequate attention should be given to this subject at all educational centres. The Committee wish to emphasise the recommendations of the Education Sub-Committee that the Dairy Colleges and Farm Institutes in dairying counties should provide courses designed for those whose chief business is the production and management of milk. The Committee also consider it essential to the success of such courses that the methods described and advocated in the lectures should be illustrated in the daily routine of the farm associated with the institution.

Valuable educational work has recently been carried out by the National Clean Milk Society in demonstrating the possibility of producing clean milk under the most unfavourable farm conditions. By attention to those details which have been proved to be of greatest importance in the production of clean milk, the demonstrators have shown that it is possible to produce milk with a very low bacterial content without the aid of model buildings or expensive and mechanical equipment.

88. *Education for Milk Distributors and Consumers.*—The Committee wish to endorse the recommendation of the Education Sub-Committee that instruction should be provided for those engaged in the wholesale and retail sale of milk, and to emphasise the need for the provision of free instruction to the general public on the value of milk as a food, the influence of a good or bad supply of milk on the life and health of children and the community as a whole, and the best methods of handling and storing milk in the consumer's home. Had the general public been properly educated in this respect in the past, there would now be a greater demand for milk produced and handled under better conditions than the present day average, and with the demand a willingness to pay a higher price for milk of guaranteed cleanliness and quality. Farmers are continually being told how much better are the methods of milk management in other countries, but the cities, *i.e.*, the consumers, in at least one other country took the lead in propaganda. In addition to the provision of free lectures and printed advice, several cities in recent years have held milk shows with no charge for admission, for the specific purpose of educating the public in the value and management of milk. One such show with the motto "To enlighten not to frighten" held in Philadelphia in 1911 was open for 8 days and was visited by 110,000 people. No milk shows have as yet been held in Great Britain.

89. *Pasteurisation.*—In previous reports, *i.e.*, the 2nd Interim Report, page 6, and the 3rd Interim Report, page 8, and Appendix C, pages 22-27, the Committee have referred to the unsatisfactory methods of pasteurisation at present in use in this country.

They confirm the following recommendations made by one of their Sub-Committees:—

- (1) That a definition of pasteurised milk should be set up.
- (2) That pasteurised milk should be sold as such and not as fresh milk.
- (3) That milk sold as fresh milk should not have been subjected to any process of heating.
- (4) That any method of pasteurisation that may be followed should be such as to provide the greatest measure of protection to the consumer.
- (5) That pasteurisation must never be regarded as a substitute for clean milk production and cleanliness in handling milk, which are the most important of all conditions affecting the milk supply, and which would be greatly promoted by the better education of the public in the demand for clean milk.
- (6) That further research is necessary in respect of the question of the preservation and pasteurisation of milk, particularly in regard to (a) the effect of pasteurisation on the chemical and physical condition of milk, its composition, nutritive value, contained bacteria, bacterial toxins, and keeping properties and (b) the effect of such milk upon the body of the consumer.

IX.—INCREASED PRODUCTION OF MILK IN GREAT BRITAIN.

90. In view of the high prices to which milk has risen, the Committee have dealt in detail with the steps which should be taken to decrease its cost. They also consider it desirable to indicate how the numbers of dairy stock in this country might be increased and the advantages which would follow.

* *See* Appendix, page 52.

They have no doubt that in a few years time when conditions have become more stabilised there will be an increased consumption of milk. The spread of education as to the value of milk and a higher standard of living on the part of the large majority of the population should lead to a greater consumption per head. Unless this demand is to be met by the diversion of milk from the manufacture of dairy products or by the importation of preserved milk (*see* page 9) the total number of dairy stock in the country must be increased.

91. *Capital*.—Any appreciable increase in the number of dairy stock in the country must involve the investment of further capital in dairy farms, buildings, live stock and equipment. Before the possessors of such capital can be expected to invest it in dairying, they must be assured of a profitable return on their investment. This involves the corollary that prices for milk and milk products should show a return which is satisfactory as compared with the return received for other agricultural products. Before the war sheep farming was the most speculative branch of farming. Next came cereal growing, then cattle fattening, next cattle breeding and rearing, while milk production was the most stable and least liable to fluctuations in profit. Now, as indicated in paragraph 44, the guarantee farmers receive against serious loss on cereals has altered the balance.

92. *Labour*.—An increased production of milk must also entail an adequate supply of labour. The fundamental fact which differentiates conditions of labour in dairying from those in other branches of agriculture and in other industries is that cows are living creatures and not machines. They must be fed regularly and milked 7 days a week every week in the year at intervals as equal as possible. The labour difficulty in dairying is not due so much to the scale of wages obtainable as to the length of hours worked, to the early hours of milking, to the discomfort connected with the industry in most farms, and to the fact that so much Sunday labour is necessary. Men and women will not work 7 days a week, particularly if they are working for someone else, if they see any alternative method of living. The shorter hours, weekly rest days and higher wages obtainable in factories have drawn workers from all forms of agriculture, and especially from dairy farming. The statutory half-holiday now in force in Great Britain, though it alleviates the position of the labourer, has increased the farmer's difficulties, since it has been necessary in many cases to re-organise staffs, and to engage additional labour to carry on the work.

93. The Committee consider that the increased supply of labour required can best be obtained if farmers are willing to recognise the fact that farm labourers not only expect, but have a right to expect, better conditions in the future than they have had in the past. This can be met to a considerable extent by better organisation of all labour on the farm, by improving the buildings and surroundings of cow houses and by the granting of holidays. Every endeavour should be made towards the establishment of good relations between the employer and employee. If a farmer is prepared to take his turn in order to give some members of his staff a day off, the latter will respond cheerfully when any extra pressure of work comes. Such schemes of co-partnership and profit-sharing which have been tried have tended to give the employees a greater interest in the ultimate success of the business.†

94. *Wages*.—The question of wages is one which falls within the scope of the Agricultural Wages Board. The Committee, however, agree that the hours and wages of dairy workers should be at least as favourable as those of other agricultural labourers. This has not been the case, although certain farmers have shown that equally favourable conditions can be provided without financial loss.

95. *Better Agricultural Statistics*.—The Committee hope that the Board of Agriculture will in future classify its agricultural statistics in such a way as to permit of the grouping of farms according to their acreage, as has been done by the Department of Agriculture for Ireland. The consideration of many aspects of policy and the drawing of conclusions from the past and the present would be enormously helped if fuller information were available. It appears that 58.4 per cent. of the total number of cows in the country are on holdings of from 50 to 300 acres. The effect of modern hours and conditions of labour and the possibility of the use of machinery varies very greatly within the limits of this group. The management and working of a farm of from 50 to 100 acres may easily be carried out by the occupier and his family, whereas on a dairy farm of from 200 to 300 acres hired labour is necessary, and there is greater scope for the use of mechanical equipment. A sub-division of the above group of farms is required.

The Committee have also been impressed by the lack of statistical information with regard to winter milk production. A census of cows in milk in June affords no guidance as to the probable output of milk in January. There should also be a more detailed annual classification of cows according to the purpose for which they are kept, *i.e.*, whether for milk or beef.

96. *Arable Dairy Farming*.—In order to maintain satisfactorily the increased number of dairy stock contemplated, the Committee are of the opinion that more home-grown foods should and could be provided by an extension of arable dairy farming such as was practised in Denmark and Germany before 1914 and in this country during the war.

Sir Thomas Middleton, in a recent Report,‡ has shown that:—(1) Germany maintained 24.5 cattle per 100 acres as against 22.2 in Great Britain. That (2) Great Britain was slightly ahead in the production of beef (1.49 tons as against 1.29 tons per 100 acres), but that (3) Great Britain was very much behind in the production of milk (17.4 as against 28.1 tons per 100 acres). This high yield of milk per 100 acres is shown by the following table to be due to the larger proportionate number of cows kept:—

Analysis of Cattle per 100 acres
GREAT BRITAIN (1914).

Total Cattle.	Cows and Heifers in milk and Cows in calf.	Heifers in calf.	Other Cattle.
22.2	8.1 (= 36.5 per cent.)	1.1 (= 5.0 per cent.).	13.0 (= 58.5 per cent.).
	Beef Production	1.49 tons per 100 acres.	
	Milk "	17.4 " "	

* See Appendix, pages 39–50, for Report of Sub Committee on Labour.

† Particulars of some such schemes actually in operation are given on pages 44–48 of the Appendix.

‡ "Recent Development of Agriculture in Germany," published by the Board of Agriculture (C.D. 8305)

GERMANY (1913).

Total Cattle.	Cows.	Other Cattle.
24 5	12·7 (= 51·8 per cent.)	11·8 (= 48·2 per cent.)
Beef Production		1·29 tons per 100 acres.
Milk "		28·1 " "

97. Judging from the average British farmer's confidence in pasture land for milk production, one would expect to find a larger proportion of pasture in Germany than in Great Britain. The average British 100-acre farm, maintaining 8·1 cows in milk, had 69 acres under grass and clover, while the average German 100-acre farm, maintaining 12·7 cows in milk, had only 32 acres under pasture. This greater proportion of arable enabled the Germans to produce, per 100 acres of cultivated land, not only 28·1 tons of milk and 1·29 tons of meat, as against 17·4 tons of milk and 1·49 tons of meat produced by the British, but in addition 33 tons of grain and 55 tons of potatoes, as against 15 tons of grain and 11 tons of potatoes in Great Britain.

It is evident, therefore, that a high production of beef and milk does not necessarily involve a low production of grain and that, in fact, the increase of pasture in Great Britain, amounting to 3,800,000 acres in the last 40 years, has resulted in a serious decrease in the total amount of home-produced food, with a corresponding increase in the imported supplies.

98. The above figures for Great Britain refer to the period before the inauguration of the war-time "Plough Policy" of the Food Production Department, which, though intended as a war measure, will have permanent beneficial results. Many farmers have now realised that a reduction in the number of dairy stock kept need not necessarily follow the ploughing up of a certain amount of grass land. On the contrary, an increase in the area of arable land and the introduction of suitable crops, will increase the stock-carrying capacity of the farm, and make the farmer less dependent on purchased foodstuffs during the winter.

In their third Interim Report (Cd. 315, page 13) the Committee made definite recommendations to the Boards of Agriculture with regard to the development and the extension of the growth of soiling crops on dairy farms, and the desirability of providing facilities for the making of ensilage for use during the winter months. In an Appendix to that Report (pages 28-29) illustrations contributed by practical farmers were given of the use of green crops for soiling purposes on dairy farms. Since the issue of the third Interim Report the results of trials in different parts of the country, and particularly the demonstrations at the Harper Adams Agricultural College,* have emphasised further the advantages to be derived from arable dairy farming. In the experiment at the Harper Adams College a small herd of cows has been maintained on a succession of soiling crops and a small allowance of concentrates, without the use of any pasture land for a period of nearly two years, and the results are very encouraging in respect of milk yield and estimated profits. By the system followed, 10 cows require only 15 to 16 acres of arable land, or 1½ acres per cow.

On many dairy farms the heavy nature of the soil will make it always desirable to retain certain fields as pastures and meadows, but there are numerous dairy farms where a proportion of the land formerly under grass is well suited for arable cultivation, and the Committee are convinced that by the adoption of arable dairying in many counties, the density of the cow population can be greatly increased.

99. *Demonstration Small Holdings.*—In this connection, the Committee welcome the scheme under which the Boards of Agriculture are establishing a limited number of Arable Dairy Farming Demonstration Holdings, for the purpose of each of which the Boards will acquire a holding of from 25 to 30 acres of land to be devoted to the growing of arable crops suitable for stall feeding to dairy cows.

The necessity for demonstrations of this nature in different parts of the country has arisen partly because it has been claimed in some milk-producing areas that, as a result of the plough policy of the Boards, it is not now possible to produce as much milk as formerly, and partly because of the necessity for intensifying milk production. Given the fact that much more milk can be produced from an area where the land is under arable cultivation than under grass, what now requires to be demonstrated is whether the return obtained compensates for the extra labour involved. A further purpose to be served by these demonstrations is to show whether it is or is not possible for a holding of 25 to 30 acres conducted on the intensive system to return a net income at least equal to that which can be obtained from a 50-acre holding carried on in accordance with the usual practice.

100. *Value of Lucerne.*—The Committee hope that dairy farmers will study very carefully the advantages to themselves and to the country which can be obtained by maintaining a large proportion of arable on their farms. Greater efforts should also be made to bring to the notice of farmers the enormous value of lucerne. Where the soil is suitable and adequately drained so that a good plant can be obtained, this crop will produce a greater weight of green forage or hay per acre during the season than can be obtained from any other soiling crop. There is also no expense in seed and cultivation after the first year, while the forage or hay obtained is of high nutritive value and the fertility of the soil is greatly increased. The neglect of lucerne on dairy farms in England is one of the weak spots of contemporary farming. If its value were more fully realised, much more systematic and determined attempts would be made to overcome the difficulties of getting a good and lasting plant. The increase in the acreage of arable land and the necessity for obtaining the maximum supply of cattle food for summer and winter, for increasing the fertility of the soil, and for reducing the importation of concentrated feeding-stuffs, all point to the advisability of a greater utilisation of lucerne in the future than in the past.

101. *Increased Dairy Stock.*—Since the chief reason for advocating an increased head of dairy stock is to obtain a larger quantity of milk for consumption as such, it follows that this increase should be chiefly in the breeds yielding milk most suitable for this purpose, such as the Dairy Shorthorn, Ayrshire, Friesian, and such other local breeds as can hold their own in economical production against these better known breeds.

* Harper Adams College Bulletin, 2A, 1918.

There is little need for an increase in the number of Jerseys and Guernseys in the herds of the ordinary dairy farmer, although where butter is required for local or private consumption these breeds are superior to all others.

102. *Comparative Study of Breeds Necessary. Facilities for Importation of Friesians.*—The Committee desire to support the following three recommendations made by their Agricultural Sub-Committee:—

- (i) That for the purpose of obtaining reliable information and that sound advice may be available for farmers as to the breed which is the most economical producer of milk under different conditions, a careful study should be made of the relative economy in the production of milk, under different circumstances of soil and climate of the chief breeds at present in this country.
- (ii) That facilities should be given for the importation of Friesians, provided that they come of a stock of sufficiently high milking record. The standard should be fixed so as to ensure that only the best dairy animals are allowed to enter the country. Their importation should be subject to the most stringent conditions that the Board of Agriculture may consider necessary in order to guard against the introduction of disease. The Committee believe that the previous successful importation of dairy cattle under Government control can be repeated.*
- (iii) That the Board of Agriculture should institute an enquiry into the advisability of the importation of other breeds of proved excellence in milk production.

103. *Government Control of the Wholesale Trade.*—The Committee feel that this Report would be incomplete without some reference to the proposals that have been made for Government control of the wholesale milk trade; and they consider that it may be useful to summarise briefly some of the arguments that have been adduced for and against Control.

For Control:—

- (i) Diversion of supply from one area to another in times of shortage.
- (ii) Regulation of the amount of milk manufactured into milk products.
- (iii) More satisfactory transport of milk.
- (iv) More economical arrangements for wholesale and retail distribution.
- (v) Maintenance of winter supply.
- (vi) Equalisation if necessary of the retail price for winter and summer.
- (vii) Protection of producer and consumer against large wholesale combinations.

Against Control:—

- (i) That it would compel the State to offer a market to all milk wherever produced. That easily accessible and therefore cheap milk would go direct to the retailer without the wholesale intervention of the State, and the State would be compelled to purchase distant and expensive milk.
- (ii) That in times of surplus the State would have large quantities of milk on its hands which could only be used for milk products, and that in competing with imported milk products the State would make a heavy loss.
- (iii) That the result of the above conditions would necessitate either raising the price of milk distributed by the State, or a State subsidy for milk.
- (iv) That it would necessitate the fixing of prices with all the recognised disadvantages.
- (v) That the unsatisfactory conditions of milk production and distribution can be dealt with by methods which would not involve the State in a costly and doubtful experiment.
- (vi) That it would involve an interference with individual enterprise for which there is no sufficient justification in times of peace.

X.—SUMMARY OF RECOMMENDATIONS.

104. I.—*National Policy.*

(a) The aims of an enlightened milk policy should be:—

- (1) to bring about the utmost possible economy in production in order that:—
 - (i) consumption of milk may be increased to the desired level;
 - (ii) an adequate supply of milk may be brought within the reach of the poorest families.
- (2) to improve the hygienic quality of milk and to ensure that that portion of the supply which requires or is subjected to artificial treatment by heat is efficiently pasteurised under supervision;
- (3) to increase the total supply in order to meet the extended consumption that should follow improved quality and the education of the public with regard to the nutritive properties of milk;
- (4) to prevent the exploitation of the producer or the consumer by any trust or combination either of a provincial, national, or international character

Page. Para.

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* Mr. J. R. Campbell does not feel that he can subscribe to this statement.

	Page.	Para.
(b) to arrange for the better distribution of milk so as to secure economy of transport, prevention of deterioration, and loss of milk through souring and, where necessary, equitable distribution between different areas ...	19	80
(c) Dairy farming should be developed as it is one of the most important, most productive, most stable, and most economic branches of agriculture in a country like the United Kingdom ...	7-10	17-32
II.—Education and Research.		
(a) In England and Wales.		
(1) The development of research in dairying should be assisted to the fullest extent ...	53	12
(2) Provision should be made for adequate itinerant instruction in every county with regard to the production, management and utilisation of milk ...	52	10
(3) Longer and better proportioned courses of training should be provided for teachers of dairying and educational centres should demonstrate the best methods of farm and dairy practice ...	52	9
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105. The Committee feel that they cannot rate too highly their obligations to our Secretary, Mr. J. Mackintosh, for the valuable assistance he has rendered in the consideration of the complex problems that they have reviewed. His knowledge of the distributive as well as the practical and scientific side of agriculture has been of the greatest value, and they deeply appreciate the tact and untiring industry which he has devoted to the work of the Committee.

They have to express their gratitude for the valuable services rendered in the work of the Sub-Committees and in the preparation of this Report by Miss Mackenzie and Miss Cowper.

They also wish to record their sense of obligation to Viscount Astor for permitting the Committee and Sub-Committees to hold numerous meetings at 4, St. James's Square.

(Signed) ASTOR (Chairman).
W. E. G. ARCHIBALD WEIGALL (Deputy Chairman).
J. F. BLACKSHAW.
WILFRED BUCKLEY.
J. R. CAMPBELL.
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GERALD LEIGHTON.
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W. ANKER SIMMONS.
BEVILLE STANIER.
ROBERT P. WRIGHT.

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 COMMITTEE ON PRODUCTION AND DISTRIBUTION OF MILK.

LIST OF WITNESSES INTERVIEWED BY THE COMMITTEE.

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 Professor R. Wallace, F.R.S.E., F.L.S., the University of Edinburgh.
 Mr. J. C. Corbett, Agricultural Organisation Society.
 Mr. A. Steel, Eastern Counties Dairy Farmers' Co-operative Society, Limited.
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 Mr. A. Barnes, Stratford Industrial Co-operative Society.
 Mr. J. H. Bates, Stratford Industrial Co-operative Society.
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 Mr. H. Trotman, Welford's, Limited.
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 Mr. R. Butler, United Dairies, Limited.
 Mr. E. Mathews, Royal Agricultural Society of England,
 Hon. Cecil Parker, Royal Agricultural Society of England,
 Mr. J. S. Paterson, National Farmers' Union of Scotland.
 Mr. A. Batchelor, National Farmers' Union of Scotland.
 Mr. A. W. Hunter, National Farmers' Union of Scotland.
 Mr. J. Huntley MacDonald, National Farmers' Union of Scotland.
 Mr. P. McConnell, British Dairy Farmers' Association.
 Mr. J. Kendrick, British Dairy Farmers' Association.
 Mr. R. Long, British Dairy Farmers' Association.
 Colonel A. S. Barham, British Dairy Farmers' Association.
 Mr. A. F. Somerville, Bath and Western and Southern Counties Society.
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 Mr. G. Aguet, Nestlé's and Anglo-Swiss Condensed Milk Company, Limited.
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 Mr. C. M. Douglas, C.B., D.Sc., Highland and Agricultural Society of Scotland.
 Mr. J. McCaig, Highland and Agricultural Society of Scotland.
 Dr. J. P. Tocher, Highland and Agricultural Society of Scotland.
 Mr. W. Arkell, Canadian Department of Agriculture.

LIST OF WITNESSES INTERVIEWED BY SUB-COMMITTEES.

Sir Stuart Stockman, Chief Veterinary Officer, Board of Agriculture—Agricultural Sub-Committee.
 Mr. F. H. Thornton, President, Dairy Shorthorn Association—Agricultural Sub-Committee.
 Mr. C. M. Douglas, C.B., D.Sc., Highland and Agricultural Society of Scotland—Agricultural Sub-Committee.
 Mr. Trevor Williams, British Friesian Cattle Society—Agricultural Sub-Committee.
 Mr. J. Speir, Scottish National Farmers' Union—Labour Sub-Committee.
 Mr. J. S. Paterson, Scottish National Farmers' Union—Labour Sub-Committee.
 Mr. J. Lunnon, Agricultural and Rural Workers' Union—Labour Sub-Committee.
 Mr. J. Duncan, Scottish Farm Servants' Union—Labour Sub-Committee.
 Mr. W. Cochrane, Workers' Union—Labour Sub-Committee.
 Mr. P. Nutley, Workers' Union—Labour Sub-Committee.
 Mr. J. Park, National Farmers' Union of England—Labour Sub-Committee.
 Mr. J. H. Horton, National Farmers' Union of England—Labour Sub-Committee.
 Mr. W. Osborn, National Farmers' Union of England—Labour Sub-Committee.
 Mrs. Abel Jones, Technical Inspector for Wales—Labour Sub-Committee.
 Mr. J. Drysdale, Scottish Chamber of Agriculture—Labour Sub-Committee.
 Mr. J. Findlay, Scottish Chamber of Agriculture—Labour Sub-Committee.
 Mr. J. Lawrie, Scottish Chamber of Agriculture—Labour Sub-Committee.
 Sir T. H. Middleton, Board of Agriculture and Fisheries—Education Sub-Committee.
 Mr. J. F. Blackshaw, Board of Agriculture and Fisheries—Education Sub-Committee.
 Mr. A. Poole Wilson, Department of Agriculture for Ireland—Education Sub-Committee.
 Principal Paterson, Board of Agriculture for Scotland and West of Scotland Agricultural College—Education Sub-Committee.
 Mr. J. Darlington, Shropshire—Education Sub-Committee.
 Mr. Richmond James, Somerset—Education Sub-Committee.
 Mr. W. Bown, Somerset—Education Sub-Committee.
 Mr. B. Broughton, Somerset—Education Sub-Committee.
 Mr. J. Hugh Mackie, Cheese Inspector, Ministry of Food—Education Sub-Committee.
 Mrs. Lacy Hulbert, British Goat Society—Goats Sub-Committee.
 Mr. W. Paget, British Goat Society—Goats Sub-Committee.
 Mr. H. Holmes Pegler, British Goat Society—Goats Sub-Committee.
 Mr. B. Ravenscroft, British Dairy Farmers' Association—Goats Sub-Committee.
 Mr. P. Dallinger, Board of Agriculture and Fisheries—Goats Sub-Committee.

For list of witnesses interviewed by Sub-Committee on Control of Wholesale Trade, *see* Cd. 9095.

APPENDIX.

REPORT OF AGRICULTURAL SUB-COMMITTEE.

MEMBERSHIP OF THE SUB-COMMITTEE.

Lieut.-Col. W. E. G. A. WEIGALL, M.P. (*Chairman*).

Mr. J. F. BLACKSHAW, O.B.E.	Dr. A. W. J. MACFADDEN, C.B.
Mr. WILFRED BUCKLEY.	Mr. J. MACKINTOSH.
Dr. C. CROWTHER.	Mr. POOLE WILSON.
Mr. P. A. FRANCIS.	Dr. J. ROBERTSON.
Mr. R. HOBBS, JUN.	Mr. J. C. ROBINSON.
Major G. R. LEIGHTON, M.D.	Mr. W. ANKER SIMMONS, C.B.E.
Mr. W. McCracken.	Mr. F. N. WEBB.

1 The Agricultural Sub-Committee have had under consideration the following points bearing on the increased production of milk throughout the United Kingdom:—

- (1) Improvement of Home Breeds.
- (2) Importation of Breeds.
- (3) Veterinary Assistance for Farmers.
- (4) Labour-saving Machinery.

1. IMPROVEMENT OF HOME BREEDS.

2. *Selection of Best Breeds for Improvement.*—The chief dairy breeds in the United Kingdom at the present time are the Ayrshire, the Friesian, the Guernsey, the Jersey, the Kerry, the Lincoln Red, the Red Poll, the South Devon, and the Shorthorn. Of these breeds the Shorthorn is by far the most important numerically in England and Ireland. In Scotland the Ayrshire is the predominant dairy breed. In the above list the Jersey and Guernsey breeds are pre-eminently suitable for butter production. The other breeds—Shorthorn, Ayrshire, Friesian, Lincoln Red, South Devon, Red Poll, Kerry, and their crosses—produce most of the milk which is used for human consumption and for manufacture into cheese, and the milk of these breeds is considered especially suitable for these purposes.

In considering the improvement of the dairying capabilities of home breeds, it is necessary to have in mind the purposes for which any increase in the supply of milk will be utilised, so that the breeds yielding the milk most suitable for these purposes may be the first to be increased in numbers. There appears to be little doubt that the milk will be utilised chiefly for human consumption or for cheese making. The relative

importance of these two methods of utilisation varies according to the district. It appears safe to say that only a small proportion of any increase will be utilised for butter making. It follows, therefore, that the increase in stock should be chiefly in the Dairy Shorthorn, Ayrshire and Friesian breeds and such other local breeds as can hold their own against these in economy of production.

The Sub-Committee have not sufficient information at their disposal to enable them to recommend that special assistance should be given to any one breed in order that its numbers may be increased, but they believe that some of the breeds mentioned above must be better for milk production than others, and also better than other local breeds not specified. They also believe that it is undesirable on national grounds that the numbers of second or third rate dairy breeds should be increased, but that such breeds should be decreased and replaced by those which have proved to be superior.

Recommendation.—In order that reliable information may be obtained, and that sound advice may be available for farmers as to the breed which is the most economical producer of milk under different conditions, they recommend that a careful study should be made of the relative economy in the production of milk under different circumstances of soil and climate of the chief breeds at present in this country.

3. *Improvement by Breeding.*—The Sub-Committee were informed that the Board of Agriculture and Fisheries, under the Live Stock Improvement Scheme, had provided 710 bulls of different breeds in different parts of the country. The bulls were selected or approved by the Live Stock Officers, and in this way a certain standard of excellence was assured. Most of the bulls placed under the above scheme were of the Shorthorn breed, and were selected with special reference to their dairy qualities, but at the present time there is a distinct need for greater attention being given to the milk record ancestry. In selecting a bull for a dairy herd, pedigree must be taken to mean not merely a list of the names of the bull's progenitors for several generations, but authenticated records of production on the part of the dams and grandams. The Sub-Committee are of the opinion that, in the present-day judging of dairy bulls, too much attention is paid to external appearance and handling properties. In the noted dairy countries of the world, dairy bulls are seldom, if ever, judged by their external characteristics only. The real test of dairy capacity in a bull is power to beget offspring with high records of milk yield and butter fat, and they believe that until this test is more clearly recognised in this country, progress in the breeding of the highest class of dairy cow will be slow and disappointing. The dairy capacity of any animal can be reduced to facts of healthiness and regularity in breeding and to figures of production, and these facts and figures are a much surer foundation for a system of breeding than are opinions as to external characteristics.

The Sub-Committee are also aware that at the present time bulls are usually disposed of before their dairy capacity, as proved by the records of their progeny, can be discovered, and they suggest that in the future breeders should find means whereby bulls can either be kept in the herd or be leased to other breeders, until the value of their progeny can be ascertained. By this method the exceptionally pre-potent bulls can be discovered before it is too late.

4. *Milk Recording.*—There is general agreement that the first step towards an all-round improvement in dairy farm management and an increase in economical milk production is the development of milk recording.

To develop milk recording it is important that the records should be generally recognised as being of commercial value, and to attain this object it is necessary that they should be strictly checked and supervised and kept in a uniform manner. It is stated that a larger staff is needed by the Board of Agriculture and Fisheries to supervise the 30,000 cows already being recorded under their scheme, and to organise into societies the many farmers who are now anxious to keep milk records. The only action previously taken by this Committee to deal with this question was the passing of a resolution that grants for milk recording assistance should be continued in 1919.

Recommendation.—In view of the fundamental importance of milk recording in the development of the dairy industry, the Sub-Committee urge strongly that energetic measures should be taken to increase the membership of the existing societies or to form new societies in every dairying district in Great Britain and Ireland. At the present time about 1 per cent. of the cows and heifers in milk in England and Wales are recorded, in Scotland about 5 per cent., and in Ireland less than 1 per cent. In each of the countries there is in operation at the present time a National Milk Record Scheme, and the Sub-Committee recommend that all necessary assistance be given in order that the responsible authorities may develop this work rapidly and to the fullest extent.

5. *Recommendation.*—It has been mentioned that one of the hindrances to development is the lack of reliable milk recorders. The Sub-Committee realise that the success of any society and the accuracy of the records depend to a very large extent on the knowledge and ability which the recorder brings to bear on his work, and they wish to recommend the provision of a definite course of training. They understand that such a course is already in existence in Scotland, but that no such course has been instituted in England and Wales or Ireland. They also suggest that the advancement of milk recorders of proved energy and ability to higher and more responsible positions is most desirable.

The duties of a milk recorder enable him to obtain a knowledge of the system of dairy management carried on in the 20 to 25 herds which he supervises, and for this reason these posts are recommended to students who on leaving an Agricultural College wish to gain additional practical experience.

6. *Analysis of Milk Records.*—*Recommendation.*—The Sub-Committee have been impressed by the valuable information which can be obtained from an analysis of milk records. They have had evidence as to the most interesting and useful results obtained in Scotland in respect of the average yield of milk and butter fat from Ayrshire cows of different ages and calving at different times of the year, and they recommend that provision should be made for a similar analysis of the records obtained in England and Ireland from the chief breeds of dairy stock in those countries. They believe also that the interest of farmers in milk records would be developed and considerable improvement in local methods of management would follow if an examination and analysis were made of the information collected by a Milk Record Society or by a group of societies. They understand that at the present time no provision is made for any such provincial study, and they wish to recommend that the Agricultural Colleges should be asked to undertake such an examination and to publish the results in a simple and concise manner. In making this recommendation they have in view the desirability of associating the educational side of milk record work with the local centre for agricultural and dairying education.

Recommendation.—The milk record scheme in operation in England and Wales appears to the Sub-Committee to concentrate attention mainly on the yield of milk. They are of opinion that the work of a Milk Record Society can most usefully be extended to include butter-fat tests of the individual cows in

the herd, or at least of those animals which have been found to be the heaviest producers and the calves of which are, therefore, most likely to be retained. *They recommend* that the Board of Agriculture be urged to formulate and publish a scheme for the testing of samples of milk from most or all of the cows in herds of members of milk record societies, and that the carrying out of the butter-fat tests at regular intervals should be encouraged by giving an additional grant to societies which adopt and carry out a reliable scheme.

7. *Register of Heavy Milking Cows.—Recommendation.*—The Sub-Committee have considered the scheme recently introduced by the Board of Agriculture and Fisheries for the formation of a register of dairy cows. They welcome this scheme, because they are of the opinion that it will assist and encourage the improvement of all dairy breeds, and because they have had evidence to the effect that such schemes have been of great value in other dairy countries. They wish to point out, however, that the scheme, in its present extremely simple form, which groups Jerseys with Shorthorns, and heifers with mature cows, does not meet the needs of the situation. They recommend that it should be developed as rapidly as possible to provide separate classes for the different breeds and for animals of different ages, and to take cognisance of the percentage of butter fat in the milk as well as of the total yield of individual cows.

2. IMPORTATION OF BREEDS.

8. Although there are several dairy breeds of international importance native to Great Britain, there are also breeds of great value which have originated in other dairy countries. The Sub-Committee considered carefully whether it was desirable in the interests of milk production in this country that the importation of dairy stock from any other country should be encouraged. They are agreed that the Friesian or Holstein-Friesian breed is the only one which need be considered from this point of view. This breed has attained a very high standard of excellence in its native country, has earned a great reputation in the United States, Canada and New Zealand, and is becoming increasingly popular in this country. Associated with the question of importation is that of the risk of the introduction of disease, but the Sub-Committee consider that adequate precautions can be taken in this matter.

Recommendation—The Sub-Committee, therefore, recommend that full facilities should be given for the importation of Friesians, provided that they come of a stock with a sufficiently high milking record. The standard should be fixed so high as to ensure that only the best dairy animals are allowed to enter the country, and their importation should be subject to the most stringent conditions that the Board of Agriculture may consider necessary in order to guard against the introduction of disease.

3. VETERINARY ASSISTANCE.

9. *Recommendation.*—The Sub-Committee have from time to time given attention to the provision of increased veterinary assistance for dairy farmers. In connection with this subject, they welcome the clauses in the Milk and Dairies Act, 1915, which provide for the appointment of Veterinary Officers by the Local Authorities charged with the administration of the Act. In so far as England and Wales is concerned, they wish to urge that the Veterinary Officers appointed should be whole-time officers, as is provided in the Scottish Milk and Dairies Act.

10. In respect of the diseases which cause most loss to dairy farmers, the most important are contagious abortion and tuberculosis. In the former, while affected animals do not die, there is a great loss in their market value, and a very serious indirect loss in calves and milk. The evidence which the Committee have had on this subject has been to the effect that compulsory notification of the disease has not brought about satisfactory results. The use of vaccine prepared and issued by the Board of Agriculture has been attended with good results, and the Sub-Committee are of the opinion that more active measures should be taken to bring the value of this treatment to the notice of dairy farmers and to encourage them to adopt it.

11. In respect of tuberculosis, the Committee consider that it is highly important that further steps be taken to reduce the incidence of this disease, and to increase as rapidly as possible the number of herds which consist solely of non-reacting stock. With this end in view, they submit the following scheme (drafted by a Special Sub-Committee appointed to consider the question) for the provision of free veterinary assistance, and the issue of certificates to farmers whose herds have complied with certain conditions.

(Signed) W. E. G. A. WEIGALL (Chairman).

June, 1919.

REPORT OF THE SPECIAL SUB-COMMITTEE ON THE INTRODUCTION OF THE ACCREDITED HERD SYSTEM IN RESPECT OF BOVINE TUBERCULOSIS.

1. The Sub-Committee have had under consideration the question referred to them in their Terms of Reference:—

“To suggest (as regards bovine tuberculosis) details by means of which a system of accredited herds can be established without unduly diminishing the production of milk.”

2. The Sub-Committee have reviewed the past and present position as regards the incidence of tuberculosis in dairy herds and the advice and assistance which have been available for farmers who wish to take steps towards its eradication. The general position may be summarised briefly as follows:—

- (1) There is reason to believe that the dairy herds of this country contain a large percentage of animals which would react to the tuberculin test.
- (2) Until recently farmers have failed to recognise the advantages of eliminating reactors other than the financial one accruing from the sale of pedigree breeding stock.
- (3) There is a lack of knowledge on the part of farmers of the comparatively simple methods to be followed in obtaining and keeping herds free from tuberculosis and of the economic advantages following therefrom.
- (4) There is a considerable lack of uniformity of system in the method and the interpretation of the tuberculin test.
- (5) There is no control of the use of tuberculin.
- (6) No serious attempt has been made by past Governments to assist the agricultural community in eliminating tuberculosis from the dairy herds.

3. The situation as outlined above is undergoing alteration, and may reasonably be expected in the near future to show an increased demand on the part of the public for tubercle-free milk at a higher price.

The Milk and Dairies (Consolidation) Act, 1915, and the Milk and Dairies (Scotland) Act, which may be expected to become operative at an early date, will also bring about considerable changes, as it will be possible by regulations under these Acts to grade milk, to license milk sellers, to increase inspection, and to improve the administrative machinery employed by the local authorities under the Acts, thus directly bringing an educative influence to bear upon farmers.

4. The Sub-Committee have had evidence to the effect that there has been a considerable increase in recent years in the number of farmers who are anxious to eradicate all tuberculous animals from their herds, and they are of opinion that a scheme which provided for—(1) official veterinary assistance in the work of diagnosis and eradication; (2) the issue of certificates in regard to those herds in which the necessary conditions had been complied with; and (3) correlation with a system of milk grading, which would provide an official guarantee on which the milk producer could base his claim to receive a better price for a better article, would be welcomed by progressive farmers, and would contribute very materially towards the eradication of this disease. They wish to emphasise the fact that eradication will depend on the thoroughness with which the details of the scheme are carried out, and they realise that to begin with progress must be slow. As the numbers of young stock in the clean herds increase, and as the supply of such stock becomes more abundant, the scheme ought to develop with greater rapidity. The Sub-Committee therefore beg to submit the following scheme as a basis to the introduction of the tubercle-free herd system:—

- (1) The manufacture, the distribution, and the use of tuberculin to be controlled by a Central Authority.
- (2) The method adopted in the carrying out and the interpretation of the tuberculin test to be standardised.
- (3) Facilities to be provided out of public funds for free tuberculin testing, provided that the farmer can supply satisfactory evidence that he has reasonable facilities for carrying out these tests and is willing to comply with the necessary conditions laid down for freeing his herd. Such a herd should be recognised as tubercle-free, and a certificate given to the effect that the herd was tested on a particular date and found free, and will be subject to re-testing periodically.

5. The Sub-Committee are also of opinion that, in view of the provisions of the Milk and Dairies Acts, the authorities deputed to carry out the above scheme should be those required under the Acts to appoint Veterinary Officers. These officers should be engaged whole time on official veterinary work.

The Sub-Committee realise that, owing to the shortage of qualified veterinary surgeons, it may be necessary to make temporary arrangements to meet the deficiency. In view of the difficulties associated with the disposal of reacting animals, the Sub-Committee consider that owners participating in the scheme should be advised as to the best methods of disposal. Should the reactors consist of valuable breeding animals, their progeny might be reared with every hope of obtaining sound stock, provided that proper precautions were taken in the feeding and housing to avoid infection.

In the opinion of the Sub-Committee the universal adoption of the Tuberculosis Order would materially assist the position.

6. Finally the Sub-Committee desire to emphasise the very great importance of the subject dealt with in this report. They would draw attention to the following passages from the report of the Royal Commission on Tuberculosis:—

“There can be no doubt that primary abdominal tuberculosis in man, as well as tuberculosis of the cervical glands, is commonly due to ingestion of tuberculous infective material.”

“A considerable amount of tuberculosis of childhood is to be ascribed to infection with bacilli of the bovine type transmitted to children in meals consisting largely of the milk of the cow.*

Whatever the exact amount of this human infection may be, it is a preventable infection, and as such calls for every effort to be made to deal with it.

(Signed) GERALD LEIGHTON, M.D. (Chairman).
 JAMES MACKINTOSH.
 A. W. J. MACFADDEN.
 J. F. BLACKSHAW.
 ROBERT HOBBS (Junr.).

June, 1919.

REPORT OF HANDLING SUB-COMMITTEE.

MEMBERSHIP OF THE SUB-COMMITTEE.

Major J. W. HILLS, M.P. (Chairman).

Mr. J. M. BELL.
 Mr. J. F. BLACKSHAW, O.B.E.
 Mr. WILFRED BUCKLEY.
 Mr. H. CHADDERTON.
 Mrs. M. E. COTTELL.
 Mr. C. T. CRAMP.
 Mr. P. A. FRANCIS.
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 Mr. C. H. TAYLOR.
 Mr. H. TROTMAN.

INTRODUCTION.

1. The Sub-Committee on the Handling of Milk was appointed in 1918 with the following terms of reference:—

“To consider the steps necessary (1) immediately, (2) after the war, to ensure that the condition in which milk is delivered to the consumer is as wholesome as possible, and to reduce the waste due to premature souring and deterioration in quality.”

* Report of the Royal Commission appointed to inquire into the relations between Human and Animal Tuberculosis (Cd 5761), 1911, page 39.

2. It will be seen that the nature of the enquiry set before the Committee determined its form. They had to ascertain the best methods of treatment, in the broadest sense of the word, which milk should undergo in transit from the cow to the consumer, and, therefore, their Report naturally follows such milk in its course and lays down for each step what the best method should be. Starting from the cow, it was held advisable to include the farm itself. Then followed the method of milking and treatment at the farm after milking. The practicability of milk depôts was also examined. Next the milk has to be taken to the consumer, either by road or, which is far more common, by train. The milk, therefore, was traced to its departure station, on the train, and to the delivery terminus. Its handling at the terminus was next considered, and its journey thence either to the retailer or to the factory. Its treatment at both of these places was gone into, and its delivery to the consumer. Lastly the risk of contamination in the consumer's house was examined, and rules for its proper care were ascertained.

3. As they followed the milk through its course, the Committee were continually laying down recommendations, either of greater or lesser importance, and in order to save time and to make their work of more practical value the whole Report has been thrown more or less into a series of such recommendations. A further reason for this lies in the nature of the subject. Upon a great many questions there is no dispute at all. There is general agreement as to what the proper method should be, and the difficulties which arise are in its application. The Committee, therefore, had no difficulty in reaching a decision as soon as they examined the subject. On only a few questions was there matter for doubt or difference of opinion. Of these pasteurisation may be cited as an example. The Committee have not expressed any final opinion upon this process for the reason that it has been submitted to a separate Sub-Committee.

4. We wish at the outset to say how grave are the evils which our Report discloses, and how little is being done to meet them. A supply of pure milk at an adequate price is one of the greatest needs of the community. Its value for the preservation of infant life is too well known to require elaboration. The susceptibility of milk to contamination is, on the other hand, extremely great, and yet though both these factors are a commonplace of medical knowledge and social investigation, little has been done to secure that purity which is so greatly needed. The methods of production and supply are in many cases archaic and unsatisfactory. This is not mainly the fault of those concerned in the trade. Enlightened methods have been handicapped, and moreover no one body has been charged with the care of milk. The system adopted has grown haphazard, and though the evils were recognised it has been nobody's duty to put them right.

5. After this short introduction, we will proceed to trace the course of milk from the farm to the home. Our Report contains recommendations both on the human and on the mechanical side, and it is difficult to say which is the more important. Cows may be properly milked and yet the result will be unsatisfactory if the outfit of the farm is imperfect. Milk may be produced under the best possible conditions, cooled immediately after milking, and yet all trouble and expense may be wasted if the churns are unsuitable or the railway vans of a wrong type. It may reach the retailer in a pure state, and all the gain may be thrown away by improper or careless delivery. Lastly it may be received pure into consumers' houses, and unless it is protected from dust, flies, and other contamination all the previous labour will have been in vain. Consequently the whole question hangs together. It is a chain of which one weak link vitiates the whole. It cannot, therefore, be tackled piecemeal, and it is to be hoped that any action taken will be both immediate and complete.

I. TREATMENT AT FARM.

6. We take first the treatment at the farm.

Cows.

Health.—Cows should be healthy and should be examined by a veterinary surgeon once every six months. It is desirable also that they should have passed the tuberculin test, and that they should be tested at least once a year and any reactors removed. Cows that have not been tested should not come into contact with tested cattle. As a precaution, it is suggested that cattle which have not passed the test should not be admitted to shows. When cows are suffering from temporary illness, such as bad quarters or sore teats, the milk should not be used for human food.

Cleanliness.—Cows should be regularly groomed, and all long hairs should be clipped from the udder. Just before milking, the flanks, hind quarters, udder and teats should be thoroughly cleansed by washing, and gone over with clean damp cloths.

Food.—The food provided should be wholesome, clean and sweet. Care should be taken in the use of foods, such as wet grains, silage, decaying cabbages or roots, which tend to give the mangers and cowshed a disagreeable odour, and dusty foods, especially hay, should not be given during milking.

Water Supply.—Drinking water, whether in the field or in the cowshed, should be abundant, fresh and free from contamination.

COWSHED.

Location.—The cowshed should be situated on a dry site and without any dungstead, liquid manure tank, pig-sty, or other source of contamination or breeding place for flies in close proximity. The yards round the cowshed should be kept as free as possible from dust and mud and well drained. All dung and refuse should be removed from the cowshed twice daily, and where not taken to the field should be carried to a suitable distance or deposited in a properly constructed manure pit. The surface of every yard and passage in connection with a dairy or cowshed should be kept in a clean condition.

Construction.—Stalls should be provided for each individual cow, or at most for each pair of cows. The floor should be of a material incapable of absorbing moisture, which can be well scrubbed and washed. The gutter should be sufficiently deep, and so placed that the standing space is kept as clean as possible. Also the gutter should be of sufficient width and slope to allow liquid to drain away at once. The walls should be smooth and impervious for at least six feet from the floor. The roof should be as simple as possible, so that it may be easily cleaned. The feeding troughs should be such as to facilitate cleansing. All gutters in a cowshed should lead to a drain inlet in the open air at some distance from any window or door of the cowshed, or to some other suitable place of disposal. All drains from the cowshed should be properly trapped.

Provision for Light.—The windows or openings admitting light should be so placed as to secure sufficient lighting of every part of the interior of the cowshed, and the total area admitting light should not be less than three square feet for every stall. The sources of artificial light provided should be ample and should be kept in a clean condition.

Ventilation.—Ventilation should be sufficient to maintain at all times a sweet and wholesome atmosphere. There should be outlets through the roof to allow heated air to escape, and air inlets in the walls. The area of inlets and outlets together should equal 36 square inches for each 800 cubic feet. In cowsheds from which the cows are habitually turned out during a portion of each day there should be a minimum air space of 600 cubic feet for each cow, and in other sheds there should be a minimum air space of 800 cubic feet for each cow, but these minima can be reduced for small breeds or where, as in the north of Scotland, climatic conditions are severe.

Cleansing.—All cowsheds should have an adequate supply of pure water for cleansing purposes, and floors, walls, and partitions should be kept well washed and cleaned. The rafters and roof should be free from dust and cobwebs. The manger and all windows and artificial lights must be kept clean and in good working order. All upper walls and roofs should be regularly lime-washed or sprayed with a good disinfectant, according to the nature of the wall or roof.

MILK ROOM AND MILK HOUSE.

7. *Location.*—The milk room should be situated at a sufficient distance from the cowshed and the dungstead or other source of contamination, and care must be taken that the drainage is thoroughly efficient.

Construction.—The entrance of the milk room should be from the open air and not from the dwelling-house, cowshed or any other farm building, and the room should be used for no other purpose than for the treatment of milk. The floor should be smooth, with a slope to provide good drainage. There should be no inside drain but an outlet through the wall to a properly trapped gully. The wall should be smooth, and the roof also should be easily cleaned. The room should be properly lighted and ventilated, and, if possible, no internal equipment should be attached to the walls, as the numerous corners then formed are very difficult to clean. It is desirable that a separate room should be provided for the treatment of the milk, cooling, bottling, &c., and another for the washing of the utensils. The latter room should have an ample supply of hot water, or steam or both.

GENERAL REMARKS AS TO COWSHED AND MILK ROOM.

8. In making the above detailed recommendations, the Committee wish it to be understood clearly that it is not so much costly premises as attention to details which is necessary to produce clean milk. Though up-to-date buildings are desirable, treatment is more important than the type of edifice used.

UTENSILS.

9. *Milking Pail.*—Milking pails should be of well-tinned material, with all seams rendered quite smooth and all joints flushed over with solder, and so constructed that all parts are easily visible and can be thoroughly scrubbed by hand. Some type of small top milking pail should be used in preference to the common open pail.

Cooler.—The cooler used should be in good condition, and sufficiently large for the quantity of milk to be cooled.

Strainer.—Strainers of wire gauze alone are unsatisfactory. Those used should consist of wire gauze with discs of cotton wool, or, in place of the latter, a straining cloth of sufficiently close mesh.

Churns.—All churns should be kept perfectly clean, free from rust and smooth inside.

Type of Churn.—The common 17-gallon railway churn should be replaced by a smaller size, preferably a 10-gallon churn. The Ministry of Food were good enough to submit drawings of the 10-gallon churn selected by them, and it was generally approved, though some of the Sub-Committee prefer a 12-gallon churn. Nine churns of the 10-gallon type, holding 90 gallons, occupy only the same floor space as four 17-gallon churns holding 68 gallons. There is, therefore, a large gain in transportation. The other arguments against the 17-gallon churn are that it is heavy to lift and too heavy for women, and that it is too deep for the bottom to be cleaned properly by hand. Altogether the arguments for the smaller churn are overwhelming.

Cleanliness.—All utensils should be thoroughly washed, then scalded with boiling water or steam, and immediately inverted in pure air to dry. Where possible, a sterilizing box should be used instead, and the utensils left in it till required.

COOLING OR CHILLING.

10. It is eminently desirable that milk should be chilled to 45° F., and that this should be done immediately after milking. In any case, it must be cooled to 60° F., though nothing short of 45° is really satisfactory. In this report chilling is used to mean at least 45° and cooling at least 60°. The Committee recognise, however, that chilling is not always or indeed generally practicable in this country, where ice is neither cheap nor readily available, and where the summer temperature of any water obtainable is often much above 45°. But they have no sort of doubt as to its desirability; so vitally important is it, indeed, that, though it may not be possible to enforce a universal standard of 45°, this should be the ideal aimed at. Two ways were suggested to the Sub-Committee of reaching this standard: First, that the milk should be collected from the farm, taken to local depôts and chilled there; second, that chilled milk should obtain a higher price.

DEPÔT SYSTEM.

11. The Sub-Committee are agreed that milk chilled at the farm should obtain a higher price, but they are not unanimous on the depôt system. In support of the system it is urged that it enables the milk to be chilled to 45°; to be housed in cold storage until despatched by train; it ensures milk being sent from one station in large quantities, instead of from several in small; it saves labour and renders easier the proper equipment of the station; it enables farmers who produce too little milk to make it worth their while to rail it, to find a ready market at the depôt, and less milk is wasted, because it can, if need be, be converted into milk products.

On the other hand, it is urged that it is a retrograde system. It frees the producer from the responsibility for quality, cleanliness, and chilling; it frees him from guarantees of purity; it delays the milk and lengthens the interval between the cow and the consumer; and that the best plan is to insist on proper cooling and production at the farm.

12. The Sub-Committee are unanimous in regarding any delay in reaching the consumer as disadvantageous so far as it goes, but in spite of this, a majority of them consider that the advantages of the depôt system outweigh its disadvantages. They are specially led to this conclusion by what they regard as the impossibility of chilling milk in summer at small dairies.

The proper organisation and equipment of depôts is set out in paragraphs 18-22 inclusive.

PASTEURISATION.

13. The Sub-Committee gave much consideration to the question of pasteurisation. They found that there was no accepted definition of pasteurisation, and that there was acute difference of scientific opinion as to its effects. They therefore make no recommendations thereon. They consider it the duty of the Government Departments concerned to take immediate action to arrive at definite conclusions on the subject.

MILKING.

14. Milkers previous to milking should put on clean milking suits and caps, and wash their hands carefully, and should be careful that their hands remain clean throughout the entire milking period, even though this entails washing before milking each cow. Clean caps and suits should be supplied to the milkers when necessary, and not only at stated intervals. The milking should be done with clean dry hands, and the fore milk should be drawn from each teat on to the floor or into a special receptacle, and not into the milk pail.

HANDLING THE MILK.

15. The milk of each cow should be removed from the cowshed immediately after milking, and carried direct to the cooler without pouring it into another pail. It should then be immediately strained and chilled churn by churn. The temperature to which the milk is chilled should, as has been said, be 45° F., or as near there as possible. Where the cooling is done in a milk-room exposed to wind and draughts, the exposed surface of the cooler should be covered to prevent dust blowing on to the falling sheets of milk. When the churns or bottles are filled they should be immediately closed and set in a cool place not exposed to sunlight, until the time of transportation to the station or purchaser's premises.

TRANSPORTATION TO STATION OR PURCHASER'S PREMISES.

16. Churns should be sealed and should be carried in a properly sprung cart or float. They should be protected when in the cart by suitable covers from mud, dust or rain, and also from the direct rays of the sun. It is advisable that the temperature of the milk in each churn should be marked on it.

CONTENTS BY WEIGHT.

17. Churns are not measures, and disputes often arise between farmers and buyers as to quantity. Then again, old churns get dented, and in particular the convex bottom is driven up into a concave shape, which makes it an unsatisfactory guide to quantity. For these reasons there are strong arguments in favour of dealing in milk by weight, weight being converted into quantity at the rate of 10.33 lb. to the gallon. If this were done all churns should be stamped with tare weight. They would then be weighed by the railway company at the despatch station, and a way-bill made out in triplicate: one part retained by the sender, one by the railway company and the third delivered by the guard to the consignee.

TYPES OF DEPOTS, IF ADOPTED.

18. If depôts are adopted they should be of three types. First, chilling depôts, drawing milk from a comparatively short radius, say, 10 miles, capable of handling up to 500 gallons. Second, larger depôts, still confined to liquid milk, with a capacity of up to 2,000 gallons. Thirdly, depôts for dealing with liquid milk but equipped with cheese-making plant and with a capacity of from 500 to 2,000 gallons.

EQUIPMENT OF DEPOTS.

19. All three types of depôt should possess equipment for weighing milk, straining and chilling, cold storage and churn-washing machinery. The outfit would, of course, vary according to the capacity of the depôt. The second and third types of depôt should possess, in addition, tank storage, pasteurising plant and a small laboratory for testing milk, and the third type should also possess a cheese plant.

CHILLING DEPOTS.

20. Taking these first, farmers within a certain radius should be required to deliver their milk to them. Outside that radius the depôts should collect at stated hours either from the farms direct or at fixed rendezvous, or suppliers might themselves organise group collections. The milk from the chilling depôt would be delivered either on rail, or direct to the retailer, or to a factory, or to a larger depôt.

LARGER DEPOTS.

21. These would receive milk either direct from producers or from chilling depôts. They would only be possible in districts where manufacturing plants exist capable of treating the surplus milk in case of emergency. They would deliver the milk either on rail or to the retailer or factory.

DEPOTS WITH CHEESE PLANT.

22. Those explain themselves. The plant would, of course, vary according to the capacity required.

II. TRANSIT.

RECEPTION AT RAILWAY STATION.

23. The milk has now reached the departure station and we must see what happens to it there and on its journey.

There are very few stations where any provision is made to protect the churns from sun, dust, or dirt, and milk has often to lie for some considerable time under most undesirable conditions. It may be contended that farmers should not deliver milk to the station until just before the arrival of the milk train,

out while this may be possible with the morning consignment, it is not so in the evening, for trains often depart so late that milk must be delivered long before, otherwise the farmers' workers who delivered would get no sleep. The Committee recommend that at all stations where any quantity of milk is received a cool room should be provided for churns, and used for nothing else; and at the larger stations refrigerating chambers should be established. If the depôt system were adopted, all stations served by a depôt could have cold storage, which is a great advantage.

RAILWAY VANS.

24. The old open type is still mainly in use, but it is unsatisfactory. The ideal would be ice-cooled vans, such as are used in Denmark and the United States; but ice is too dear and scarce for this to be possible in this country. The railway companies should be asked to produce experimental vans, either cooled by air or otherwise, and comparison could then be made of their efficacy. The Committee are unanimous in condemning the present open van, but they are not agreed on the type which should replace it, as they consider that the subject requires further investigation.

TRAIN SERVICE.

25. Since the war the train service has been going from bad to worse, by reason of the depletion of railway staffs and despatch of locomotives, waggons, and rails to France. Peace-time service should be restored immediately. The railway companies should provide a service twice daily.

CARRIAGE BY TRAIN.

26. Milk, having been loaded at the dispatch station, is made up of consignments not only for the terminus but for suburban stations. A non-stop train runs into the terminus, and then a slow train carries back the suburban consignments and drops its load station by station.

ARRIVAL AT TERMINUS.

(a) Taken to Retail Depots.

27. On reaching the terminus milk is dealt with by one of three alternative methods, each with separate features. It is either taken straight to the large depôts or is taken over by wholesale dealers or direct by the retailer. To deal first with the large retail depôts: on arrival at the terminus the large retail companies are in waiting with their lorries and vans to convey the churns to their centralised depôts for checking quantity, condition, and quality, where by numerous mechanical appliances it is filtered or clarified, pasteurised, chilled, and placed in a fresh set of clean cans or churns for distribution to the retailing branches.

(b) Taken over by Wholesale Firms.

28. If, however, it goes to wholesalers, the proceedings are different. The strictly wholesale dealers who supply individual retailers examine the churns at the railway station. Examination near the station is necessary, for it would be a waste of labour and transport to start a carman out with a load of milk which his customer might reject on delivery. Milk which does not pass this examination is sent to the dairy to be filtered, pasteurised, chilled, or otherwise dealt with. But, while examination near the station is a necessity, the Committee condemn in the severest terms the practice now prevailing in London and other large termini. It is the custom to inspect the milk on the railway platform. The churns are opened on the platform exposed to all the dust, dirt, and risk of contamination which must exist at a busy terminus. Not only are churns opened, but the milk is tested, and the contents of one or more churns may be mixed together; during this process the lids of the churns often lie underside downwards on a filthy platform, and are then replaced on the churns, with consequences which may be imagined. All this is so unsanitary that it only has to be stated in order to be condemned, yet it still goes on. There should be an absolute rule that no churn under any excuse whatever should be opened at a railway station, and to this rule there should be no exception.

EXAMINATION AT TERMINUS BY GOVERNMENT OR LOCAL AUTHORITY.

29. But the milk dealers are not the only sinners. We are informed that Inspectors either from the central Government or the Local Authorities also open and inspect churns at railway stations, and we condemn this with equal emphasis. It is not necessary and should cease at once.

30. If handling milk and opening churns near the terminus is necessary, and the Committee recognise that it is, a proper building or Clearing House should be set apart for this, suitably cooled and equipped and used for nothing else. The Local Authority should bear the expense of providing it.

(c) Milk sent direct to Retailer.

31. There remains one more case to consider: milk which is not consigned to the large retail depôts or to wholesalers, but sent direct from the farm to the individual retailer. In the main, the precautions suggested in the previous paragraphs apply to this milk, for in its journey from the cow to the railway terminus it follows the same course. But milk so supplied has certain incidents and difficulties which are peculiar to it, and these require explanation.

32. An ideal source of supply for a large city retailing firm would consist of farmers of four classes. These would be, first of all, farmers within a short distance of the terminus, sending milk twice daily and keeping up approximately the same supply in winter as in summer. Next there would be farmers within a longer distance, also producing an equal supply all the year round, but sending only once daily. Thirdly, some farmers between whose winter and summer supply there is a large margin. Lastly, there are accommodation senders, who normally employ their milk for cheesemaking, but who at week-ends (in order to avoid Sunday cheesemaking) and in winter are willing to sell to the retailer. Between these four classes the retail dairyman had in normal times no difficulty in regulating his supply. The system was much to recommend it. The evening's milk from both the long and short distance farmers is served to customers fresh before 8 o'clock on the following morning, while the morning's milk from short distance farmers is delivered fresh that same evening, and that from long distance farmers is pasteurised.

The war and controlled prices threw this branch of the trade into the greatest confusion. It was difficult for retail dairymen to retain their supply, since, until the recent Milk (Summer Prices) Order, farmers got the same price from the factories. Thus much milk was diverted, and retail dairymen were put to desperate expedients to obtain reliable milk, even in some cases, it is alleged, making secret payments over the controlled price. It is hoped that the trade will soon return to normal conditions.

SPECIAL DIFFICULTIES OF THE SYSTEM.

(i) *Opening of Churns at Railway Stations.*

33. Retail dairymen do not use railway churns for delivery purposes. Therefore, on arrival the milk must be transferred into delivery churns, from which the milk is supplied to the actual consumer. Under proper conditions this transfer should take place on the retailer's premises. His vans should fetch the churns from the terminus: they should arrive at his place of business with seals unbroken, and should then be opened and the milk inspected for quantity and condition, analysed, and measured out into the delivery churns. Unfortunately, this ideal state of things by no means always obtains. It is not unusual for churns to be opened and milk transferred at the railway station, with consequences mentioned in a preceding paragraph. We can only repeat what we have said in paragraph 28. Moreover, the war has made this proceeding more common than before; there being an acute shortage of churns and of labour, retailers have been driven to economise churns by emptying them at the railway terminus, in order to return them more quickly to the farmer and to economise labour by saving the carriage of the full churns from, and the empty ones back to the station.

(ii) *Difficulty of Cleaning Churns.*

34. But this does not represent the whole evil of opening railway churns at stations. There is also the impossibility of cleaning them there. If churns are taken, as they ought to be, to the retailer's premises, they can be properly cleaned and steamed there. But if they are emptied at the station they are then bundled straight back into the train without even being rinsed. This, unfortunately, is happening daily in London to hundreds of churns.

All this reinforces the Sub-Committee's recommendation that clearing houses should be established at all large termini. We regard this as an absolutely essential reform.

LOSS OF CHURNS.

35. The loss of railway churns calls for serious consideration. It is the unanimously expressed opinion of the trade that more churns are lost than ever before, and that the number lost is still increasing. As the value of a 17-gallon churn is at least double that of the milk it will contain, it is obvious that any serious increase in the expense of replacing losses must have an appreciable effect on costings, and consequently on the price to the consumer. Another effect of churn losses is to discourage farmers from direct sending, as continued irregularity in the return of empties frequently leads to an abrupt termination of relations and is fatal to the chance of a renewal of contract. The knowledge of this urges buyers to throw in churn after churn on receipt of complaints from senders. The Sub-Committee are satisfied that the loss of railway churns is aggravated by the mixing-up of churns from many different owners in factory yards, whence they are despatched, not to their rightful proprietors, but indiscriminately all over the country. In circumstances of such confusion, it is impossible to make operative the regulation by which it is an offence to use other people's churns, but of the necessity of such a regulation the Sub-Committee have no doubt.

SUGGESTED REMEDIES.

36. All milk sold by wholesale should be in seller's churns, except in the case of producers selling directly to one customer only, or producers sending directly to one customer by direction of the seller, or milk fetched away by the buyer from the place of sale. Penalties for wrongful possession or use of churns should be rigorously enforced by proceedings taken, not by the aggrieved owner, but by the authorities, on information received. Properly authorised inspectors should have the power to enter at reasonable times any place where they have cause to suspect the presence of stray churns. Every churn should be indelibly imprinted on the body with the owner's name and address, and the date of purchase. On the occasion of a sale, the new owner's name and the date of purchase should be imprinted, but no erasure of the late owner's name should be allowed, thus each churn would bear a record of its history. All churns, or parts of churns, found derelict at railway stations should be collected and sent to a clearing house. It should be an offence for any station master to allow a stray churn to remain longer than a specified time on his station. The owner of a churn, as indicated by its inscription should be offered his property (when derelict) on payment of a reasonable charge for expenses of recovery, and should he refuse to accept the churn on these terms, or fail to reply, then the churn should be sold and marked as prescribed. The question as to who is to bear the charges involved in these suggestions would have to be considered.

III. RETAIL DISTRIBUTION.

37. The milk has now reached the retailer, and its sale by him must be examined. This has different features in different localities.

(i) LONDON.

The milk supply in the County of London has one characteristic which cannot be found in any other city or town in the United Kingdom, for the inhabitants of inner London, say a radius of ten miles from Charing Cross, do not obtain their milk from the immediate outer zone as in the provinces, but have to break through a ring of some 40 miles before they begin to pick up supplies. The outer ring or zone consumes nearly all the milk produced in its own area, and therefore compares with the Provinces.

38. Given a train service twice a day and two retail deliveries daily, deliveries would be one milking behind, for the evening milking would be delivered the next morning, and the morning in the afternoon. This was the practice before the outbreak of war. The difficulties that have arisen as a result of wa

conditions, shortage of labour, curtailed train service, great shortage of utensils and small cans, together with the employment of women, forced the dairy trade to deliver only once a day, so that to-day it may be taken that deliveries are one day behind production. This is a war necessity and should not be allowed to continue longer than is necessary.

Present Methods of Delivery.

39. Milk is sent out from the retailing depots either in large brass mounted churns or in glass bottles. Taking the churns first, these are fitted with a tap and a suitable size hand-can of 6, 8 or 10 quarts. Each carrier is provided with a measure dipper with which the household supplies are measured out. The hand-can and measure is a survival of the early days of milk vending, and is unquestionably the cheapest form of milk distribution. The disadvantage is that milk is dealt with in the street and exposed to contamination from dirt, dust, and flies.

40. Delivery churns should be sealed and a control sample from each churn retained, so that if a sample is taken by an inspector under the Sale of Foods and Drugs Act, or if any customer makes a complaint, the dairy control sample affords an effective check on the roundsman.

Glass Bottle Service.

41. So much for the ordinary way of delivering milk in London. The delivery cart, either pushed by hand or drawn by donkey or pony, is too common a sight in our London streets to need any elaborate description. But besides milk from delivery churns a small percentage of the total supply is delivered in glass bottles, bottled and sealed at the dairy, and encouragement is given to this method in the present Milk Order, which allows a penny per quart for the bottled milk over the price to be charged for loose milk. The history of the glass bottle service is instructive. The disc-stoppered glass bottle was introduced to this country by a well-known company in 1897-8. It was used for nearly two years at an extra charge of a penny per quart with gratifying results, when another company suddenly started delivering milk in bottles at the same price as loose milk, then fourpence per quart. It is true that this company, after making a heavy loss, gave up the practice, but their intervention caused an upheaval in the trade which did not cease with their departure. It increased the demand for milk in glass bottles, and dealers were driven to supply it at the same price as loose milk. This was an entirely profitless line of business, which could only be made profitable by giving short measure, which, of course, all reputable dealers refused to do. They attempted to impose the extra penny per quart, when another competitor entered the field, made their venture, disorganised the trade, and in turn lost their capital. The foregoing examples show that milk in bottles holding full and proper measure cannot be sold profitably at the same price as loose milk.

After-War Possibilities.

42. Yet the fact remains that a well-organised glass bottle delivery service for milk is to be desired. But it must be commercially profitable. It prevails in America and in Paris. Is it desirable or possible to make it compulsory here? Its advantages are the avoidance of contamination; its drawback the extra cost, extra weight, extra bulk and the impossibility of supplying small quantities, for one pint is the smallest bottle practicable. As to cost, the one penny per quart charged in peace-time would probably scarcely meet the present increased cost of glass bottles. The weight and bulk of milk in pint bottles is about double that in churns, as will be seen from the following figures:—

Taking a round of 36 gallons.

<i>Pint bottles.</i>			
Crate containing 12 full bottles,	36 gallons would require		
1½ gallons.	24 crates.		Dimensions (inches).
41½ lbs. weight.	996 lbs.		11½ by 9½ by 16½ each.

24 crates would require a huge space, 35 by 50 by 30.

<i>Churns.</i>			
2 required, 18 gallons each.	Weight of milk.		Total.
Weight—48 lbs. each = 96 lbs.	372 lbs.		468 lbs.

Space required for churns 20 inches diameter: 40 inches by 20 inches.

<i>Difference in Weight.</i>							
36 gallons in bottles ...	...	...	...	...	...	...	996 lbs.
36 " " churns ...	...	...	...	...	...	...	468 "
							528 "

Hence, bottles are more than double the weight of churns.

Quantities less than one pint must be fetched by customers themselves from shops, and seeing how much milk is taken in half-pints or less, this would cause considerable inconvenience. On the other hand the prohibition of the open milk-can in the street would be a great advance in the interests of public health, and consumers would benefit thereby, as a milk service, bottled by machinery at the dairy depot under hygienic conditions, sealed and delivered in bottles, containing full and proper measure, would be advantageous to those customers who take not less than one pint at a time. Customers requiring less than one pint would be less conveniently served as they would have to get their smaller quantity from the dairy shop. The practice in America appears to be that, in addition to the deliveries direct to the consumer's house, milk is on sale in sealed glass bottles at a number of "stores" and the purchaser-dealing from the "store" purchases the first bottle as well as the milk, and returns the empty bottle when a fresh full one is required. Assuming that delivery in bottles is best, it is impossible to make a hard and fast order in the first stage, as the needs of smaller customers must be met, and if a change is made the trade must have time to adapt itself to it.

43. We, therefore, recommend that the ideal to be aimed at is a delivery in bottles, but we recognise that this involves a drastic change in the trade and can only be reached gradually. Meantime bottled milk should be encouraged by being allowed a higher price.

(ii) THE PROVINCES.

44. The methods at present in use vary considerably in different towns. For example in many large towns in the north of England and elsewhere a large percentage of the milk is delivered by local farmers who both produce and retail their own milk. On the outskirts of Manchester, again, there are many farmers who have the same method, and most of the milk they sell in normal times is sold "warm from the cow" twice daily. But the bulk of the milk in the Provinces is delivered, as it is in London, from churns. The difference between the Provinces and London lies in the fact already noted that London milk usually has to travel further. The milk is retailed either by being drawn off from a tap at the bottom of the churn, or the churn's lid is lifted and the milk ladled out and measured. The same criticisms can be made on this as were made on the London practice. The system of delivering in bottles has not made much way. It remains, however, the best system, but its introduction must be a matter of time, and some means must be devised for supplying customers requiring less than a pint more convenient than that of compelling them to go to shops.

45. There is, therefore, not much to distinguish the supply of large towns from that of London. In London, it is true, the milk has to travel a longer distance, and direct supply by the producer is, therefore, much commoner in the provinces. But the differences do not call for any comment for they do not involve different treatment. All the evidence is in favour of the recommendations made earlier in the Report; the importance of chilling at the farm, of quick and sanitary transit, of proper distribution.

IV. TREATMENT OF MILK AFTER DELIVERY AT THE CONSUMER'S HOUSE.

46. The strictest precautions may be taken at the cowshed, during transit, and during delivery to ensure a supply of clean milk, yet all these precautions may be nullified if care is not exercised in the consumer's house after delivery.

47. Milk in the house is exposed to contamination from various sources such as dirty milk vessels, dust and flies, and the influence of temperature.

48. While a warm temperature brings about an increase in the number of bacteria present in the milk before delivery, contamination from milk vessels, dust, and flies adds new bacteria. It must be noted that the new additions, especially the bacteria from flies, may be of a dangerous character, producing definite disease in susceptible persons. For example, infantile diarrhoea, enteric fever and possibly diphtheria may be caused in this way.

Most housewives know that milk cannot be kept fresh in a dirty vessel. For this reason, and also because a sufficient supply of hot water for cleansing is usually readily available in the kitchen kettle, contamination from milk vessels is perhaps not the most common cause of deterioration. The contamination of milk in the house from exposure to dust and flies is much more common, since the public generally have not yet recognised the importance of at all times keeping the milk covered, and, as has been noted above, it is more dangerous.

49. The most important factor determining the deterioration of milk in the house is temperature. Bacteria increase with a rise in temperature. Most bacteria are inhibited at 50° F., but they multiply rapidly with rise of temperature until 100° F. is reached when they are again inhibited. The usual temperature of a dwelling house, 65° F. and upwards, is most favourable for the multiplication of bacteria and thus souring occurs.

In summer, therefore, conditions are most favourable for rapid souring unless precautions are taken. The popular view that thunder causes souring of milk is a fallacy; it is the warmth of the atmosphere during thundery weather which brings about this result.

50. Contamination from all three sources can, however, be avoided by the use of simple precautions. Milk vessels should be cleaned with boiling water, and kept covered, not only when holding milk, but before. Milk should be stored in a pantry, cellar, or other cool place. This, of course, is a council of perfection, for unfortunately many dwellings do not contain any cool place; but if they do not, certain precautions can be taken which are within the capacity of the humblest home, such as to place the milk jug in a basin of cold water and allow fresh cold water to trickle into the basin. Another is to cover the jug with a small inverted basin, put a piece of muslin over this, and place the whole under the tap and let cold water trickle over the muslin. Lastly, in very hot weather (but only then) the jug can be covered by a wet cloth, and the milk cooled by evaporation.

The Sub-Committee are glad to note that some Public Health Authorities throughout the country have in recent years been steadily inculcating these ideas, and that from the Infant Welfare Centres and Schools for Mothers, which are being established all over the country, instructions are being given broadcast. But much more still remains to be done. The need for instructing the people with regard to milk, as with regard to other health matters, is great and urgent.

51. Owing to abnormal conditions, souring of milk in the consumer's house has been the cause of serious waste during the war and now. This has been largely due to the delivery of milk taking place only once daily and the milk being older than in normal times. Much milk now being delivered in London is at least 18 hours old, and some at least 24 hours old. On account of the single delivery daily the consumer must keep a portion of this milk in the house until he receives his supply next morning, that is, nearly 24 hours after delivery. Thus the milk for the baby in the morning, not considering the porridge for adults, may be anything from 36 to 48 hours old, or older.

52. Waste from souring is most likely to occur during the warmer months of the year although even in winter a few days of mild weather may cause the same result, especially with the single daily delivery when the milk delivered is many hours old.

53. This waste can be minimised by using the remedies mentioned early in the Report. If milk is properly chilled at or near the farm and delivered cool, souring is less probable. If it cannot be chilled, it should be pasteurised. A delivery twice daily is a great help, and lastly the consumer can protect himself by heating the milk to the boiling point and storing in a cool place.

54. The Sub-Committee were not concerned to decide the debatable question whether more contamination took place at the farm or at the home, for they are satisfied that the risk at the home is so grave and so common as to require immediate action. There is abundant evidence of this, and it comes from New York

as well as from this country. The Sub-Committee are therefore satisfied both of the risk arising in the home and also of the futility of wasting time and money on obtaining pure milk unless at the same time a universal educational campaign is undertaken to teach housewives the danger and folly of buying milk and then allowing it to become contaminated or decomposed when a few simple precautions would maintain its purity.

55. This concludes our enquiry. We can only repeat what we said at the beginning, that the question is one of the most urgent health problems before the country. We believe that if our recommendations are adopted the standard of purity can be raised very greatly; and there is universal agreement as to the benefits which will accrue from this not only to children but also to adults. And we believe also that this can be done without undue increase of price. If our enquiries have the effect of hastening this desirable result we shall be well satisfied.

56. We wish to express our gratitude to our Secretary, Miss Mackenzie, whose knowledge of the subject and business capacity have proved of the greatest assistance to the Committee.

(Signed) J. W. HILLS (Chairman).

June, 1919.

REPORT OF THE SUB-COMMITTEE ON LABOUR IN DAIRYING.

MEMBERSHIP OF COMMITTEE.

Major The Hon. E. F. L. WOOD (*Chairman*).

Mr J. F. BLACKSHAW, O.B.E.	Mr. J. MACKINTOSH.
Mr. WILFRED BUCKLEY.	Miss M. M. MACQUEEN.
Mr. C. T. CRAMP.	Sir GEORGE NEWMAN, K.C.B., M.D.
Mr. P. A. FRANCIS.	Sir DOUGLAS NEWTON, K.B.E.
Mr. C. M. DOUGLAS, C.B., D.Sc.	Mr. GEORGE NICHOLLS.
Mr. H. M. HOLMAN.	Mr. HAMAN PORTER.
The Hon. Mrs. EDITH LYTELTON.	Mr. POOLE WILSON.

TERMS OF REFERENCE.

1. *Terms of Reference*.—"To consider what steps can be taken to meet the immediate difficulties with which farmers are faced at the present time and also to devise some means of making dairying more attractive and so enabling it to compete with more hope of success with industry."

2. *Meetings and Witnesses*.—The Sub-Committee have held nine meetings and have interviewed witnesses from the National Farmers' Unions of England and of Scotland, the Scottish Chamber of Agriculture, the Agricultural Labourers' and Rural Workers' Union, the Workers' Union, the Scottish Farm Servants' Union, and with reference to labour conditions in Wales.* They have also had before them the opinions expressed by the Royal Agricultural Society of England, the British Dairy Farmers' Association and the Highland and Agricultural Society of Scotland when the representatives of these Societies gave evidence before the Main Committee on the development of the dairy industry.

3. *Immediate difficulties*.—According to their terms of reference the Committee were asked in the first instance to consider what could be done to meet the immediate difficulties of dairy farmers. Since the Sub-Committee was set up hostilities have been suspended and consequently some of those difficulties directly attributable to the war are likely to be less seriously felt. It is, therefore, unnecessary for the Sub-Committee to prepare definite recommendations on these points.

4. *Future conditions of Labour*.—In respect of the second subject of their reference, namely, "to devise some means of making dairying more attractive and so enabling it to compete with more hope of success with industry," they realise that the subject is of profound importance to the continuation and development of dairy farming and that the conditions of the dairy industry are so various, that their Report is likely to be more useful educationally by collating different suggestions as to how the methods and conditions of labour in dairying may be improved, than by formulating definite recommendations with a view to legislation.

5. *Necessity for practical suggestions*.—The conditions under which dairy farm labour is carried on are not susceptible to rapid change, and at the present time the effect of ill-balanced recommendations might well be to increase the tendency of farmers to dispose of or to reduce their herds in order to lessen their labour difficulties.

The increased demand for milk from all towns and cities has brought farming for milk production into existence to a greater or lesser degree in almost every county in Great Britain, and as a result there is an extraordinary variety in the conditions obtaining on dairy farms. Even in the well known dairy districts—South West of Scotland, Cheshire, Lancashire, Derbyshire, South Midlands, Essex, the South Western Counties of England and the South West of Wales—the traditional habits of the farmers and the workers, the climate, the soil, the type of farm buildings all show great variation, and make the formulation of general recommendations well-nigh impossible.

For all these reasons, the Sub-Committee have been impressed with the necessity for making suggestions which would commend themselves to practical farmers, and which could be introduced with the least disturbance into the systems of farm management which are at present followed.

6. *Common Features*.—Throughout all dairy districts, however, there are two important considerations which emerge as common to all dairy farms. These are:—

- (a) the necessity for the carrying on of the work of feeding, milking and management of the milk seven days a week and every day of the year;
- (b) the desirability of having cows milked twice daily at as equal intervals as possible.

These points are of great importance and must be regarded as fundamental in the arrangement of hours of labour on dairy farms. Their application, however, varies according to the actual nature of the operations carried out on individual farms. On those farms where the milk is made into cheese or

* See page 28.

butter, the intensity of the work varies from season to season and the hours of milking are entirely under the control of the farmer; much the same conditions obtain on farms where the milk is sold wholesale to factories for conversion into milk products with the exceptions that the seasonal intensity is not so marked, and where the milk is called for by lorry, there is not the same latitude in hours of milking.

On farms where it is the object to maintain a uniform output winter and summer, the labour during the winter is considerably greater than on farms which concentrate on summer production; where the milk is sold wholesale the hours of milking are largely governed by the local train service, and where it is sold retail they are fixed in relation to the consumers' requirements as to the delivery of the milk.

The hours of milking show a great divergence from the desired equal intervals on farms selling milk for human consumption. There is no doubt that in many instances a very long night interval (15-16 hours) is harmful to the cows and results in milk of very unequal quality. The morning's milk occasionally contains less than 3 per cent. fat, thus rendering the seller liable to prosecution. This risk would be almost entirely eliminated by uniform intervals between the milkings. At the same time, milking at equal intervals can only be attained by spreading the day's work over a period of 13-14 hours.

7. *Relation of Labour problems to size of farms.*—The problems in respect of labour also vary according to the size of the farm and the number of cows kept. Unfortunately, there is no information available as to the distribution of cows between large, medium, and small herds, the classification of farms into groups of different acreage throws a certain amount of light on the distribution of cows, but this information is not detailed enough to be of material value. The following table shows the agricultural holdings above one acre in England and Scotland divided into four groups, the number of holdings in each group and the number and percentage of cows:—

ENGLAND AND WALES.					IRELAND.				
Class of Holding.	Total Number.	Total Number of Cows.	Percentage of total Cows	Total Acreage under Crops and Grass.	Class of Holding.	Total Number	Total Number of Cows.	Percentage of total Cows	Total Acreage under Crops and Grass.
Above 1 and not exceeding 5 acres.	89,958	43,977	1·9	281,096	Above 1 and not exceeding 5 acres.	47,619	28,186	1·9	157,174
Above 5 and not exceeding 50 acres.	197,218	609,775	26·2	4,087,234	Above 5 and not exceeding 50 acres.	321,335	801,576	51·4	6,061,458
Above 50 and not exceeding 300 acres.	127,864	1,354,834	53·4	16,015,365	Above 50 and not exceeding 100 acres.	57,476	359,328	24·4	3,276,457
Above 300 acres ...	15,041	313,225	13·5	6,964,218	Above 100 and not exceeding 200 acres	23,159	192,957	13·1	2,422,143
Total ...	430,081	2,321,811	100·0	27,347,913	Above 200 and not exceeding 500 acres.	8,231	70,470	4·8	1,607,154
SCOTLAND.					Above 500 acres ...	1,967	20,792	1·4	771,227
Above 1 and not exceeding 5 acres.	18,136	23,101	5·4	59,699	Total ...	459,787	1,473,309	100·0	14,295,613
Above 5 and not exceeding 50 acres.	34,601	96,836	22·9	637,766					
Above 50 and not exceeding 300 acres.	23,138	255,677	60·5	2,951,270					
Above 300 acres ...	2,673	46,834	11·2	1,214,738					
Total ...	78,548	422,448	100·0	4,863,473					

From the above it appears that some 28 per cent. of the dairy herd in Great Britain is maintained on holdings of under 50 acres; that is to say, on holdings where the labour can be largely carried out by the occupier and his family. Approximately 60 per cent. is kept on farms of between 50 and 300 acres. From the point of view of finding out the proportion of the national dairy herd kept on farms where labour problems may be acute, further sub-division of this group is desirable, but unfortunately, statistics for this purpose are not available. The Sub-Committee consider that in the future a method of classification should be adopted similar to that used in Ireland. The labour requirements of holdings of 50 to 100 acres may be largely met by the owner and his family, whereas on farms of 200-300 acres additional labour is essential. It is probable that the greatest difficulty in obtaining an adequate supply of labour will be experienced on medium-sized dairy farms depending very largely on hired labour, but with only a moderate mechanical equipment. As regards Ireland the table shows that the Irish dairy herd is maintained to a much greater extent on small farms than is the case of Britain, e.g., 56 per cent. on holdings under 50 acres and about 81 per cent. on holdings under 100 acres. In this connection it may be pointed out that farms on which the entire work is carried out by the family are in reality working in unfair competition with those on which outside labour has to be employed, since the wages item, one of the most serious in the cost of production, is practically eliminated.

8. *Increased Demand for Milk.*—Associated with the change in agricultural conditions arising from the war and the question of labour in dairy farming in particular, there have been indications of an increased demand for milk as a human food. The rise in the price of foods and the awakening of popular interest in food values has directed attention towards the cheapness of milk as compared with other animal foods; there has also been a greater realisation of its unique value as a food for children. The increased demand is also attributable to the ability on the part of many consumers to purchase larger amounts than formerly. From the national point of view this higher appreciation of, and greater demand for milk are most hopeful signs, but this demand can only be met if dairy farmers have an adequate supply of labour. Further, compliance with the demand on the part of the health authorities and the public for a cleaner milk supply will require, under the conditions of production which obtain on most farms, the employment of extra labour.

To obtain this supply the dairy farmer must enter into keener competition with industry than has been necessary in the past. This competition will be rendered all the more intense, and the farmer's difficulty in securing the additional labour necessary to produce the requisite increase in the milk supply will be aggravated by the experience of social life which many thousands of rural workers have had in the army or in different kinds of war work. By some means or other the attractions of town and city life must be counterbalanced if the country is to obtain and keep its due share of labour.

9. *Difficulties common to all branches of agriculture.*—In surveying the field to be covered by their enquiries, the Sub-Committee considered it desirable to adopt the guiding principle that those subjects which, though of great interest and importance, were common to all branches of farming, should be interpreted as being outside the scope of their work. On this basis such subjects as:—

- (a) the actual rate of wages to be paid;
- (b) rural housing conditions, including the question of the "tied" cottage;
- (c) social conditions in the country in general

would not arise for detailed consideration.

The first of these is in the hands of the Wages Board which has been created for the specific purpose of fixing minimum rates of wages suitable to the conditions in the different counties. The second, though of prime importance in dairying and indeed in all branches of agriculture, cannot be adequately considered except as part of a national scheme of housing associated with other problems of local government and reconstruction. There is no doubt that at the present time there is a very great need for additional cottages, and that in numerous districts large numbers of existing cottages are far below modern standards. The third subject is also one of national interest and is an essential part of any scheme for increasing the numbers of the rural population. It has been dealt with in the report of the Agricultural Policy Sub-Committee of the Reconstruction Committee (Cd. 9070, pages 118-122, Appendix 11. Village Industries and Social Life). Also one aspect of this subject, namely, that of Women's Institutes, is now directly associated with the Women's Branch of the Board of Agriculture and Fisheries and with the Board of Agriculture for Scotland.

In addition to subjects such as those just mentioned, there are others which, although common to other branches of agriculture, have a direct relationship to the future of labour in dairying and, therefore, require special reference. Of these the most important would seem to be:—

- (a) improved educational facilities;
- (b) improvement in the relations between employer and employed.

10. *Education in Dairying.*—The Sub-Committee are aware that the subject of education in dairying has been referred to another Sub-Committee, and therefore refrain from making any detailed recommendations upon it. They welcome the opportunities which will be provided under the Education Acts, 1918, for the general development of education and, in particular, for the provision of country continuation schools.

They trust that the courses of study and instruction which it is proposed shall be provided for pupils during their latest years at such schools will be the means of securing a higher standard of education and efficiency in rural workers. They also wish to emphasise the desirability of some instruction being given in rural subjects at all continuation schools so that pupils in industrial districts may have an opportunity of acquiring some knowledge of, and interest in rural life.

As regards the provision of increased educational facilities for those at present engaged in farm work the Sub-Committee believe that much could be done by the County Agricultural Education Staff and other bodies, and that lectures, short courses of instruction, and demonstrations on appropriate subjects at suitable hours would be appreciated by cowmen and other farm workers as well as by farmers themselves. In this connection, the Sub-Committee would draw attention to the valuable educational work at present being carried out by the National Clean Milk Society by means of demonstrations of the possibility of producing clean milk under the most unfavourable farm conditions. If satisfactory attendance at such courses and the attainment of a certain degree of practical efficiency were followed by the awarding of certificates, and the possession of such certificates were recognised by employers as meriting the payment of a higher wage the results could hardly fail to be to the benefit of all concerned.

11. *Relations between employers and employees.*—The Sub-Committee realise that in the course of time the relations between employees and their employers will become the subject of frequent discussion between the various representative organisations. They are of the opinion, however, that no official conferences between branch unions or with official representatives can take the place of personal contact and sympathy between the farmer and his men. Conditions of labour and rates of wages should be the subject of more frequent discussion between the individual farmer and his men, in order that each may understand and be able to sympathise with the other's point of view. By such personal contact and understanding it should be possible to develop mutual confidence between employers and employees, and to increase the interest of the workers in the management and output of the individual farm. The working hours and conditions under which dairying has been carried on in the past must be improved in the future, and employers will be well advised to give their workers an opportunity of stating their views as to what alterations they consider necessary and satisfactory, and in what way these may best be made effective.

The Sub-Committee have given considerable thought to the part which may be played in the improvement of the relationship between employer and employed by schemes of co-partnership, profit-sharing and bonuses, but they are of the opinion that it is well-nigh impossible to devise any scheme which could be made the subject of a general recommendation. They have given particulars of a few such schemes in Appendix A, but they are principally concerned to emphasise the importance of employers—by whatever means local conditions may make most suitable—endeavouring to give their employees an interest in the conduct and prosperity of the business in which they are engaged.

The organisation of farmers and farm and other rural workers into their respective unions has extended with varying rapidity in different parts of the country. In nearly all parts of Great Britain there are organisations representative of the interests of farmers, and as regards farm workers, the Agricultural Labourers' and Rural Workers' Union and the Workers' Union in England, and the Scottish Farm Servants' Union in Scotland all have a considerable membership. In districts where employers and employees are

well organised, meetings between representatives to discuss labour problems have had beneficial results and there is much to be gained by the development of such opportunities for free discussion. One notable instance is the arrangement which has been come to between the Edinburgh and Leith Dairymen's Association and the Scottish Farm Servant's Union in respect of the hours and holidays of byremen and vanmen, dairymaids and women milkers. The general terms of this arrangement are given in Appendix B.

In English counties where the Agricultural Labourers and Rural Workers' Union and the Workers' Union have branches it is to the advantage of the farmers' organisation to recognise and confer with both of the former as an agreement with the representatives of one Union cannot be binding on the members of the others. During the next few years an increase in the membership of all unions mentioned above is both certain, and, in the opinion of the Sub-Committee, desirable, inasmuch as upon the development of a more complete organisation for farmers and farm workers alike, the representative character of any such joint and permanent body as an Agricultural Whitley Council or a National Council for Agriculture must depend.

12. *Hours of Labour.*—The definition of a week's work as a stated number of hours with a corresponding wage and a specified rate for overtime, or the adoption of the alternative method of fixing an inclusive wage for "customary hours" and no overtime are questions which fall definitely within the scope of the Agricultural Wages Board. The Sub-Committee, therefore, do not wish to make recommendations on these points, but having in mind the early and late hours at which much dairy work must be performed, they desire to emphasise the importance of making the conditions as to hours and wages for dairy workers at least as favourable as for other agricultural workers. They have had evidence to the effect that at present in counties where the system of customary hours is in practice, the position of cowmen and others engaged in the production of milk compares unfavourably with that of horsemen. The former often have a longer working week and much more Sunday labour for the same weekly wage.

13. *Holidays.*—On the subject of holidays, the Sub-Committee are unanimous that a definite holiday period should be provided, but that the actual method by which holidays are allotted to employees must be left to agreement between the employer and the employee. On this point much will depend on the situation of the farm with reference to towns or cities. Experience has shown that in the case of farms close to towns, an arrangement permitting one half day per week works satisfactorily, whereas in the case of farms at a considerable distance from a town, preference has been shown for a holiday of several days' duration in a given period of months. Whatever system may be adopted, it is evident that the means whereby the work of the farm may be carried on efficiently must receive careful consideration.

On some farms it may be possible to make arrangements by a re-organisation of the working hours of the labourers at present employed, but, generally speaking, and especially on the larger farms, it will be found necessary to engage additional employees either for whole or part time. In many districts one of the great difficulties in the way of engaging additional whole time workers is the lack of cottages. Although the farmer may be willing to engage the extra labour he cannot do so, because there is no housing accommodation available in the district, and in order to make the amount of work on his farm fit in with the number of workers and hours of labour, he may be forced to reduce the number of milking cows in his herd.

In the course of their enquiries, several instances of arrangements whereby workers were enabled to get a half or a whole day holiday have been brought to the notice of the Sub-Committee and particulars of these are given in Appendix B.

14. *Employment Exchanges.*—The attention of the Committee has been drawn to the fact that very little use is made of the Labour Exchanges as a means of bringing farmers and labourers into touch with each other. They believe this to be largely due to the failure to appoint persons with agricultural experience to the staffs of Labour Exchanges in country districts. They believe it to be essential that in such areas, where agriculture is the most important employing industry, at least one member of the staff of each Employment Exchange should be thoroughly conversant with farming conditions and the various types of labour required. Only in this way can the Exchanges inspire the confidence needed to supply the necessary link between the demand for and the supply of labour.

15. *Part time work.*—In some parts of Great Britain the engagement of part time workers on dairy farms is a general practice, the wives and daughters of the farm labourers being employed for the work of milking morning and evening. While this system has enabled many labour difficulties to be overcome in the past, it is doubtful if it can be relied on to the same extent in the future. There is the outstanding objection that if the farm labourer's wife and daughters are engaged in the early morning work of milking, it is sometimes difficult for the labourer himself to obtain a substantial morning meal. There are also indications that as the wages of the men increase the women and girls become less inclined to undertake work outside the home. The Sub-Committee, nevertheless, believe that an increase in the number of part time workers, especially for the hand milking of cows, would afford a supply of labour which would enable many dairy farmers to overcome some of the labour difficulties arising from the institution of shorter hours and regular holidays.

The increase of small holdings in dairying districts may in some cases have the effect of providing a rural population who might be willing to add to their income by undertaking part time work in connection with dairying, and the Committee consider it desirable that this point should receive the careful attention of the authorities responsible for the establishment of small holdings.

16. *Conditions under which work is carried out.*—In respect of the conditions under which the work on dairy farms is usually carried out, the attention of the Sub-Committee was directed chiefly to the waste of labour entailed by the lack of system in the arrangement of the farm buildings as a whole and by the inconvenient internal equipment, such as bad floors without adequate drainage arrangements and improperly constructed stalls. Where the cows are housed in a number of sheds, and where much of the food has to be conveyed to those sheds through open yards, the labour in feeding is considerably increased, and during the winter the workers are much more exposed to weather conditions. Where the internal equipment is poor, it is well-nigh impossible to maintain any reasonable degree of cleanliness.

As regards labour-saving equipment, the milking machine has been largely tried throughout the country and results are, generally speaking, somewhat conflicting. On some farms where a mechanical milker has been in use for years good results have been obtained, and in other districts the majority of machines installed are now disused. The Sub-Committee have had before them a Report* on an enquiry

* See page 51.

into the use of milking machines in England which was prepared for and is being fully considered by the Agricultural Sub-Committee. A summary of the information contained in this Report in so far as labour is concerned, would lead to the conclusions that where reliable hand milkers can be obtained, it is not desirable to instal a milking machine, but that where milkers are unreliable, the installation of a machine should be of considerable benefit, provided that a thoroughly efficient operator is in charge. Further, with well arranged buildings, the installation of a mechanical milker should lead to a reduction in the amount of labour required, but where the buildings are badly arranged, the milking machine does not save labour on the whole, as the labour required for the feeding of the cows and the cleaning of the sheds is also capable of carrying on milking. Other mechanical labour-saving devices such as a ground level system of rails with waggons or an overhead system of one rail with trolleys are not common on farms in Britain, and the chief reason is the lack of systematic arrangement of farm buildings.

The Sub-Committee believe that much could be done towards a solution of labour difficulties by the rearrangement and reconstruction of dairy farm buildings and their equipment with suitable mechanical labour-saving machinery, but they realise that improvements are needed on a very large scale, and that the cost would in many cases be prohibitive. In order that more information may become available to demonstrate the advantages of well-arranged buildings, &c., and to guide those who contemplate alterations and improvements the Sub-Committee recommend that in the general investigations to be conducted by the Agricultural Costings Committee an analytical study be made of the cost of labour and the amount required on farms representing respectively good and bad arrangements and equipment.

It cannot be doubted that in the future those farms on which the work in connection with milk production can be carried on in the most convenient, efficient, healthy, and comfortable manner will, other things being equal, have least difficulty in attracting and keeping an adequate supply of labour.

A memorandum outlining the means contributing to labour-saving on dairy farms is given in Appendix C.

17. *Women labour on dairy farms.*—The Sub-Committee have had before them a memorandum on Women Labour on Dairy Farms, prepared by one of their members, in which the type of women to be employed, the kind of work which can be undertaken by women, the size of farms which might employ women and the conditions of employment are fully discussed. This memorandum is given as Appendix D. They realise that experience has proved that women can undertake a considerable amount of the work on dairy farms, particularly that which can be carried on at the homestead.

In future, in view of the somewhat larger supply of men which will be available for farm work, it appears probable that women will be employed chiefly as whole-time workers on large farms, or as part-time workers on small farms. It is exceedingly difficult at the present time to forecast in any detail the conditions under which women will be employed. In those districts where it is customary for women to undertake farm work and to live in the farmhouse, very long hours are often worked, and it is desirable that some reduction should take place. Any such reduction, however, will necessitate, as in the case of men, reorganisation of the farm labour or the employment of additional workers, and the difficulties of obtaining satisfactory solutions to the problem along these lines have already been mentioned. Evidence was brought before the Sub-Committee to the effect that in certain districts the introduction of Land Army workers, with their regular hours of employment and wages, created considerable discontent amongst the local women workers living in. It is evident that some means will have to be found of bringing into line the conditions under which the local women who combine farm and domestic work are employed with those now obtaining in the case of "imported" and other female farm workers. As regards the general conditions as to hours of labour, holidays, and wages for women employed in the manner referred to above, the Sub-Committee consider it desirable that these should be dealt with by the Wages Board as in the case of other female farm labour.

18. *Co-operation amongst Farmers.*—Reference has been made to the dairy farms of 100 acres or less where the work can be almost entirely carried out by the farmer and his family, and the view has been laid before the Sub-Committee that such farms must be the mainstay of the national milk supply in the future. There should also be associated with this class of farm those holdings where it is the custom to engage a dairyman to take charge of a herd of cows, and where the cows are sublet according to local custom. In such instances the work is often carried out entirely by the dairyman and his family. It is undoubtedly true that the new conditions of labour as to wages, hours, and holidays have not the same application to such farms as to those of greater size or where other labour customs are the rule, but the new conditions must sooner or later affect even such farms, and it will be necessary for such changes to be made as will prevent the junior members of the farmer's or dairyman's family acquiring such a distaste for dairy work that they will take the first opportunity of departing to more congenial employment. An approximation to the statutory conditions as to wages and hours of labour would tend to have this effect, and the Sub-Committee also believe that a considerable improvement could be effected by the spread of co-operation. The labour of milk delivery and haulage of manure and feeding-stuffs could be reduced, and where cheesemaking is largely practised, the organisation of milk collection and the erection of depôts where milk could be adequately treated for transit to consuming centres and the surplus made into cheese would materially lessen the amount of work to be undertaken by the family. Evidence from districts in Scotland is strongly in favour of the development of co-operation with this end in view.

Further, it was pointed out that, previous to the control of milk and in the absence of co-operation, farmers were unable to get such a price for their milk as would have enabled them to work reasonable hours and pay a proper wage. In the event of all regulation of milk prices being removed, co-operation amongst the producers would appear to be the only means whereby they could avoid the re-occurrence of the unfortunate conditions under which they previously carried on their work.

SUMMARY.

Bearing in mind the general considerations in para. 6, the Sub-Committee are of opinion that:—

I. EDUCATION.

In addition to the opportunities for education provided under the Education Act, 1918, it is most desirable that, wherever possible, lectures, demonstrations and short courses should be given on appropriate subjects

at hours convenient to farmers and their employees. The granting of certificates to farm hands attending such courses who attain a certain standard of efficiency, and their recognition by higher pay would greatly increase the value of such a method of instruction.

II. RELATIONS BETWEEN EMPLOYERS AND EMPLOYED.

Discussion and consultation, not only on such subjects as the conditions of labour, but also on the actual working of the farm, will, by giving each individual labourer a personal interest in his work, do more to encourage friendly relations between farmers and their workers than formal conferences between organisations of employers and employed, although, of course, the Sub-Committee fully recognise the necessity of this also and the beneficial results which, as mentioned in their Report, they know to have accrued.

III. HOURS.

Without making definite recommendations on the subject of hours and wages, which they recognise as falling within the province of the Agricultural Wages Board, the Sub-Committee desire to emphasise the importance of making the conditions in this respect at least as favourable as for other agricultural workers.

IV. HOLIDAYS.

In view of the varying conditions on different farms, their distance from towns and so forth, the Sub-Committee feel that the method of arranging holidays must be left to agreement between employers and employed. They are, however, unanimously of the opinion that definite holiday periods should be given to dairy workers.

V. EMPLOYMENT EXCHANGES.

In order to increase the value of the Employment Exchanges in rural districts, the Sub-Committee strongly urge that in each case at least one member of the staff should possess expert agricultural knowledge, such as will enable him to be of adequate assistance in the supply and allotment of agricultural labour.

VI. PART-TIME WORK.

The employment of part-time labour, especially in the hand-milking of cows, would assist many farmers in overcoming some of the difficulties with which they are faced owing to the institution of shorter hours and regular holidays. They urge that this point should be borne in mind by the authorities responsible for the establishment of small holdings, for they believe that many of the owners of such holdings might be glad to increase their income by undertaking part-time work in dairying.

VII. LABOUR-SAVING MACHINERY.

Where difficulty is found in obtaining good hand-milkers, milking machines might be used with advantage, provided that a competent operator can be placed in charge.

The Sub-Committee recommend that, in the general investigations to be conducted by the Agricultural Costings Committee, an analytical study be made of the cost of labour and the amount required on farms representing good and bad arrangement and equipment.

VIII. WOMEN LABOUR.

With regard to the labour of women on farms, some means must be found of bringing the conditions under which the local women who combine farm and domestic work are employed more into line with those now obtaining in the case of "imported" and other female workers. As regards the general conditions as to hours of labour, holidays and wages for women employed in this manner, they consider it desirable that these should be dealt with by the Wages Board, as in the case of other female farm workers.

IX. CO-OPERATION.

There is undoubtedly a future for co-operative methods in dairy-farming, especially in the opportunities they afford of reducing the labour required in cheesemaking and the collection and delivery of milk. Further, in the event of the control of milk prices being removed, an extension of the practice of co-operation is likely to provide the most satisfactory remedy for the evils arising from the former unrestricted competition amongst the milk producers.

The Committee desire to express their thanks to Miss Mackenzie for the valuable assistance which she has given them in the course of their investigations.

(Signed) E. F. L. WOOD (Chairman).

May, 1919.

APPENDIX A.

PARTICULARS OF CO-PARTNERSHIP, PROFIT-SHARING AND BONUS SCHEMES.

1 Mr. T. ———, *Lincolnshire*.—"What I am doing here is this. There are 54 cows at this minute in milk. I pay A. and his wife 1½d. a gallon for the milk. They not only milk but feed the 54 cows. I allow them one milker to whom I pay the current wages. The cake is crushed and brought to the door for them. The root room is kept supplied with roots and the straw is near at hand, so that they have to waste no time in collecting food or fetching it from a distance. A. and his wife are very thrifty. They earn upwards of 75s. per week."

"I forgot to say that, as well as paying A. 1½d. per gallon for the milk, I pay him 2s. 6d. for each calf which reaches one week old. On the other hand, if the calf dies, A. pays me 10s. forfeit. This system is working very well."

2 Mr. K. ———, *Hunts*.—"My herd consists of, say, 46 cows, and in order to make milking more attractive and financially interesting to my workers, the following scheme has been adopted:—

"That for every gallon of milk produced in the year over 20,000, 1d. per gallon be handed over as a bonus

divided between the workers who have served 12 months in the shed."

3 Mr. H. ———, *Oxon.*, "has adopted the practice of allowing his stockmen bonuses on sales in order to keep alive their interest in pedigree stock. The milkers and dairy workers get a weekly bonus in proportion to the agreement which is found between the totals of the daily milk record sheets and the total in the milk sales' account.

"So far Mr. H. has not devised or adopted any system of profit-sharing or co-partnership, or of payment according to output of milk or other means."

4 Mr. S. ———, *Essex*.—"About 20 years ago Mr. S. commenced paying his employees an annual bonus in addition to their wages. This bonus ranges from a payment of £20 to a foreman, £5 to a head cowman, to 40s. to an ordinary hand. The system has been still further elaborated in the case of cowmen, who receive an additional bonus if the amount of milk from their cows exceeds a certain quantity. While certain rough rules of this kind are observed in allocating the

University College Agricultural Section. Tillages and unexhausted manures unless otherwise specified will be valued at the current rate in the district, and live stock will be valued and depreciated at the rates set out in Schedule "A" hereto. The basis of valuation and rates of depreciation made herein shall be revised quinquennially by the Head of the Statistical Branch of the Agricultural Department of the University or by some other person nominated by the President of the Board of Agriculture, and there shall also be a quinquennial re-valuation of the Fixed Capital.

6. *Accounts.*—Proper Accounts (and whenever possible separate accounts for each department or section of the Farm) of all receipts and expenditure, will be kept by or on behalf of the Employer, and a yearly Balance Sheet and Trading Account will be made out, audited and certified by a firm of chartered accountants to be selected by the Employer, and when so audited and certified, shall be final and conclusive. Employees will be entitled to see the Balance Sheets and Trading Accounts, but shall not be at liberty individually to enquire further into them.

They will, however, be invited to appoint one of their number as their representative to examine the accounts and to report to them thereon. And such representative will be given access to such accounts, and to all vouchers relating thereto.

7. *Gross Profits and net Profits.*—There will be paid out of the receipts from the Farm the general working expenses of the Farm, including salaries, wages, rates and taxes, insurance premiums, rent (calculated in manner before mentioned), interest on the working capital at the rate aforesaid, renewals of all live stock, repairs, maintenance, depreciation of live and dead stock, the guaranteed interest upon the Deposits hereinafter mentioned, and any other expenditure connected with the business of the Farm and properly payable out of its receipts.

The residue of such receipts as aforesaid will be deemed to be the "gross profits." Out of such gross profits there will be paid annually to the Reserve Fund hereinafter mentioned the sums hereinafter specified and the residue of such gross profits shall be deemed to be the "net profits."

8. The net profits will be divided between Capital, Labour and Management, so that each £1, whether (1) of interest on Working Capital (provided that when any Working Capital is transferred by the Employer to the Employee by means of deposits—Section 12—an equivalent amount of the Fixed Capital will be entitled to share as if it were Working Capital) or (2) of salary, or (3) of wage, shall entitle it to an equal share provided that the Employer may before such deduction set aside not more than — per cent. which he may allocate at his discretion (unless otherwise agreed to in writing) either among Management or Labour, being guided by the comparative profits of departments of the Farm and by the special degree to which any employee has contributed to such profit.

9. The proportion of the net profits allocated to them will be distributed among the permanent Employees in shares proportionate to their weekly remuneration. The weekly remuneration of every Employee will be taken as comprising his weekly wages, exclusive of overtime or bonus, but including the estimated weekly rent of any cottage and garden where these are provided for him free of charge. Provided the total amounted limited in Clause 12, Sub-section D hereof, is not exceeded, the share of net profits payable to each Employee, whether as a member of the Management or of the Labour Staff, will be placed to his deposit account (or to one to be opened for the purpose in his name), and will be paid to him from this deposit account in four equal instalments. The first of such instalments will be paid to him on October 1st or as soon after as the accounts are certified by the Auditors as aforesaid, and one other instalment at the expiration of three successive periods of three calendar months thereafter. Provided nevertheless that any Employee may, if he thinks fit, permit such share of net profits to remain to the credit of his said Deposit Account, and while there it will be subject to all regulations affecting deposits herein contained.

For the purpose of calculating the share of the net profits payable to any Employee weekly remuneration amounting in value to less than 20s. will be treated as 20s., if over 20s. but under 30s., as 30s., if over 30s. but under 40s., as 40s., and so on.

No employee who leaves or is dismissed from the employment of the Employer for any reason whatsoever will participate in any share of the profits for the farming year during which he leaves or is dismissed. This will not apply to any employee leaving or dismissed during the war and six months after the cessation of hostilities. Employees leaving during this period will get a *pro rata* share of profits for every completed period of three months on the farm.

10. *Reserve Fund.*—A Reserve Fund will be created as a provision against losses. Such Reserve Fund will be formed in the following manner.—At the commencement of the Profit Sharing Scheme herein set forth, the Employer will pay the sum of One hundred pounds to the credit of such Reserve Fund, and at the end of every farming year on the taking of the Annual Accounts there shall be paid to the same Fund

out of the gross profits of the preceding year a sum of money calculated as follows:—

- (A) When the gross profits show a return not exceeding 6 per cent. for the farming year, no contribution will be made to Reserve.
- (B) When the gross profits amount to more than 6 per cent. but less than 10 per cent. then an amount equal to 12 per cent. of the net profits will be carried to the Reserve Fund Account.
- (C) When the gross profits amount to more than 10 per cent. but less than 15 per cent., then 15 per cent. will be carried to the Reserve Fund Account.
- (D) When the gross profits amount to 15 per cent. or upwards, then 20 per cent. of the net profits will be carried to the Reserve Fund Account.

The Employer may at any time at his discretion, withdraw such sums from the Reserve Fund as he may think advisable, and out of them may defray losses.

11. The moneys standing to the credit of the Reserve Fund will be invested by the Employer in his name in such stocks, funds, shares or securities quoted on the London Stock Exchange, and in no way connected with the business of the Farm as he may in his discretion think fit. Should the Profit Sharing Scheme herein contained be abandoned, the investments representing the Reserve Fund will be sold by the Employer in such manner as he shall think fit and the proceeds thereof (after payment of the expenses of realization) with any cash standing to the credit of the Fund will be applied in the repayment to the Employer of the amount or amounts contributed by him and the remainder will be distributed among the Employees for the time being and the pension holders in such proportions as the Employer may determine. Provided that no Employee will be entitled to share in such distribution unless he was in the employment of, or pensioned by the Employer at the date of such abandonment. But in the case of an Employee or Pensioner who may have died during such farming year and who had prior to his death been in the employment of or pensioned by the Employer for the 10 consecutive years, immediately preceding such death his widow (if any) or failing her, his personal representatives will be paid all sums which would have been payable under this clause to such deceased Employee or Pensioner if he had not died. Should however such deceased person have been employed or pensioned by the Employer for less than such ten years as aforesaid, but for more than three years, his Widow (if any) or failing her, his personal representatives will receive a proportion to be determined by the Employer of such sums as aforesaid, varying with his length of service.

12. *Deposits.*—Any permanent Employee, whether on the Management or the Labour Staff (subject as hereinafter mentioned) may subscribe towards Working Capital, and will receive a Deposit Book in which will be entered the amount or amounts of the Capital so subscribed. The amount or amounts so subscribed (hereinafter called "the Deposits") will be treated as a loan to the Employer, and will be subject to the following Rules which will be printed in the Deposit Books:—

- (A) Deposits will be received on the first day of any calendar month from any Employee on the farm who has been in the Employer's continuous employment for a period of three calendar months preceding such day, and shall be in sums of not less than £1 or a multiple of £1. The employer personally guarantees their repayment to the Depositor with interest thereon (but not share of profits) as hereinafter mentioned.
- (B) Deposits for the time being standing to the credit of a Depositor will carry interest at the rate of 2½ or such other rate as is current for Post Office Savings per cent. per annum, and the due payment of such interest is hereby guaranteed by the Employer on any Deposit up to a total not exceeding the total annual wage or salary (exclusive of bonus or overtime) of the employee. Employers may increase their Deposits beyond this amount but no interest will be guaranteed on any such excess which will be on the same footing as if it were capital provided by the Employer. Such interest shall be deemed to accrue from day to day, and shall annually, on the taking of the annual accounts hereinbefore provided for, be placed to the credit of the Depositor as an addition to his deposit, with any share of profits that he may become entitled to as hereinbefore mentioned, and such deposit shall be deemed to be increased and shall carry interest accordingly.
- (C) The Employer reserves the right at any time or times to refuse or to return the whole or part of any deposit.
- (D) Every Employee shall have an equal opportunity of increasing his Deposit proportionately to his wage or salary, i.e., No employee may by increasing his Deposit disproportionately absorb an undue proportion of the working capital available.

- (e) If any person is dismissed from or leaves the employment of the Employer for any reason whatever, his deposit shall be returned to him (less any amount that may then stand to his debit) together with 3½ per cent. interest to the end of the last completed week nearest the date of withdrawal, but he shall not be entitled to participate in any further or additional profits of the share allocated to capital or rate of interest for any part of the farming year during which he leaves.
- (f) Any Depositor may withdraw the whole or any part, not less than £1 or a multiple of £1, of his deposit at any time upon giving one week's notice to the Employer at his Office at the Farm upon a form provided for that purpose, but if such withdrawal shall be made before the 30th March in any year, he shall only be entitled to the receipt of 4 per cent. interest to the date of such withdrawal, and shall not be entitled to participate in any share of profits for the current farming year in respect of the amount mentioned in such notice.
- (g) Unless the Employer shall expressly so permit in any individual case, Depositors shall deposit money belonging to themselves, only, and not money belonging to or provided by relatives, friends, or other persons. Any Depositor infringing this rule shall have the whole of his deposit money returned to him immediately, and shall not be entitled to any interest thereon or share of profits.

13. *Military Service.*—The calling out of men for service under the Crown will not be deemed an interruption of continuous service. Employees, however, must apply to the Employer for re-engagement at the earliest possible moment after the date of the termination of their service is known to them, and if they fail to do so the Employer may hold their employment by him to have been voluntarily discontinued.

14. *Method of Termination.*—This Scheme will continue in force until the Employer gives notice to the Employees as a whole, or to any Employee in particular determining it, either generally or in any particular case, but such notice unless given before or during the month of February in any year, will not take effect during the then current Farming year. Notice will be deemed to have been duly given if a written announcement to that effect be displayed in some prominent place on the Farm.

15. *Partnership not to be Created.*—This Scheme being of an experimental character and having been framed for the guidance of the Employer and as an indication to his Employees of the method of the distribution of profits proposed to be adopted by him shall not (except as regards Clause 12) constitute a contract of any kind or create any contractual relationship as between him and his Employees or anyone else. And no Employee except under Clause 12, shall have either in law or in equity any rights or liabilities of any kind whether of partnership or otherwise, nor shall any Employee, except as is herein expressly provided or unless so instructed by the Employer intermeddle with, or be concerned in, or be entitled to enquire into, the management of the business or its book-keeping or accounts.

16. *Bonus, etc.*—No Employee will receive any bonus, present or allowance, which is not specified either in this Scheme, or in the Schedule hereto, or in an Agreement made in writing with the Employer and signed by him.

17. *Alterations.*—Alterations or modifications of this Scheme and the Schedules hereto (or of any Rules made in connection therewith) which experience may suggest are desirable, may from time to time be made by the Employer.

18. The Employer may make such Rules and Regulations as he may think fit for the purpose of carrying out more fully and effectually the Profit Sharing Scheme herein set forth.

19. *Regulations.—Determination of Questions.*—Any question that may arise in the working of this Scheme, or on the interpretation of any of the clauses hereof, or of any Rules or Regulations made in connection therewith, or on the taking of the said accounts will be referred to the decision of the head of the Agricultural Section of _____ University College for the time being, or failing him, to some person nominated by the President of the Board of Agriculture, or failing either of them will be decided by the Employer himself.

20. *Interpretation.*—The expression "Farming Year," as herein made use of shall mean the year commencing on the 1st day of April and ending on the 31st day of March following.

In this Scheme words importing the masculine sex also include females, and those importing the feminine sex also include the masculine.

21. *Date of Commencement.*—The Scheme will commence as from the first day of _____ and will continue as long as the Employer thinks fit, subject to Clause 14.

The following Schedules will be Schedules kept:—

SCHEDULE A.—Containing the detailed principles and basis of valuation and depreciation adopted herein.

[This Schedule will be printed with and attached to this scheme.]

SCHEDULE B.—Containing a detailed statement of the fixed and working capital.

SCHEDULE C.—Containing such additions to and such alterations to and interpretations of this scheme as may be made.

[Schedule B and C.—Will be kept up to date and copies will be circulated to the staff as often as may be necessary, or will be available for their inspection but will not be printed in or attached hereto.]

SCHEDULE A.

- The rates of depreciation shall be —
 - per centum per annum on stone, brick or other permanent building.
 - per centum per annum on wooden or iron buildings (not including chicken huts, coops, etc.).
 - per centum per annum on fixed machinery.
 - Carts, wheelbarrows, and moveable machinery, utensils, implements, chicken coops, wire netting, fencing, gates etc., to be taken at the valuation made 30th September, 1916, a "life" to be assigned. The depreciation to be the value divided by the number of years of life.
 - per centum on the tubing implements and parts of the milking machine other than the engine.
- Live stock shall be valued at the following rates.—
 - Milch cows at £——
 - Bulls at £—— each
 - Calves at —— at birth, with a —— increase per head up to a maximum of £——
 - Pigs at £—— each, or at —— at birth, with a —— increase per head per month up to a maximum of £——.
 - Sheep at market price, less —— per cent
 - Cattle same as sheep.
 - Horses To be valued at Cost and to be depreciated by such annual sum as will leave them on the books at £—— per Horse by the time they reach the age of —— years.
 - Poultry shall be valued at the following rates:—
 - Pullets of the same year ——
 - Hens of the preceding year ——
 - Hens of 2 years preceding ——
 - Young birds —— at birth with a —— increase per week
 - Purchased feeding stuffs will be valued at the net cost price to which will be added at the beginning of every quarter the same interest as on all other working capital calculated on the total of such feeding stuffs actually then in stock. This interest per cent. will be credited to the respective feeding stuffs account.

Any stock for breeding purposes bought at a higher price than the figures set out in 2 (1), (2) and (3), the amount by which it exceeds those figures will be entered to a "Dairy Pedigree Account." This account will be depreciated at the rate of ——per cent per annum.
- Home grown feeding stuffs will be valued at the cost of production—interest will be charged as on purchased feeding stuffs.

SCHEDULE B (Summarised) CAPITAL VALUATION

	£
Land	_____
Buildings	_____
Fruit Farm	_____

Working Capital £——— (at date).	£———

SCHEDULE C

- The rent of a cottage on the Estate, occupied by an Employee shall be reckoned at —— a week, until otherwise determined. Every cottage shall have the same rent charged. Any person being moved by the employer from one cottage to another shall be paid —— by the Estate.
- The allowance for a single man or woman lodged with an employee having a cottage on the Farm shall be —— per week, which payment shall include use of furnished bedroom and a share in the sitting room and kitchen, but shall not include meals or washing.
- Where work is done by the Farm for the Estate including the Stud Farm the actual cost will be charged to the Estate plus —— per cent. The same arrangement shall apply for work done for the Farm by any outside department.
- The cash value of manurial Residue will be arrived at by taking —— of the value of coke fed to stock. No allowance will be made for the value of any other food. The value of such residue will be charged as follows:—

One-half the first year and one quarter to each next succeeding crop.

APPENDIX B.

HOLIDAYS.

1. *Mr. B*———, *Hants*—"Every dairy worker has one day in seven as a complete holiday. There are from 70 to 75 cows in milk, and seven milkers are employed; they milk on the average 12 cows each daily, as there are six on duty."

2. *Mr. K*———, *Hunts*—"Instead of keeping 4 milkers I keep 5, so that each worker can have the week-end off every fifth week."

3. *Major W*———, *Yorks*—"For a herd of 20 cows in milk and calves, young stock, and pigs, one cowman and two women are employed. Each gets one full day off in 3 weeks; this is preferred to a half-holiday because of the distance of the farm from a town. This arrangement also gives a practical equality between the hours per week worked by the cowman and the customary hours of the horsemen. Occasionally for the holiday additional assistance is required for calf-feeding."

Northamptonshire—"It is interesting to draw attention to the case of one very enlightened farmer, who has a large milk business, and who employs all his workers on Sundays so as to get the work done quickly, who gives to each Sunday worker a half-holiday during the week, one man going on Monday, another on Tuesday, and so on. This is a principle which might be applied to the Saturday half-holiday scheme, for it is not necessary for all workers to go on the same day, indeed, it is obviously impossible that they should do so. The enlightened employer referred to above gives this half-holiday quite voluntarily, and he finds no difficulty in the working of the arrangement. It is sometimes argued that all the men in the country village, some miles from a town, would wish to have their half-holiday on the same day, so that they could enjoy games together. The reply may be suggested that it would be the younger men and the youths who would want to play the games, and it is not usually this class of man who is employed in doing the skilled work among the stock. It may be assumed, therefore, that to the older man—the skilled horse and stockman—it would be a matter of indifference which day he had his half-holiday."

5. In the Edinburgh district a claim made for higher wages, shorter hours and half-holidays by the Edinburgh and District

Branch of the Scottish Farm Servants' Union, which is composed entirely of dairy workers, was submitted to arbitration. The award was as follows:—

"Award by the Arbitrator in reference between the Edinburgh and Leith Dairymen and their workers."

"Having accepted the Reference, heard parties for their interests, and carefully considered the whole circumstances, I fix the wages of the workers from and after week commencing 10th November last as follows:—

Byremen and Vanmen.—Competent men to be paid £2 17s 6d. per week and one quart of milk daily.

Men boarded by employers.—Competent men to be paid 30s. per week and board.

"Where men are required by their employers to cut grass on Fridays such men will be paid 2s. 6d. extra, but it will be optional for the employers to arrange the work so as to dispense with grass cutting on Fridays.

"Men to be off work every third Sunday after the morning work is finished.

Women Milkers.—Women milking three times a day to be paid 16s. a week, and one quart of milk daily, the minimum standard to be ten cows. Such women will get one milking off once a week at times to be arranged with the employers.

Women milking twice daily to be paid 12s. 6d. a week and one quart of milk daily, the minimum standard to be ten cows. Such women to get a milking off once a fortnight at such times as can be agreed to by the employers.

Dairymaids (Competent)—To be paid £19 10s in the half-year and board.

"All dairy workers to have two hours off each day for meals. Other conditions as regards service to remain as formerly.

(Signed) *James J. Davidson.*"

(The Sub-Committee are aware of the very exceptional circumstances under which milk production is carried on in the district in question and the rates of wages are not under their consideration, but they have nevertheless thought it desirable to set out the award in full.)

APPENDIX C.

LABOUR SAVING ON DAIRY FARMS.

In view of the existing and future shortage of labour on dairy farms and the necessity of maintaining the present and attracting an additional supply, it is most important that steps should be taken:—

- (a) To lessen the labour requirements of the farmer.
- (b) To improve the conditions under which the labourer works.

In as far as building and machinery are concerned these ends may be attained by:—

1. Economical arrangement of the farm buildings as a whole.
2. Convenient internal arrangement of individual buildings.
3. Introduction of mechanical equipment.

1. *Economical Arrangement of the Farm Buildings as a Whole.*

Generally speaking a notorious lack of systematic arrangement is in evidence in the situation of the various buildings on the great majority of dairy farms. Frequently the herd of cows is accommodated in several sheds scattered about the homestead, causing much unnecessary labour in the conveyance of food to cows and in the carrying of milk from the sheds. The only apparent principle of arrangement has been that the sheds should be grouped as closely as possible around a manure-yard. The lack of economical arrangement causes loss of fodder, and the workers are exposed to weather conditions to an undesirable degree. This condition of affairs has arisen partly through the adaptation of existing buildings to dairy purposes, and partly through the erection of new buildings without considering the relation which should exist between such new buildings and those already in use. Dairy farm buildings should be arranged on a definite plan embodying the following principles:—

- (a) The herd of cows should be housed as far as possible in one shed (with suitable premises for isolation purposes) to economise labour in feeding, cleaning, and removal of milk.

- (b) The food-preparing shed should be so situated in relation to cow-shed, cake and meal store or granary, and root-shed, that the work preparatory to the feeding may be carried out with the minimum of labour, of waste of food, and of exposure to weather. Where possible the cake and meal store should be on an upper floor with shutters leading to the food-preparing and mixing shed.

- (c) The fodder store (hay or straw stack, or Dutch barn) should be as conveniently situated as possible to cow-shed and food-preparing room, for the same reasons as in (b).

- (d) The solid manure should be stored, when storing is necessary at the homestead, in a suitable place at some distance from the cow-shed in order that the yards may be kept clean, the sheds healthy, and the loss of fertilising constituents prevented.

- (e) Liquid manure should be collected from the cowsheds in a properly made tank from which the liquid manure carts can easily be filled. Wherever possible liquid manure should run into the tank and manure cart by gravitation.

- (f) A separate drainage system should be provided to deal with water used for washing out the cowsheds.

2. *Convenient Internal Arrangement of Individual Buildings.*

When existing buildings have to be altered or new buildings erected, the internal arrangement should be carefully considered with the view to economy of labour and general efficiency.

- (a) Uneven or badly paved or cobbled floors; (b) stalls which are too wide or too long; and (c) gutters which are too narrow or wrongly sloped for the removal of liquid manure by gravitation all increase the labour required in cleaning the floor and in the removal of the manure. Cows kept in at night in such

sheds are usually in a filthy condition in the morning, making such cleaning as may be practised a never-ending labour and the operation of milking exceedingly dirty and disagreeable. Where feeding passages are not provided, the labour involved in feeding the cows is as a rule increased

3. Introduction of Mechanical Equipment

Mechanical equipment is desirable as an aid to the work associated with milk production, particularly in relation to those sections of the work which are—

- Most constant, e.g., milking and removal of manure;
- Most arduous, e.g., removal of manure, preparation of foods and feeding of cows; and
- Most disagreeable, e.g., removal of manure.

(a) *Milking*—The most constant work in connection with the dairy herd is that of milking. In addition, probably half of this work has to be undertaken at very early hours, and more than half under conditions of artificial light.

Mechanical milkers have been used to a considerable extent to supersede hand-milking. Where mechanical milkers are not used, the labour and monotony of hand-milking can be relieved by making the conditions under which it is usually carried out more attractive, that is to say, by having well-equipped cowsheds kept reasonably clean, the cows likewise being kept in as clean a condition as possible and ample light provided.

(b) *Removal of Manure*.—The time and energy required for this work is at its maximum in the winter, and the best means of saving labour in addition to the points mentioned in (2) above is by the installation and use of—

- (a) A ground level system of rails leading from the cowshed to the manure yard with small tip waggons.
- (b) An overhead system of one rail with the necessary trolleys.

In the latter system the trolleys are easier to move and more convenient for the conveyance of manure when full, also more convenient for tipping either in manure heap or waggon or cart.

If the cowshed has gutters of sufficient width and slope and a suitable external drainage system, the liquid manure should be dealt with entirely by gravitation thus leaving only solid manure to be removed by hand labour.

(c) *Preparation of Foods*.—Most farms possess machinery for cutting roots, chaffing fodder, and breaking cake. Where considerable numbers of stock are to be fed, it is desirable that some kind of power unit should be installed to save hand labour. When mechanical power is available, a root cutter with a cleaning attachment and a mill for the grinding of cereals can be used.

It is often advantageous to have the cake breaker, grinding mill and chaff cutter on an upper floor with chutes leading to the mixing floor. By the exercise of some ingenuity in the

arrangement of chutes much time and labour can often be saved in the placing of meal and chaff in different parts of the mixing shed, and by the attachment of suitable hooks sacks can easily be filled when required.

(d) *Feeding of Cows*.—Mechanical equipment in the form of ground rails and waggons or overhead single rails and trolleys is almost as advantageous for lessening the labour in the feeding of cows as in the removal of the manure. Where cowsheds have no feeding passages, one rail system may be made available for both manure waggons and food waggons. Where long hay or straw has to be brought from a stack or Dutch barn some distance from the cowsheds, large iron framework fodder barrows are very useful both in saving labour and lessening waste of fodder on windy days. The wheelbarrow and the bushel basket are out of place on a well equipped farm.

The mechanical equipment referred to above should be supplemented with up-to-date machinery for the economical and rapid handling of crops, for instance, portable engine for use in rickyard or fields, elevator, horse fork, hay sweep, swathe-turner, side rakes, &c, and a silo for ensilage.

Water Supply.—On many farms where the sole source of water is one or two wells, much time and labour has to be spent in the pumping of water and conveying it to stock on different parts of the farm. In many instances the lack of water limits considerably the use which can be made of certain fields. When a suitable well exists, or has been found on any farm; a suitable pump with the requisite power unit and cistern for storage should be installed, and water laid on to such fields and parts of the buildings as may be necessary. An adequate supply should likewise be laid on to the cowshed for washing purposes and to the milk room for cooling the milk and for washing-up. Hand pumps and water carts should not be required on an up-to-date farm.

The arrangement and construction of farm buildings and their equipment with suitable mechanical labour-saving machinery is a subject which requires the co-operation of landlord and tenant, and the alteration of old buildings and erection of new and the installation of mechanical equipment cannot but add to their value to both parties. Also, it cannot be doubted that in the future the farm on which the work in connection with milk production can be carried on in the most convenient, efficient, healthy and comfortable manner will be the farm which will have least difficulty in attracting and keeping an adequate supply of labour.

J MACKINTOSH

December, 1918.

APPENDIX D.

WOMAN LABOUR ON DAIRY FARMS

In dealing with this question, the following points will have to be considered:—

1. The type of woman to be employed

- (a) Whole-time workers.
- (b) Part-time workers

The (a) class might be divided into educated and industrial. The educated woman would in the natural course of events endeavour to qualify herself to act as forewoman, and to do such work as keeping of accounts and records, milk-testing, and dairy management. As such workers would probably only be employed on the larger farms, the total number would be small, and it is from the industrial class that the bulk of workers would be drawn.

(b) From many parts of the country expressions of opinion have been heard that part-time workers on the smaller farms would be an invaluable form of labour. These would include not only the village woman who would milk when required, but the farm servant whose work would be partly indoors and partly out.

2. Description of work which could be undertaken by women.

During the war women have proved that they can undertake the following work with efficiency:—

Cleaning sheds, preparation of food, feeding and grooming of stock, care of young stock, milking by hand or machine, cooling and weighing of milk, cleaning of utensils and milking machine, keeping of records, care of milk float and horse, and the delivery of milk, provided that it does not entail the lifting of heavy churns.

Special attention should be paid to the recommendations and suggestions in Appendix C, as they apply more emphatically in the case of women than of men. It is also advisable that all implements used, such as shovels, barrows, etc., should be as light in weight as possible in order to avoid unnecessary strain.

3. Size of farms which might employ women.

From observation, it would appear that it is only the larger dairy farms which can usefully employ whole-time workers, for the following reasons—

The very small farm usually worked by the farmer himself and one helper is generally unsuitable unless the woman worker happens to be a member of his family.

The medium sized farms also present difficulties. In these cases two or three men and one boy would be usually employed. It is unlikely that the farmer would engage a woman as horseman. Unless she were very skilled, she could not take the place of the cowman, and few women would care to work as "odd man" under the other men. It would be unwise to encourage her to take the boy's place, as only in this way can the future agricultural labourer be trained. Exceptions to the foregoing might be found where the woman was a daughter of one of the labourers or where she was sufficiently skilled to be cowman and have another woman under her. Until women have gained more experience, it is improbable that many will be engaged as head women, and it is generally conceded that only a small proportion of farm labourers' daughters have taken up this form of work. Want of sufficient

* For a Report on the use and efficiency of such machines, see page 54.

accommodation in the cottages as well as the higher wages paid in the towns have been contributing causes.

The great demand on the small and medium sized farms is for the woman who will undertake a certain amount of outdoor work, and work the remainder of the day indoors. Difficulties of housing do not occur in this case, as she lives in the farm-house. The rate of pay also, when the cost of living is considered, is often higher than that given to the whole-time outdoor woman. Conditions in this form of employment do not at present appear to be attractive to the average woman, but as this worker is needed and does fill a very important part in agriculture, it is essential that some steps shall be taken to render the position more congenial to her and to secure greater leisure and freedom.

On large farms, however, where several assistants are necessary in the cowsheds, it would be feasible and advantageous to employ a certain number of women. One large farmer who has a herd of about 400 cows expressed his opinion that it would be practicable to employ women in the proportion of two women to every man. Where labour saving machinery is employed, it would seem possible in very large herds to employ a greater proportion.

Where several women are employed, it would be possible to arrange for a rotation of workers, so that each could have regular time off, and it would be economical to allow one cottage or two, if necessary, for housing the workers.

4. Conditions of Employment.

Wages.—It is difficult to make definite suggestions regarding these in the present state of uncertainty as to what wages will obtain in the future in the industrial world and as to the prices to be paid for dairy produce. The wages, if they are to attract, must bear some proportion to those paid in other industries. At the moment, the amount generally considered satisfactory is about 30s. per week. Other conditions are, however, quite as important if women are to stand the strain of heavy physical labour and exposure to weather. In these may be included—

Housing.

Hours of work.

Holidays

Conditions under which the work is done.

Housing.—In the case where one, or perhaps two, women are employed, board and lodging have been frequently given in the farm-house. From the farmer's point of view, this is often a desirable arrangement, as proximity to work ensures greater punctuality. On the worker's side the chief drawback appears to be in the fact that early hours have to be kept in the evenings, and that sometimes she is expected to give assistance in the house.

Good housing is, however, a question of vital importance, and where good and reasonable billeting cannot be obtained

it is essential that a cottage or both should be provided. Such cottage should be within reasonable distance of the farm and be provided with at least the absolutely necessary furniture. One cottage could house several workers, and, from experience, it has been found an advantage if the employer can arrange for a certain amount of assistance to be given in the work of the house, either by employing a woman to do regular cleaning or by employing one woman part-time in the cowsheds (preferably for milking) and allowing her to work the remainder of her time in the cottage, or by allowing each woman one week of part-time in turn. Want of domestic comfort, in addition to being prejudicial to the health of the worker, would quickly drive her to other employment.

Hours of Work.—In this industry the work must of necessity start at an early hour in the morning, but for the convenience of the workers it might be advisable, instead of having long breakfast and dinner intervals, to have a short breakfast with a long dinner interval. This would more especially apply where the workers have to live at some distance from the farm and considerable time and energy would be expended in the walk to and fro. It would appear, from experience gained through the war, that an average woman can work nine hours per day without injury, provided there is a suitable interval.

Individual cases have been known where these hours have been exceeded without apparent injury, but such cases should be considered the exception rather than the rule. A free Sunday should occur at regular intervals and one free afternoon per week, if the work is to remain attractive.

5. General Conditions.

Another important matter in the case of women who are residing at some distance from their work is the provision of a place in which they can change and dry wet clothes in bad weather, and where breakfast can be warmed up and eaten with some degree of comfort. Social amenities will also bulk largely in the younger women's outlook, and employers should endeavour to bring them into such social life as the village can offer, especially Women's Institutes. Through this latter body they should be able to get any educational facilities they require and help in securing their own allotments should they so wish, or advice about any hobby they wish to undertake.

6. Keeping up supply of labour.

At the present moment a good number of Land Army women could be secured to continue in agriculture. Up to the present date, between five and six thousand of them have expressed their desire to remain in agriculture; these are, however, young women, of whom a large proportion will probably marry, and if the supply is to be kept up it may be necessary at some future date to consider how this can most economically be done.

M. M. MACQUEEN.

January 16th, 1919.

REPORT OF SUB-COMMITTEE ON EDUCATION IN DAIRYING

MEMBERSHIP OF COMMITTEE.

Lieut.-Col. WEIGALL, M.P. (*Chairman*).

Right Hon. F. D. ACLAND, M.P.

Major The Hon. E. F. L. WOOD, M.P.

Dr. C. CROWTHER.

Mr. C. M. DOUGLAS, C.B., B.Sc.

Mr. P. A. FRANCIS.

Principal GOODWIN.

Mr. J. MACKINTOSH.

Mr. ERNEST MATHEWS.

Mr. A. POOLE WILSON.

Mr. A. TODD.

Miss YELD.

TERMS OF REFERENCE.

1. The Sub-Committee was asked to report on education and research in dairying and particularly, as stated in a letter received by Major Astor from the President of the Board of Agriculture and Fisheries, "to submit a statement of the matters which they consider require to be dealt with and provided for in the future, outlining the deficiencies which have been shown to exist and the special requirements of the industry which have to be met."

EVIDENCE TAKEN.

2. In the course of their meetings and in order to supplement the knowledge of the different branches of dairy education possessed by the Sub-Committee, they have interviewed the following witnesses:—

Sir T. H. Middleton, Board of Agriculture and Fisheries.

Mr. J. F. Blackshaw, Board of Agriculture and Fisheries.

Mr. A. Poole Wilson, Department of Agriculture and Technical Instruction for Ireland.

Principal Paterson, for Board of Agriculture for Scotland and West of Scotland Agricultural College.

Mr. J. Darlington, Shropshire.
 Mr. Richmond James, Somerset.
 Mr. W. Bown, Somerset.
 Mr. B. Broughton, Somerset.
 Mr. J. H. Mackie, Cheese Inspector, Ministry of Food.

Education in Dairying inseparable from Education in Agriculture.

3. It was evident to the Sub-Committee at the beginning of their work that the facilities for and methods of education and research in dairying could not be satisfactorily considered except as part of the national scheme of agricultural education and research.

Further, in view of the fundamental differences in administration obtaining in England and Wales, Scotland and Ireland, they considered it necessary to deal with and to report on each of these countries individually.

ENGLAND AND WALES.

Scheme of Agricultural Education and Research.

4. The subject of agricultural education has been carefully studied in all its aspects during the last 15 years, and particularly by the Committee presided over by Lord Reay, which presented its report in 1908.

That Committee pointed out clearly the deficiencies which then existed, and made many useful suggestions for improvement and development. Since that date, the passing of the Development and Road Improvement Funds Act, 1909, and the consequent provision of much larger sums of money for agricultural education and research has enabled comprehensive new schemes to be thought out and brought into operation to a greater or lesser extent in almost all the counties of England and Wales. The scope and method of these schemes is best stated by the following extracts from the Report of the Development Commissioners (H.C. 305) for the year ending March 31st, 1912:—

“The schemes for the extension of a system of education fall under two main heads: first, the division of England and Wales into 12 areas, each centred round an agricultural college, and grants to those colleges to enable them to demonstrate the application of known results to local conditions and to provide technical advice to local agriculturists; secondly, grants to county councils to enable them to provide or extend farm institutes or schools—educational centres which will give short winter courses or similar instruction, and also be the headquarters of an increased county staff of itinerant teachers, advisers and organisers.”

As regards research the scheme adopted was based on two main principles.

“First, that what may be called pure research is not a local matter, and the proper division of effort is not by geographical districts, and secondly, in order to be really effective it must be continuous and concentrated. Attempts have therefore been made to divide agricultural science into 11 main branches, and to provide for systematic research into each of these at one or two institutions devoted to that subject.”

“When these schemes are in full operation the Commissioners hope to see an organic system of research, technical advice and education covering the whole of England and Wales. At the head will be the research institutes, each carrying forward the investigation of a particular branch of agricultural science, and with similar Irish and Scotch institutions, covering practically the whole field of that science. Next, there will be the colleges, whose duty it will be to provide the highest form of education in agriculture, to demonstrate by experiment the application to local conditions of the results obtained by the research institute, and to advise farmers within their areas on the more difficult problems of farm practice. Last, there will be the farm institutes, closely connected with the colleges, providing education for classes to whom the long college course is unnecessary or impossible, and finally, by means of itinerant county staffs centred at them, advising the farmers in the simpler and less far reaching difficulties which require for their solution no great scientific knowledge or prolonged scientific training.”

Present Facilities in England and Wales.

5. Education and research in dairying development on the lines indicated in the above scheme have been greatly hindered by the war. The existing facilities consist of three stages of dairy education provided by County Education Authorities. The first stage takes the form of itinerant instruction, including courses in cheesemaking and buttermaking at different centres in the counties, and advisory visits to dairies and farms. The instruction in cheese and butter-making is frequently provided by travelling schools, and such courses were carried out in fully two-thirds of the administrative counties of England and Wales in 1918. The next stage in dairy education is provided by the same authorities at dairy schools attached to the county farm institutes. There are some 13 county centres for this instruction at the present time, and other counties have schemes in hand for the establishment of institutes within their own boundaries. The third and highest existing stage of dairy education is provided at three provincial centres in England and Wales. At the same time, it is very difficult to make any hard and fast distinction between the instruction given at some of the best county schools and that given at the provincial centres. The long courses of instruction provided at these colleges constitute the courses of training for teachers who undertake itinerant instruction in counties and for other dairy experts. These colleges are the best-equipped institutions for such educational work in England.

Facilities for Research.

6. No special facilities for research work were provided at any educational centre prior to 1912, but in that year, in the development of the scheme adopted by the Development Commissioners and referred to above, an Institute for Research in Dairying was established at University College, Reading. Owing to the war, however, progress has been slow, and there has been great difficulty in obtaining the necessary external and internal equipment for the different branches of research work. Grants have also been made to Cambridge and Leeds Universities for the purpose of research in the nutrition of the milk-producing animal.

Administration and Finance of Schemes.

7. The responsibility for the initiation of schemes for agricultural and dairying education in England rests on two groups of authorities. First, education in the administrative counties, of which there are 62 in England and Wales, is in the hands of the county councils; and, second, the schemes for centralised and advanced agricultural and dairying education are administered by certain agricultural colleges and universities.

With regard to the counties, most of the money that was available for educational work was, previous to the date of the Development Act, entirely under the control of the county authority. The Development Act, however, made it possible for the Board of Agriculture and Fisheries to assist counties by grants for new and additional work. The Board had no driving power with regard to the initiation of educational schemes in backward counties.

In respect of the work already in existence in 1912 the Development Fund was held not to be available for assistance. Grants were made available to colleges for the appointment of additional officers to undertake advisory work and investigation of local problems. Only one provincial centre, however, appointed an adviser in dairy farming.

Reference has already been made in paragraph 6 to the establishment of a research institute in 1912.

Deficiencies and Recommendations: Strong Central Authority Necessary.

8. In considering the official scheme of agricultural and dairying education as it was outlined in 1912, it must be remembered that sufficient time had not elapsed before the outbreak of war to permit of any considerable development. Much of the evidence given before the Sub-Committee, however, showed conclusively that in counties which were thought to have well organised schemes there was still a great gulf to be bridged between the agricultural organiser and his staff and the average practical farmer; and that in others any advancement was well-nigh impossible, because of the lack of interest or initiative on the part of the local authorities and the absence of driving power on the part of the Government Department responsible.

The first essential in remedying this defect is to strengthen the position of the Board of Agriculture and Fisheries, and the Sub-Committee, therefore, most cordially welcome the statement made in the House of Commons on March 26th last by the Parliamentary Secretary to the Board of Agriculture, on behalf of the Government, that the necessary measures will be brought forward as soon as possible to re-organise the Board of Agriculture and to accord to the Department the status, staff, and accommodation of a first-grade Ministry.

Lack of Well-trained Teachers.

9. At the present time there is great lack of really well-trained teachers and advisers in dairying subjects. The institutes giving the highest type of education are not in a position either as regards accommodation, equipment, or staff, to give technical instruction up to the standard required, nor are they able to give sufficient attention to training in teaching. In order to obtain teachers and experts of the desired standard of practical and scientific knowledge, the Sub-Committee recommend that longer and better proportioned courses of training be provided. They consider that a course covering not less than two years is necessary, and that the centres providing such courses should have such additional equipment as may be necessary in respect of farms, dairies, and laboratories to enable all aspects of the production and management of milk to be taught in a comprehensive and efficient manner. They wish to emphasise the point that no educational centre, whether for advanced or elementary work in dairying, can be considered adequately equipped unless the students have easy access to a dairy farm, and can obtain practical illustrations of the best methods of dairy stock management and the handling of milk.

Lack of Instruction in Counties.

10. Reports on the facilities for dairy education throughout England and Wales show that in some counties little is done in the way of providing even the first stage of dairy education, *i.e.*, itinerant instruction, and that in others where dairying is an important branch of farming no county farm institute has been established. The Sub-Committee attach great importance to itinerant instruction as the foundation of a complete scheme of dairy education, and they welcome the extension of this work which has recently taken place under the scheme of the Board of Agriculture for the encouragement of cheese-making. They consider, however, that further provision should be made for adequate itinerant instruction in each county and they recommend accordingly. In the case of small counties, or in those where milk production is not an important branch of farming, two or more county authorities might co-operate to provide such instruction. Further, this instruction should not be concentrated so much on butter and cheese-making as has been the case in the past, but should deal fully with the best methods in the production and treatment of milk for direct consumption. It should be remembered that 70 per cent. of the milk produced in this country is sold for this purpose, and not for the manufacture of dairy products.

With regard to dairy schools attached to county farm institutes, the evidence laid before the Sub-Committee has shown that certain counties, which at present limit themselves to itinerant instruction, contemplate the establishment of institutes, and they believe that there is ample scope for such additional county educational centres provided that the school is located on a farm, and that the system of management on the farm exemplifies, according to circumstances, the principles advocated in the school.

Lack of Instruction in Factory Management.

11. At the present time there is not only a deficiency in the facilities for the training of teachers and advisers, but there is a total lack of facility for training in factory management. The most fully equipped dairy schools undoubtedly give great attention to practical instruction in cheese-making, but this instruction, though quite adequate for the manufacture of cheese on individual farms or in private dairies, does not give students experience in dealing with large quantities of mixed milk such as is received at factories. In other respects also, such as the management of machinery, the existing institutions fail to give the training which is essential.

As the number of farmers' co-operative societies and factories will probably be largely increased in the near future, and as there is a lack of managers and cheese-makers with a sound technical training for existing factories, the Sub-Committee are of opinion that special provision should be made for training in this work. Such facilities may be provided either in immediate association with existing teaching

centres or by the establishment of entirely new centres. They recommend that, having regard to the presence of laboratories and staff at existing institutions, and to the advantages of maintaining close touch with technical and scientific work, provision should be made for instruction in factory methods and management at existing institutions in preference to the establishment of new centres.

Research Work.

12. Owing to the neglect of research work in dairying in this country in the past, the itinerant teacher and the college lecturer alike have had to depend for their information with regard to many recent and important discoveries in dairy science and practice on reports received from other countries, and often translated from other languages. One of the results has been that improvements in practice resulting from scientific research have found their way but slowly into this country, and often long after they have been incorporated into daily practice in other countries. All teachers and advisers know that their work is much more convincing and effective when they can support their recommendations by reference to experiments which have been carried out under conditions obtaining in this country, instead of having to quote from reports of work done in other countries, and there can be no doubt that the lack of facilities for research has been a great handicap to dairy education and to dairy practice in the United Kingdom.

The Sub-Committee recommend that the development of research be assisted to the fullest extent, and in view of the importance of considering the breeding and individuality of the cow and the food and method of feeding in relation to the quantity and composition of milk and the quality of produce obtained, they consider it very desirable that the Research Institute should be able to carry out investigations in connection with the breeding, feeding, and management of dairy stock as well as in relation to milk and dairy products.

SCOTLAND.

Scheme of Dairy Education in Scotland.

13. Agricultural and dairy education in Scotland is much more centralised than in England. The country is divided into three areas, each having an Agricultural College as an educative centre. The College authorities are responsible for the initiation of schemes for internal and external agricultural and dairy education. External or itinerant instruction work is carried out in co-operation with county authorities, who act in an advisory capacity. This centralisation of finance and responsibility is considered in Scotland to have given more satisfactory results than would have been obtained by the placing of responsibility in the hands of county authorities.

Facilities for Dairy Education in Scotland.

14. The first stage of dairy education is carried out as in England by county organisers assisted by instructors and instructresses who give instruction in cheese and butter making at various centres and who visit farms where difficulties have arisen and where improvements are desirable. In the cheesemaking districts the advisory work on cheese farms has been very extensive, and has given very good results.

Courses of instruction in dairying are provided at the three Agricultural Colleges, and the practical instruction is concentrated at one centre, namely, the Dairy School for Scotland at Kilmarnock. This school receives students from the whole country and is worked in association with, and administered by the West of Scotland Agricultural College. Research work in cheese-making has been commenced in recent years at Kilmarnock.

Deficiencies and Recommendations: Itinerant Advisory Work and County Education.

15. Although considerable success has attended the work of visiting advisers in the past, it is felt that much better results would be obtained if a sufficient staff were provided to enable the farms in the different dairying counties to be visited more frequently. One-day visits to cheese-making farms are not thoroughly satisfactory, as the adviser cannot follow up the results of his day's work in such a manner as to enable the local cheesemaker to obtain the greatest benefit. It is also desirable that small centres, if possible in association with small demonstration farms, should be established in different districts, where investigation work into local problems could be carried out and advice given to local farmers. The Sub-Committee, therefore, recommend that the necessary steps be taken to obtain additional staff, and to provide and equip county centres in dairying districts where it is found that such centres are desirable.

Equipment of the Existing Centre.

16. The Dairy School for Scotland cannot be said at the present time to be efficiently equipped in respect of plant, and it is unable to provide accommodation for all the pupils who wish to attend. The Sub-Committee recommend that it be extended so as to provide space for such additional machinery and equipment as may be necessary and to enable it to deal with a larger number of students.

Advanced Dairy Education.

17. They also recommend that longer courses going into greater detail and affording better opportunities for the training of experts in different branches of dairy work be provided.

Research.

18. With the assistance of the Development Commissioners, a certain amount of research work in the manufacture of cheese and in other matters relating to the manufacture of dairy products has been carried on through recent years. There are, however, many additional problems requiring attention, and the Sub-Committee recommend the provision of additional facilities in respect of buildings, equipment and staff for research work.

19. There appears to be room in Scotland for an increased number of dairy schools with special reference to the training of smallholders.

Scheme of Dairy Education in Ireland.

20. Provision for Dairy Education in Ireland falls under two headings:—

- (a) that which is administered directly by the Department of Agriculture, e.g., provision of education of creamery managers and itinerant teachers or instructors;
- (b) that which is administered by County Committees of Agriculture, e.g., itinerant instruction in butter-making and soft cheesemaking.

In each county an Agricultural Committee administers funds raised by rates for the particular purpose of instruction in agriculture, including dairying. The funds of these County Committees are contributed to by the Department of Agriculture, the amount so contributed varying in each case with local conditions. The County Committees work in accordance with schemes recommended by the Department, and though the Department has no power to enforce the adoption of these schemes, it is worthy of note that they have been put into operation by every County Committee in Ireland. The itinerant teachers, through whom these schemes are worked, give instruction in butter-making and in soft cheese-making at local classes and on farms.

Present Facilities for Dairy Education.

In addition to the instruction provided through the medium of the local classes referred to above, complete courses in dairying are given at two central dairy schools and at nine schools of Rural Domestic Economy. The terms or sessions at one central dairy school cover a period of about eleven weeks, but the majority of the pupils in attendance remain for either two or three terms, and for those who are being trained as teachers the course covers a period which averages about eighteen months. The terms at the schools of Rural Economy cover about five months, but, as in the case of the central schools, the majority of the pupils remain for a second term.

21. Instruction for managers of creameries, cheese factories, &c., is as follows:—

- (1) A preliminary course of five months' lecture and laboratory work at the Royal College of Science held during the winter months.
- (2) A practical training, under the supervision of the Department, of thirty weeks during the summer months follows, the students being placed at approved creameries where butter and cheese are manufactured. During this stage those undergoing the training are expected to take part in every section of the work of the creamery, &c. A maintenance allowance is paid to the student during this period.
- (3) A final course of five months during the winter at the Royal College of Science, when the student attends an advanced course of lectures and laboratory work. The instruction thus covers a period of eighteen months.

The highest stage of Dairy Education provided for in Ireland consists of a four years' course at the Royal College of Science.

Deficiencies and Recommendations.

22. From the evidence placed before the Sub-Committee it would appear that the facilities for Dairy Education in Ireland meet to a greater degree the requirements of the country than is the case either in Scotland or in England and Wales. They wish to point out, however, that in their opinion teachers in dairying should have the opportunity for obtaining a more comprehensive course of scientific instruction than is at present provided.

In respect of facilities for research, nothing appears to have been done, and the Sub-Committee recommend most strongly the giving of all necessary assistance for carrying out research work into the problems which have arisen and which require to be solved in order that further progress may be made in the dairy industry of Ireland.

(Signed) W. E. G. A. WEIGALL (Chairman).

January, 1919.

REPORT OF AN ENQUIRY INTO THE USE OF MILKING MACHINES.

At the early meetings of the Committee the value of milking machines as labour aiding appliances on dairy farms was discussed, and in view of the present and prospective difficulties of obtaining a sufficient supply of labour for milking and the differences of opinion expressed as to the utility of the types of machines at present available, the Secretary was asked to obtain further information and report to the Committee.

SCOPE OF REPORT.

In 1917 an investigation into the use of milking machines in Scotland was carried out by the Highland and Agricultural Society, and a Report prepared for the Society by Mr. W. Burkitt, Grange Hill, Bishop Auckland, was issued, giving the results of the enquiry. So far as Scotland was concerned, therefore, it was not considered necessary to undertake another detailed enquiry.

As no recent enquiry covering all the machines now on the market has been carried out in England and Wales,* it was decided to make an effort to get opinions from all parts of the country, both from makers and agents, and from dairy farmers. Names of farmers who had experience of milking machines were received from makers and agents and from the agricultural organisers in the different counties. Information was collected from these sources in the autumn and winter of 1917 and analysed, and the report prepared as time permitted during 1918.

In respect of England and Wales, therefore, the report consists of three parts. Part I deals with the information received from farmers; Part II deals with the information received from makers and agents, and Part III contains general conclusions and suggestions.

* The only reports issued in recent years are:—

- (1) Report on Milking Machine Trials, 1909 and 1911, Midland Agricultural College Bull. 1311-12.
- (2) The Trials of Milking Machines, 1913 (J. R. Agric. Soc.).
- (3) Farm Labour-Saving Machines, etc., 1916 (pages 22-27), by J. R. Bond, B.Sc.

REPORT ON THE USE OF MILKING MACHINES IN ENGLAND AND WALES.

PART I.

INFORMATION RECEIVED FROM FARMERS.

The list of questions given below was drawn up and submitted to 204 farmers in all parts of England and Wales.—

- 1a. What is the name of the milking machine you are using?
- b. How long have you had it in use?
- 2a. What is the daily average number of cows milked by your plant?
- b. What is the number of cows milked for each machine used?
- c. Do you use it all the year round?
- 3a. If your machine works by suction, what pressure, as indicated by the gauge, do you find most suitable?
- 4a. What source of power do you employ?
- b. If an engine, state the kind and horse-power.
- c. Does this engine do other work? If so, what work?
- 5a. What is the average time required to milk the number of cows given above under 2a?
- b. How many persons are required?
- c. Are the cows hand-stripped after the machine?
- d. About what quantity of strippings do you get per cow?
- 6a. Have you found any injury or irritation to the teats or udder of a cow from the use of a machine?
- b. Do cows take readily to its use?
- 7a. Have you had cows that held up their milk, or were so fractious with the machine that they had to be milked by hand?
- b. If so, about what proportion?
- 8a. How soon after calving do you begin to use the machine?
- b. Are the cows dried off by hand?
9. What is your opinion of the difference, if any, between hand milking and machine milking—
 - a. In the yield of milk?
 - b. In the length of lactation period?
 (If you have any actual records on these points, please forward copies.)
- 10a. Is it easier with the machine to prevent impurities getting into the milk?
- b. Does the milk keep sweet longer?
- c. What is your experience of taints arising through the use of the machine?
- 11a. What is your method of cleaning the machine?
- b. What time does the cleaning require daily?
- c. Do certain parts of the machine require more perfect cleaning periodically?
- d. How is this effected and what time is required?
- 12a. What was the total cost of your installation?
- b. Please divide total cost as follows:
 1. Cost of providing power.
 2. Cost of milking machine plant.
 3. Any other costs.
- c. Were there special circumstances in your case affecting this cost—such as situation or construction of cowsheds, or extra power of engine for other uses?
- 13a. Can you state approximately the average total annual cost of running your installation, apart from labour, but including oil, &c., for engine, replacement of rubber parts and other parts and repairs generally?
- b. What is the smallest herd for which you would instal a machine?
14. What do you estimate to be the saving through the use of your machine—
 - a. In labour?
 - b. In cost of production?
- c. If sufficient reliable hand milkers were available, would you continue to use a milking machine?
15. In what particulars do you consider that there is room for improvement in your machine, especially in regard to:—
 - a. Simplicity in mechanism, ease in working and cleaning?
 - b. Saving in wear of parts?
 - c. Easy adaptation to any size of teat and for comfort of cows?
 - d. Obtaining milk as free from impurity as possible under practical conditions?
- 16a. If you were installing a milking plant now, what changes would you make in your engine, make of machine, or fittings?
- b. Should the engine do other work than that required for milking machines?
- 17a. If you have had experience of more than one type of milking machine, please compare their merits.
- 18a. Does the success of your machine depend on continuous personal supervision?
- b. Do you consider that an average cowman, after a few lessons, can be trusted to operate your machine with success and clean it satisfactorily, or is any special training and knowledge desirable or necessary?
- c. Are there recurring difficulties or occasional breakdowns which cannot be overcome by a cowman of average intelligence?
19. Any additional remarks about milking machines that would further this enquiry.

The replies obtained to these questions are summarised below:—

NUMBER OF REPLIES RECEIVED AND NAMES OF PLANTS USED.

In respect of the 204 forms sent out, 142 replies were received. These replies covered 8 different machines as follows:—

"Lister"	...	...	...	...	...	...	...	...	38
"Amo"	...	...	...	...	...	...	...	...	21
"Vaccar"	...	...	...	...	...	...	...	...	20
"Hinman"	...	...	...	...	...	...	...	...	17
"Gane"	...	...	...	...	...	...	...	...	15
"Wallace"	...	...	...	...	...	...	...	...	12
"Manus"	...	...	...	...	...	...	...	...	10
"Lawrence-Kennedy"	...	...	...	...	...	...	...	...	9

All the above machines are of the *suction* type, and it may be assumed that only machines of this type are making any headway in England at the present time. Some years ago machines operating on the cow's teats by *pressure* only were in use here and there, but these met with little success. It may also be safely assumed that no types of suction machines other than the above are used in any numbers in England.

DESCRIPTION OF SUCTION MILKING PLANT.

All mechanical milking plants of the suction type in use in this country are constructed on the same general lines. They consist of the following essential parts:—

1. A power generating unit for driving the vacuum pump.
2. A vacuum pump for creating the necessary suction, and a tank and gauge for steadying and registering the pressure.
3. A system of iron piping leading from the pump to the cowshed, and usually fixed above the cow-stalls.
4. A pulsator, pulsators, or other mechanical device, for converting continuous into intermittent suction.
5. One or more rubber tubes connecting the overhead vacuum pipes to the pulsator and the teat cups.
6. A milk receiver or receivers.
7. Teat-cups and tubes for conveying the milk from the teats to the milk receiver.

In the different types of plant reported on variations were found to exist in all the above parts, and the following general description is given in preference to an attempt to describe each plant in detail.

The Power Unit is the most variable item in the plant, and may consist of petrol, oil, steam, or gas engine, an electric motor, or any other means of driving a pump. A list of the sources of power reported on is given on page 57.

The Pumps used vary according to the make of the machine, the action is similar, and is somewhat as follows:—

The pump consists of a cylinder (or cylinders, according to the size, capacity, and make of the pump), fitted with a rod and piston actuated by means of either a crankshaft and flywheel or coupled direct to the engine, the cylinder being fitted with both intake and exhaust valves, which are automatically worked. On the upward stroke of the piston, the intake valve opens and the air is drawn through the valve from the vacuum pipe by the sucking action of the piston; at the top of the stroke the intake valve closes and the exhaust valve opens, releasing the air on the downward stroke; as the exhaust valve closes at the bottom of the stroke, the intake valve again opens and thus a continual sucking action is maintained.

At a short distance from the pump and connected to the vacuum pipes a small *tank* is generally placed to assist in maintaining a uniform vacuum; to this tank is fixed a *safety valve* for the regulation of the suction and a *gauge* to register the pressure.

A gauge is often attached to the vacuum piping in the cowshed, where it is visible to the person in charge of the milking operations.

The Overhead Piping is usually of iron; with a diameter of from $\frac{3}{4}$ " to $1\frac{1}{2}$ ". Where the cowsheds are badly arranged, the amount of piping and the cost of installation is considerably increased, particularly if part of the piping has to be carried underground.

The Pulsator varies in construction according to the patents of the different manufacturers, and is placed in different positions between the pump and the cow's teats. Thus in the Gane and Hinman one pulsator only is required for each plant and it is placed at any convenient point in the piping system, either inside or outside the cowshed. In the Lister, Vaccar, and Lawrence-Kennedy, the pulsator is attached to the lid, and in the Amo and Manus to the body of the milk receiver, one being required for each receiver and set of teat cups; in the Wallace, one very small pulsator is fixed to each teat cup, four being required for each receiver and set of cups.

The vacuum is continued from the overhead piping to the pulsator or receiver by means of *rubber tubes*. These are connected to the piping by T-pieces, and at each junction an airtap is inserted to shut off the vacuum from the pulsator and teat cups when necessary.

The Milk Receivers vary according to the make of the machines. In the Amo and Manus they are slung under the belly of the cow by means of a suspender over the back. Each receiver is round in shape, and has a capacity of $2\frac{1}{2}$ -3 gallons. In the other plants the receivers rest on the ground between the cows, and are of two types; (a) a large receiver with two compartments designed to take the milk of two cows at once, but to keep the milk separate to facilitate milk recording. Receivers of this type are used in the Lawrence-Kennedy, Vaccar, and Lister plants; (b) a receiver of one compartment only, designed to take the milk of one cow at a time, and used by the Wallace, Lister, and Gane plants.

It should also be mentioned that in the Gane and Lister plants an "automatic receiver" can be installed in place of the types just described. By this method the milk is drawn straight from the teat cups through bronze or tinned copper piping with rubber joints into a receiver or twin receivers placed immediately above the cooling apparatus or elsewhere; this receiver is fitted with an automatic device which causes it to empty when a certain weight of milk has been collected, the milk falling into the reservoir of the cooler or other vessel. The advantages to be gained from this system are a saving of labour and time in milking, and in carrying the milk to the milk room; the disadvantages are the impossibility of keeping milk records and the increased amount of tubing to be washed after each milking. No installations of automatic receivers were reported on in this investigation.

The *Teat Cups* are of several different patterns according to the make of the machine, but the principle of construction is practically the same in all. A metal cup made of aluminium, gunmetal, or brass, often nickel-plated to facilitate cleaning, is fitted with a rubber lining or moulding in such a manner that a space is left between the lining and the outer shell. The suction of the pump, regulated by the intermittent action of the pulsator, withdraws the air from and refills this space, thus causing the rubber lining alternately to grip and release the teat; the lining is so constructed with thick and thin parts that a downward pressure from two or more sides is applied to the teat and the milk is forced into the conveying tubes by a combination of pressure and suction.

One make of pulsator is fitted with a filter so that no dust from the air of the cowshed can be drawn through the inlet.

The teat cups are in most cases connected together at the base by means of a "claw," and from this claw rubber or celluloid tubes connect with the milk receiver. In the Gane, Lister, and Vaccar, one air and one milk tube lead from the receiver to the teat cups, so that no air is drawn through the tube through which the milk passes; in the Hinman, Lawrence Kennedy and Wallace machines only one tube leads from the teat cups to the receiver, and this is used for both milk and air. In the Manus machine there is one short celluloid tube for the conveyance of the milk from the claw to the receiver and four separate rubber tubes connecting the pulsator and the four teat cups. In the Amo machine there is a celluloid milk conveyor and rubber air tube to each cup. The celluloid tubes have the advantage of being short, straight, transparent and easy to clean, and they are not so perishable as rubber.

PERIOD OF TIME USED.

The period of time during which milking machines have been used in the various herds ranged from a few days up to 11 years, the average time for the various machines being as follows —

"Lawrence Kennedy"	...	...	...	...	...	...	4.8 years.
"Vaccar"	...	...	...	...	...	...	4.2 "
"Gane"	...	...	...	...	...	...	2.4 "
"Wallace"	...	...	...	...	...	...	2.4 "
"Lister"	...	...	...	...	...	...	2.3 "
"Amo"	...	...	...	...	...	...	2.1 "
"Hinman"	...	...	...	...	...	...	1.2 "
	(Introduced into this country in 1915.)						
"Manus"	...	...	...	...	...	...	1.0 years.
	(Introduced into this country in 1916.)						

Both the "Lawrence Kennedy" and the "Vaccar" machines had been in use on farms for 11 successive years; the "Wallace" and "Gane" for 5 years continuously; the "Lister" for fully 4 years and the others for shorter periods due to the more recent date of introduction into this country. Many of the farmers who had had machines in operation for periods of years reported very satisfactorily, and said that they were quite satisfied with the type of machine which they were using. One reporter stated that throughout 5½ years' usage, he never had to milk his herd of 60 cows by hand, while another with 8½ years' experience, stated that he found machine milking equal to the average good and bad hand milking. On the other hand, one user of a machine stated that he had discontinued it after 9 days as the milk yield fell off so rapidly, while, another, who had his machine installed early in 1916 used it throughout that summer only and stated that 5 out of 7 machines erected in his district at the same time as his own are not being used now. In numerous instances farmers reported that they had had to discontinue or reduce the work done by their machines during 1917, owing to the shortage of petrol and the inadequate amounts allowed to them.

On the whole the replies received to the questions sent out are sufficiently numerous for each make of machine, and cover a sufficiently long period of time to make them a reliable basis on which to form an opinion as to the efficiency and value of mechanical milkers.

AVERAGE NUMBER OF COWS MILKED PER DAY.

The herds in which machines were used ranged from 10 to 140 cows, the average herd numbering 48. Where double receivers were in use, the average number of cows milked per machine was 10, and with single receivers the average was 8.6. In reply to the question as to whether machines were used during the complete 12 months, 93 out of 130 stated that the machine was used continuously, while 37 stated that it was not continuously in use. Amongst the latter were a considerable proportion of cheese makers, who so arranged the management of their herds that they had a maximum number of cows in milk during the summer and a very large proportion dry during the winter, and who considered the use of the machine uneconomical during the latter period. In other instances, the lack of petrol contributed to the stoppage of the machines for varying periods.

AMOUNT OF PRESSURE AND SOURCES OF POWER USED.

The pressure used varied according to the make of the machine, and ranged from 12 to 20 lbs. per square inch. On this point definite instructions are usually given to the operators by the firms installing the machines. The sources of power used for driving the plants were as follows:—

Petrol Engine	...	...	...	...	...	...	77
Oil	...	...	...	...	...	...	31
Gas	...	...	...	...	...	...	3
Electric Motor	...	...	...	...	...	...	7
Water Power	...	...	...	...	...	...	1
Oil and Electric Motor	...	...	...	...	...	...	1
Steam Engine	...	...	...	...	...	...	2

In a number of instances 2 sources of power were available, one for emergency use.

Many of the farmers had utilised as sources of power for the milking plant such engines as they had previously had installed in their farm buildings for other indoor work, and the majority considered that the power unit installed for driving a milking machine should be available for other work. The horsepower of the various power units ranged from 2 to 4 h.p. in 83 replies out of 129 received, the remainder

using power units of from 4 h.p. upwards. In many replies emphasis was laid on the necessity for having reliable power units, and in many instances the installation of an emergency power unit was advised, particularly in the case of large herds of cows, since in the event of a breakdown of the engine, it would be difficult to obtain the necessary number of hand-milkers to carry through the milking of the herd in a reasonable time.

TIME AND NUMBER OF PERSONS REQUIRED FOR MECHANICAL MILKING.

The average time required to milk the average herd of cows worked out at 82 minutes. The averages for the individual machines ranged from 69 to 94 minutes. The number of persons required to milk the average herd worked out at 27 persons.

NECESSITY FOR HAND STRIPPING AFTER MECHANICAL MILKING.

Out of 136 replies received, 130 stated that it was their custom to strip by hand afterwards. The remaining 6 stated either that it was not necessary, or that only a few cows needed hand stripping. The quantity of strippings obtained varied from 0.12 to 2.65 pints, the average being 83 pints. The point involved in the hand stripping of cows is not merely one of the efficiency of the machine; most, if not all, of the machines would strip out the majority of cows effectively but at the expense of time. Further, it is desirable that the teats and udders should be examined closely every day by the cowman in order to note in due time any sore teat or any defect in any of the quarters. This daily inspection can be most reliably carried out if it is the custom to strip the cows by hand.

INJURY OR IRRITATION RESULTING FROM THE USE OF THE MACHINE.

On this point 131 replies were received, and in 110 instances the reply was to the effect that no bad results were caused by the use of the milking machine. The remaining replies stated that various troubles had followed its introduction, such as the teats becoming very tender, and quarters swollen if the cups were left on too long.

In respect of the adaptability of the cows to mechanical milking, 75 per cent. of the replies stated that cows took readily to the machine. Nearly all reporters agreed that heifers took more readily to machine milking than older cows. With cows, the majority became accustomed to it in a few days, but there were a few exceptional animals which it was almost impossible to milk by mechanical means. The general opinion was to the effect that cows and heifers are much quieter under mechanical milking than with hand milking once they get used to the noise and action of the machines.

USE AT BEGINNING AND END OF LACTATION PERIOD.

The time of bringing machines into use in the case of newly-calved cows varied greatly. A few replied that they used the machine "at once," but it is difficult to take this as meaning that the machine was used within 24 hours after calving. Others stated that they used the machine 2, 3, 4, 6, 7, 8, 9, 10, 14 days up to 3 weeks after calving.

In respect of cows drying off, out of 127 replies received, 84 stated that the cows were dried off by hand and 33 stated that during this period the cows were milked partly by hand and partly by machine.

EFFECT OF MECHANICAL MILKING ON YIELD AND LACTATION PERIOD.

In respect of the effect of mechanical milking on yield, out of 116 replies, 75 (or 65 per cent.) stated that there was no difference as compared with hand milking, 28 per cent. stated that the yield was less, while 7 per cent. expressed the opinion that the yield was slightly increased.

As regards the lactation period, 70 per cent. of the replies agreed in stating that there was again no difference, while 28 per cent. gave the period as slightly shorter, and 2 per cent. as slightly longer. The replies as to the amount of the reduction in the lactation period were very variable. Some stated that the milking period was shortened by one month, while another ventured the statement that it was shortened by 3 months.

Actual records of the effect of mechanical milking on milk yield or on length of lactation period were asked for, but it is a matter of regret that none were forthcoming. Undoubtedly some of the replies were based on the records in the possession of the farmers, but in many cases the replies were expressions of opinion unsupported by any actual records.

EFFECT OF MECHANICAL MILKING ON CLEANLINESS OF MILK.

Ninety-two per cent. of the replies stated emphatically that it is easier to prevent impurities getting into the milk by using a milking machine.

In reply to the question "Does the milk keep sweet longer?" 47 out of 99 replies received were in the affirmative, 35 stated there was no difference, while 17 were in the negative. It is remarkable that 10 replies out of the 17 were from users of the same make of machine. It is difficult to understand exactly what is implied in the answers to this question, because of the lack of information as to the length of time during which the milk remained sweet under former methods of milking, but it is impossible to avoid the general conclusion that milk obtained by a mechanical milker kept in proper order should be cleaner, and should keep sweet for a longer time than milk obtained under the average conditions of hand milking.

In respect of taints, 89 replies out of 123 stated that they had had no experience of taints arising through the use of their machine; 27 replied that there were no taints if the parts through which the milk passed were kept clean; 7 instances of taints were recorded, and these were attributed to the following causes:—

1. Dirty rubber tubes.
2. Old " "
3. New " "
4. Faulty rubber teat-cup linings.
5. Pulsator leakage leading to oil taints in the milk.
6. Water which had collected in vacuum pipes obtaining access to and tainting the milk.

With efficient management and adequate renewals of worn out parts, no taints need have arisen from any of the above causes

METHOD OF CLEANING MECHANICAL MILKERS.

The usual method of cleaning resorted to consisted of passing first cold water and then hot water through the teat-cups and milk-conveying tubes into the milk receiver. In some instances the hot water contained a disinfecting agent, in others the teat-cups were regularly brushed out, but it was obvious from the general tenor of the replies that the cleaning was, as a rule, not sufficiently thorough or systematic. The time given to the daily cleaning appeared to be about 5 minutes per receiver and associated parts, and it was added that the rubber parts required more perfect cleaning periodically. In most cases the machine was taken to pieces and thoroughly cleaned weekly, fortnightly, or monthly. Again, it was obvious that on many farms there was no definite procedure laid down for the dismantling and careful examination of the working parts and the parts which come into contact with the milk. At no stage in the management of a mechanical milker is there greater need for attention to detail than in the daily cleansing. The other work of a cowman is by no means of a cleanly nature, and it is not to be expected that the average cowman will carry out this work satisfactorily unless the necessity for thorough cleansing of the milking machine is understood or regular supervision is given by the farmer or bailiff.

The following are several of the most complete replies to questions relating to cleansing, and show the work undertaken and the time required where satisfactory results were obtained from the machines —

Machines conveying Milk in Rubber Tubes.

- (1) Used 2 years in a herd of 100 cows:—
“A reliable man with no stint of brushes, soap, soda and time to use it takes at least 4 hours taking to pieces two machines daily.”
- (2) Used 3 years in a herd of 80 cows:—
“After milking each time rinse with water and steep the pipes and fittings in cold water and formalin. Once a week machine is taken to pieces and thoroughly cleaned by hand. Takes 10 minutes daily and 3 hours once a week.”
- (3) Used 4½ years in a herd of 34 cows:—
“First rinsed with cold water, then thoroughly swilled with water at about 100° Fahrenheit, using brushes at the same time and soda. Takes 30 minutes daily. Dismantling and re-assembling takes one man one hour once a month.”
- (4) Used 8 years in a herd of 38 cows:—
“Draw cold water through milk tubes first, then boiling water, then use long tube brushes. Takes 20 minutes daily.”
- (5) Used 10 years in a herd of 45 cows:—
“First draw cold water through cups and rubber tubes. Take to pieces and wash in a tub containing warm water, washing powder and soda. Fix together again and draw boiling water through, then hang them up on hooks to drain and dry. Takes ½ hour in the morning and ¼ hour in the evening. Pulsators require cleaning once in 3 months; takes one hour each pulsator.”
- (6) Used 11 years in a herd of 60 cows:—
“Strong soda water sucked through cups and tubes by power, then scalding clean water. Then brush outside; re-rinsed and hung up. Takes 5 or 10 minutes. Twice a week all rubbers boiled for 5 or 10 minutes. Pulsators are occasionally taken to pieces and cleaned; takes an hour once a month.”

Machines conveying Milk in Straight Celluloid Tubes.

(Amo and Manus.)

- (7) Used 2½ years in a herd of 40 cows:—
“Wash with cold water first, then scrub them with hot; takes one hour. Tubes take ½ hour to clean well.”
- (8) Used 2 years in herd of 60 cows:—
“Washing thoroughly with warm water once a day and all parts taken to pieces. After using in the evenings the machines are simply rinsed out; takes about 15 minutes for each machine.”
- (9) Used 2 years in a herd of 28 cows:—
“Cold and then hot water drawn through teat cups, and milk tubes and milk containers are steamed. Time required, 10 minutes daily. Taken apart and thoroughly cleaned once weekly in summer and once fortnightly in winter. Time required, 2 hours.”

In addition to the methods described above, it was customary on a number of farms to keep the teat cups and rubber tubes in cold water from the time of cleansing after milking until required for the next milking. In a few instances a brine solution, sometimes with a disinfectant, was used instead of cold water.

COST OF INSTALLATION ON FARMS.

Satisfactory replies on the whole were received to this question, but it is not considered desirable owing to the great rise in the price of material and labour to take up space and time giving details. In quite a number of replies it was stated that the unsystematic arrangement of the milking sheds made it necessary either to have the sheds altered, or to instal engines of greater power; in several other instances, the cost of installation was increased by the uneconomical arrangement of the buildings.

COST OF MAINTENANCE.

The figures supplied under this head were very variable, and for this reason, in addition to the increases in the price of material, petrol and labour, it is impossible to give any reliable average figure.

MINIMUM HERD FOR MECHANICAL MILKING.

In reply to the question “What is the smallest herd for which you would instal a machine?” replies giving a minimum of from 10 to 50 were received, but generally speaking, the replies ranged between 20 and 30 cows. It was, however, noticeable in the replies where a low minimum was given, that very good

results had been obtained. This may indicate that the management in these small herds was more thorough, and that more attention was given by the farmer himself than was usually the case with large herds. In the latter, the success or non-success of the plant often depends on the cowman in charge.

ESTIMATES OF SAVING IN LABOUR AND COST BY MECHANICAL MILKING.

There was great variation in the replies given to the questions on these points. In many instances it was stated that there was no saving in labour or in the cost of production, indeed, in a few instances, it was definitely stated that the cost of production was increased. Others again, pointed out that although the actual labour in milking might be reduced in the use of the machine, the same amount of labour was required for the cleaning of the cowsheds and the feeding of the stock. On the other hand, numerous replies were received giving definite instances as to reduction in the labour required, and figures as to saving in the cost of production. The following are typical replies on these points, together with expressions of opinion on the continued use of the milking machines if sufficient reliable hand milkers were available:—

No	Size of Herd	Period in Use.	Saving in Labour	Saving in Cost of Production.	Continued Use if Reliable Hand-milkers Available.
1	35 cows...	3 years ...	One man	None, but it enables me to keep on milking, which I should not be able to do without it.	No, as there is such a lot of work to do when the cows are lying in.
2	34 " ...	4½ " ...	Three milkers ... ..	... ..	Yes, decidedly.
3	38 " ...	8 " ...	One man	Present day pay of one man £75 per annum.	No.
4	90 " ...	5½ " ...	50 per cent	½d. per gallon	Yes.
5	42 " ...	7 " ...	50 per cent.	Pays greater percentage on capital than any other machine on farm, as it is used more constantly.	Certainly.
6	34 " ...	8½ " ...	Two men	Very little	Yes, a great advantage in harvest time.
7	25 " ...	1½ " ...	None, but skilled men not required. It enables me to carry on with very indifferent labour.	None	No.
8	45 " ...	3 " ...	I had six milkers when war commenced, four joined and I at once put in machine. Have done it since with two men and a boy.	I should say at present cost of labour, machine would be a little cheaper, petrol costs so much.	I think I should. Several men milkers always quarrel.
9	60 " ...	2 " ..	3 good men milk 60 cows in about 1½ hours; a little longer when cows are in full milk thus save three milkers.	It does not save much in cost of production.	No.
10	100 " .	5 " ...	In my case 8-10 milkers ...	... ..	Yes, certainly.
11	43 " ...	2½ " ...	None, the only reason I continue to use the machine is the great difficulty in getting milkers.	None	Certainly not.
12	40 , ...	11 " ...	One man... ..	... ..	Yes.
13	140 " ...	? " ...	None	I found my machine a dead loss, and before I would put in another I would sell my herd.	No, if each milker had to milk 14 at a meal.

The answers (several of which have been given above) to the question "If sufficient reliable hand milkers were available would you continue to use a milking machine?" were generally to the effect that *reliable* hand milkers were preferable to the machine, but the fact that a number of users, with years of experience, stated that they would continue the use of the machine makes it evident that under reliable management the mechanical milker is an efficient substitute for hand milking.

SUGGESTIONS FOR IMPROVEMENTS IN MACHINES.

Many of the suggestions received dealt with small points which apparently had been brought to the operator's notice in the management of his own machine. It is possible that more careful management in some cases would have obviated the necessity for improvement, for instance, one user said that the pressure on the teat and udder was too severe, which was probably due to his having worked the machine at an unnecessarily high pressure. Another asked for teat-cups adaptable for any size of teat, while a third was more reasonable in asking for different sizes of teat-cups. On this latter point, it is worth noting that some of the earlier machines put on the market supplied teat-cups in 4 or 5 sizes, but later use has apparently shown that so great a variety is unnecessary. The suggestions which appeared to have most force were those which asked for pulsators of simple yet strong construction, and for greater simplification in the construction of the machine so as to facilitate cleansing. One farmer stated that in his opinion stripping by hand should not be necessary, but as it has already been pointed out, many machines will effectively strip the cow at the expense of time and with greater risk of too late detection of udder trouble. A number of users mentioned as a defect that the machines they had in use were too costly.

CHANGES IF ANOTHER PLANT WERE TO BE INSTALLED.

The majority of the replies on this point were to the effect that the users would prefer the plant which they already had in operation. Several stated that they would use a different type of engine, either smaller for the use of the milking machine only, or larger to enable them to have sufficient power for other work in the farm buildings. Several who had plant with vacuum pipes of ¾" diameter stated they would

prefer to have pipes of the diameter of 1" to 1½" in order to have less variation in the pressure, and one stated that he would prefer single milk receivers to double receivers taking the milk from two cows at a time.

In reply to the question "Should the engine do other work than that required for the milking plant?" the general opinion was that the engine should be available for other work. Most of the replies were from farmers who had had no experience of other plants than that in use on their farms at the time of making the Report, and in cases where the users had experience of several machines the replies were of a very variable and conflicting nature.

IS PERSONAL SUPERVISION ESSENTIAL FOR SUCCESS?

With very few exceptions the owners stated definitely that they considered the success of a milking machine to be absolutely dependent on personal supervision. Also, there was general agreement that the average cowman could not be relied upon to operate and clean the machine satisfactorily. Much, of course, depends on how the words "average cowman" were interpreted in the opinions given on this point, but there would probably be general agreement that a man capable of looking after a herd of cows satisfactorily and also able to clean and operate a milking machine with success over a prolonged period, was distinctly above the average. Several replies were to the effect that if the farmer provided the personal supervision necessary to ensure the cleanliness and smooth working of the plant, the actual operation of milking could be carried on by men or women of comparatively little experience. A few of the replies as to the necessity for personal supervision and the need for training of the operator are given below.—

	Can the average Cowman become a successful Operator ?	Is Personal supervision essential ?
(1) Herd of 50 cows. Plant used 3 years.	"Of course, there are exceptions, but it requires a man with a mechanical turn of mind for the case of both engine and milking plant."	"Emphatically, yes"
(2) Herd of 80 cows. Plant used 5 years.	"A boy that can milk is quite capable after a few lessons."	"I think so."
(3) Herd of 70 cows. Plant used 5 years.	"No special training required, only must use common sense, not to tire cows by keeping machine on too long and injuring them."	"Yes, wholly so."
(4) Herd of 36 cows. Plant used 4 years.	"An average cowman can operate and clean the machine satisfactorily if he takes an interest in it and is really anxious to learn and work it. Boys learn much quicker."	"No."
(5) Herd of 100 cows. Plant used 5 years.	"Yes, anyone can learn it in a day or two. I have taught 20 or 30 women at different times."	"Early success of my machine did depend on personal supervision but not now, the girls all know it."
(5) Herd of 34 cows. Plant used 8½ years.	"It is impossible to find a cowman who can manage the machine satisfactorily; they very rarely give the attention to details which counts so much towards success."	"Yes, certainly."
(7) Herd of 60 cows. Plant used 11 years.	"Yes, a cowman may be satisfactory if he has the above qualities" (conscientiousness and observation)	"Yes, much depends on the operator's conscientiousness and observation"
(8) Herd of 45 cows. Plant used 10 years.	"A fortnight's training is necessary."	"Yes, we think all milking machines require personal supervision"
(9) Herd of 35 cows. Plant used 8 years.	"No special knowledge necessary; it is easily managed."	"No"
(10) Herd of 34 cows. Plant used 4½ years.	"Any cowman with intelligence would adapt himself to the machine and become an expert in three months."	"No, but it must be kept in good working order."
(11) Herd of 34 cows. Plant used 3 years.	"Special training is very desirable. The ideal milker for a machine must be a good hand-milker and must have a liking for and a gift for mechanics and be firm, quiet, and thoroughly used to cows."	"No."

Several owners referred to the desirability of having a young active man as operator, and pointed out that such a man could make much more rapid progress in the actual milking by changing the machines from cow to cow more quickly.

PART II

INFORMATION RECEIVED FROM MAKERS AND AGENTS.

The list of questions given below was drawn up and submitted to the following firms.—

1. R. & A. Lister & Co., Ltd., Dursley, England, makers of the "Lister" Milking Machine.
2. Dairy Supply Co., London, England, agents for the "Amo" Milking Machine. (Swedish)
3. Associated Manufacturers' Co., London, England, agents for the "Hinman" Milking Machine. (American.)
4. Boving & Co., Ltd., London, E., agents for the "Manus." (Swedish.)
5. Worthington Simpson, London, E., agents for the "Gane." (New Zealand.)
6. Lawrence Kennedy, Ltd., Glasgow, Scotland, makers of the "Lawrence Kennedy" and L.K.G. Milking Machine.
7. J. & R. Wallace, Castle Douglas, Scotland, makers of the "Wallace."
8. Vaccar, Ltd., London, England, makers of the "Vaccar" Milking Machine

List of questions.

1. What is your estimate of the number of herds in England and Wales milked by your milking machines at the present time?
2. What is the minimum size of herd for which you recommend the installation of a milking machine?

3. What is the cost and horse-power of an engine suitable for:—
 - (a) 40 cows?
 - (b) 80 „
 - (c) 120 „
4. What is the approximate cost of an installation, excluding engine, and with an average amount of piping, for:—
 - (a) 40 cows?
 - (b) 80 „
 - (c) 120 „
5. Has there been an increased demand for milking machines on the part of farmers since 1914?
6. Have you had difficulty in turning out sufficient machines to meet orders? Is this difficulty increasing?
7. Do you consider that an average cowman after a few lessons can be trusted to operate your machine with success and clean it satisfactorily, or is any special training and knowledge desirable or necessary?
8. In your opinion, what are the chief factors contributing to the lack of success occasionally experienced in the use of milking machines?
9. Will you kindly supply me with a list of 10 farmers who have used your machine for a period of years, and who would give me first-hand information of their own experience?
10. Have you had any complaints of taints arising in the milk when your machine has been used?
11. In what direction do you think there is room for great improvement in the types and operation of milking machines?

The replies obtained to these questions are summarised below.—

(1) *Number of herds milked by milking machines in England and Wales.*

Up to the autumn of 1917 the total number of herds milked by milking machines was apparently between 1,400 and 1,500. This total was made up as follows:—

- “Lister” Machine, fully 350 herds.
- “Amo” Machine, approximately 130 herds.
- “Hinman” or “Hinman Amanco” Machine, approximately 200 herds.
- “Manus” (type 3) Machine, 14 herds.
- “Gane” Milking Machine, 50 herds.
- “Lawrence Kennedy” Machine, approximately 120 herds.
- “Wallace” Machine, 46 herds.
- “Vaccar” Machine, approximately 500 herds.

The number of installations of the above machines are not necessarily an index to the popularity or efficiency of the machine, as some of them have been on the market for a much longer time than others, for instance, the “Manus” (type 3) is the most recent introduction into this country—1916; also machines such as the “Vaccar” and “Lister,” which are manufactured in all their parts in this country, have an advantage over others, such as the “Manus,” “Hinman,” “Gane” or “Amo,” where at least some of the parts have to be imported from the countries of origin. The “Wallace” and “Lawrence Kennedy” machines being manufactured in Scotland, are stated to have the largest number of plants in that country.

(2) *Size of minimum herd.*

The minimum herd for which the installation of plant is advised ranges from 12 to 30 cows. Seven firms give from 12 to 20 as the minimum number, and one firm states that the minimum herd should contain 30 cows.

(3) *Cost and horse-power of engine.*

The replies received showed the following ranges:—

- For herds of 40 cows, from £25 to £54, and from 1½ to 2½ h.p., according to type of machine.
- For herds of 80 cows, from £25 to £65, and from 2 to 2½ h.p., according to type of machine.
- For herds of 120 cows, from £35 to £85, and from 3 to 6 h.p., according to type of machine.

The size and cost of the engine are not necessarily directly in proportion to the requirements of the milking machine, as occasionally farmers have more powerful engines already installed for general farm work, or where no engine is already in use, one of sufficient power for additional work is often preferred.

(4) *Cost of installation of plant, excluding engine.*

- For 40 cows, from £85 to £130.
- For 80 cows, from £150 to £240.
- For 120 cows, from £200 to £330.

The above figures were supplied in the Autumn of 1917, and the cost has undoubtedly risen since that time. On the figures supplied the “Manus” and “Hinman” can apparently be installed at the lowest costs, whereas the “Amo” and the “Lister” appear to be the most costly. In the present circumstances, however, it is unwise to attach too much importance to estimates of costs.

(5) *Increase in demand since 1914.*

All firms report that there has been an increased demand since the outbreak of war owing to the difficulties experienced by farmers in obtaining reliable hand-milkers.

(6) *Difficulty in meeting orders.*

Up to 1917 several makers found no difficulty in supplying plants, but others were in some cases unable to obtain certain material. In the case of the “Manus” machine, it has, of course, been necessary to obtain permits to import parts from Sweden; such permits have usually been granted without difficulty.

(7) *Can the average cowman operate machine successfully and clean it satisfactorily, or is special training desirable and necessary?*

(8) *What are the chief factors attributed to the lack of success?*

In considering the replies received to question 7, some difficulty arose in the definition of an "average cowman" and of what constituted "special training," hence the actual replies are quoted below. Also, as in replies to question 8, lack of success was usually said to be due to the operator rather than to the machine, it has been considered advisable to quote the actual replies side by side with those given to question 7.

Machine.	Replies to Question 7.	Replies to Question 8.
"Luster" ...	An average cowman, if he will take an interest, should, after a little tuition, operate it successfully.	Lack of interest and inattention to certain points, such as cleaning, personal element is important.
"Amo" ...	A cowman or cowwoman can operate quite well after our operator has installed and instructed in the use of machines.	Lack of interest and perseverance on part of operator.
"Hinman" ...	2-3 days at most for average cowman; boys and girls can do it. Experienced milker essential afterwards to see that cows are properly stripped.	Lack of interest and proper supervision of owners. Opposition on part of cowman.
"Manus" ...	6-10 days ample time to instruct attendant thoroughly, depending on interest displayed.	Absence of supervision of farmer. Attendant not encouraged to attain success.
"Gane" ...	No special knowledge necessary. Girls and women can work it.	Installed by merchant salesmen with little knowledge of engineering.
"Lawrence Kennedy."	Average cowman or dairymaid is generally quite able to operate satisfactorily after instruction by us.	Less trouble when some member of family supervises than when left entirely to hired labour.
"Wallace" ...	A few lessons to cowman when machine is started and again a month later are all that is necessary with an average man.	Machines not working on correct principle. All should imitate calf sucking.
"Vaccar" ...	We consider the average cowman requires a week's instruction from an expert. Advise and practise making visits 1-2 months after installation.	Too little interest is taken and too much left to cowman. Want of attention on part of user to cleaning and upkeep. Faulty power units.

While it was to be expected that makers and agents would find the chief reason for the non-success of their machines to be lack of proper attention on the part of the farmer or his assistant, it is a question worthy of consideration whether this lack of attention to detail is not attributable in part at least, to the insufficient training given by the representatives of the firms installing the machine. Those responsible for the sale of milking machines in order to effect sales, naturally emphasise the ease with which their machine can be operated by the average cowman after a few days' instruction and minimise the difficulties which are bound to arise sooner or later; it follows naturally that the cowman, continually hearing the management of the machine spoken of as a simple matter, does not give the attention to it which it requires, and in due course complaints are received by the makers and agents. The amount and quality of instruction given by the firm installing the machine must contribute largely to the results obtained by the farmer or the cowman. This point will be dealt with more fully at a later stage in the report. (See page 64.)

One firm attributes non-success in some cases to a faulty and unreliable source of power on the farms, and points out that the power unit for a milking machine plant must start and operate efficiently twice a day, seven days a week. Attention to this detail is most important.

(10) *Complaints of taints in the milk.*

Four firms report that they have had complaints, but that these were due to inefficient washing out after milking. None should occur when the machines are properly cleaned.

(11) *Where the greatest improvement is possible.*

Several firms report that they are unable to foresee any material improvements which will render their machine more perfect. Others state that they are continually experimenting, and that everything that is discovered to be of value in increasing the efficiency of the machine is incorporated in it. One firm says that the improvement most necessary is the simplification of the machine so that as little labour as possible may be required for milking, and that stripping may be reduced to a minimum. Another firm reports that milking machines have been most successful in those countries where attention has been given to the production of clean milk under sanitary conditions, while another complains of the bad arrangements of cowsheds in the south of England, and the long ranges of piping and the numerous bends and joints thus necessitated.

One firm summarises the chief points that require attention in future improvements as follows:—

- (1) Construction should be as simple as possible.
- (2) There should be no rubber tubes required.
- (3) Machine should be easily cleaned and handled.
- (4) There should be the minimum number of perishable parts, and these should be easily and cheaply replaceable.

CONCLUSIONS AND SUGGESTIONS.

CONCLUSIONS.

The answers given in the preceding pages cover in detail a large number of points, and a brief statement of the more important conclusions which can be drawn from the investigation as a whole may be of general assistance.

1. The experience of many farmers, several of whom have had mechanical milking plants in use continuously for ten to eleven years, shows that mechanical milkers can, under proper management, do the work expected of them in a satisfactory manner.

2. Since 1914 there has been a notable increase in the demand for mechanical milkers because of the increasing difficulty in obtaining hand milkers.

The installation of machines has enabled herds to be maintained which would otherwise have been dispersed.

3. Opinions differ as to the saving in labour resulting from the use of a mechanical milker, but there are sufficient instances of a definite reduction in labour to warrant the inference that with herds of over 30

cows housed in well-planned and equipped cowsheds the installation of a mechanical milker should lessen the labour required.

4. Opinions also differ as to the effect of mechanical milkers on the cost of production. Where plants have been successfully operated and a saving in labour has been effected, the cost of production has most probably been lessened. Much, however, depends on the cost of renewals, petrol, &c.

5. The greatest economy through the use of a milking plant will be possible where cows are concentrated in large herds.

6. The success of a mechanical milking plant depends almost entirely on the operator. With a capable man or woman in charge, excellent results can be obtained from all the makes of machines reported on.

7. Good results cannot be expected unless the parts of the machine which come in contact with the milk are thoroughly cleansed after each milking. There is evidence of a lack of system in the methods of cleansing in general use.

8. Manufacturers and agents emphasise the short period of instruction required to make the average cowman a successful operator. The replies from farmers lead to the conclusion that a successful operator is considerably above the average cowman in intelligence. It appears probable that failure is often due to a lack of realisation on the part of the farmer of the attention to detail which is necessary in order to attain success. He has installed the plant because he has been told it is easy to manage and will save labour. He does not understand that the more complex the machine the higher the intelligence required in its operator.

9. Although all the plants here reported on are successful when they receive proper attention, there are undoubtedly differences in respect of simplicity in management, efficiency in milking, ease in cleaning and cost of upkeep. At the present time in this country there is no definition, based on experiment and practice, of "proper attention," and no facilities exist whereby the differences between the various machines on the above-mentioned points and others may be accurately measured.

If reliable information were obtainable on the above points the installation of milking plants could be carried out on sounder principles, and there should be a considerable decrease in the number of failures.

SUGGESTIONS.

The chief drawbacks to greater usefulness and popularity are:—

- (i) In the event of a breakdown, hand milking has to be resorted to, and sufficient milkers may not be available.
- (ii) The difficulty of obtaining sufficiently well trained and reliable operators.
- (iii) Although labour may be saved in the actual work of milking, it is necessary to maintain the same staff as before, because of the amount of work involved in feeding the cows, cleaning the cowsheds, &c.
- (iv) With herds of under 30 cows it is doubtful if an adequate return would be obtained on the capital expenditure necessary.

Suggestions as to how these drawbacks may be lessened or removed.

I.—*In the event of a breakdown hand milking has to be resorted to, and sufficient milkers may not be available.*

Suggestion.—Lessen the possibility of a complete breakdown by (a) having someone on the farm with sufficient knowledge to keep the mechanical parts in good working order; (b) duplicating those parts most likely to get out of order and cause a stoppage.

These parts are:—

- (a) *The power unit.* An emergency power unit could be maintained in working order on most farms without any material increase in the cost. In large herds, where the result of a complete stoppage would be most serious, the cost of an emergency power unit could most easily be met.
- (b) *The pulsators.*—In the "Hinman" and "Gane" plants, where only one pulsator is required, emergency pulsators could be kept and placed in position when necessary. In the "Lawrence Kennedy," "Vaccar," "Lister," "Manus" and "Amo" plants reserve pulsators and associated parts, and in the case of the "Wallace" reserve pulsators and teat-cups could be kept. It should be part of the ordinary maintenance of a milking plant to keep a reserve supply of such rubber parts as require occasional renewal.

II.—*The difficulty of obtaining sufficiently well trained and reliable operators.*

The operator should possess:—

- (a) Knowledge of the management and milking of cows.
- (b) Knowledge of the mechanism and mode of operation of the plant in question.
- (c) The will to make mechanical milking a success.

Suggestions.—(1) An essential to the obtaining of an efficient operator is that the management of a milking machine should be recognised as highly skilled work, and paid accordingly.

Most dairy farmers know and appreciate the value of a good cowman—a man who will study the temperament and habits of each individual cow and treat each one accordingly, both in feeding and in milking. The installation of a milking plant does not make such a man unnecessary. In spite of its highly specialised mechanism it is still but a machine, and the best results can only be obtained when it is under the care of a man who knows how and when to modify the action to suit cows of different milking habits at different stages of lactation, with udders and teats of unequal size, and, in addition, knows how to keep all parts in thorough working order. In the preceding pages it is emphasised that the average cowman cannot be expected to get the best results.

In the case of comparatively small herds the farmer himself or his son usually acts as operator, and very good results are frequently obtained. With herds of 40 cows or more the responsibility for the plant is usually placed on the cowman, and in such cases an adequate training may be considered as essential to success. Where a dairy farmer has sufficient mechanical equipment on his farm as a whole to warrant the employment of an engineer, the latter could see to the mechanical parts of the plant, leaving the responsibility of milking and cleaning to the cowman.

(2) The difficulty of obtaining well-trained operators may be overcome in one or other of the following ways:—

(a) By the provision of adequate training by the firm installing the plant.

This would necessitate the firm's expert remaining on the farm for a longer period of time, and would add to the cost of installation. Also, after a few days, there would be comparatively little for the expert to do on the farm in the intervals between milking.

(b) By the appointment of a milking machine supervisor by firms installing plants.

The supervisor would pay periodical visits to the farms, examine all parts of the plant and report thereon, supervise cleaning, and give all possible assistance and advice for successful management. This method would add to the cost of upkeep to the extent of the charge made by the firm to each individual farmer; further, as the plants installed by one firm are rarely on adjacent farms, or even numerous in any one district, the travelling expenses of the supervisor would be considerable.

(c) By the appointment by a group of farmers, a dairy farmers' society or a milk recording society of a supervisor for the plants used by the members.

The supervisor would do the same work as in (b) above and would require to be familiar with the details of the different types of plants in use. It might be possible to combine the duties of milk recorder and milking machine supervisor and thus lessen the cost.

(d) By the provision of short courses of training for operators and supervisors at a suitably equipped centre.

A large farm with suitable buildings and equipped with two or more of the commonest plants under the charge of an expert would make a suitable centre, or the farms of some of the dairy educational institutions could be equipped for this purpose. Short courses at the latter centre could also include instruction in the feeding of cows, the structure of the udder, the secretion of milk, and the necessity for cleanliness in the management of milk.

III.—*Although labour may be saved in the actual work of milking it is necessary to maintain the same staff as before because of the amount of work involved in feeding the cows, cleaning the cowshed, &c.*

This drawback can only exist on farms where the buildings are scattered, and an unnecessary amount of time must be devoted to the feeding of the stock, &c. In any well-arranged homestead the number of hands required for the feeding of the herd and associated work should never equal the number required for milking; for instance, a herd of 40 cows in milk would require 4 milkers, but two men should undertake all the labour necessary.

Suggestion.—Mechanical milking plants should be associated with all possible means of economising labour, such as (a) arrangement of buildings to lessen labour in the carrying of fodder, roots, cake and meals, and litter to the cowshed; (b) the provision of adequate power and equipment for the preparation of food; (c) the provision of carriers on ground rails or an overhead system for conveying food to cows and for removal of manure.

IV.—*With herds of under 30 cows it is doubtful if an adequate return would be obtained on the capital expenditure.*

On small dairy farms, in addition to the drawback of the high initial cost, the total labour employed is often so small that even though a milking machine be installed it may not be possible to reduce the number of employees. This is particularly the case when most of the work is carried through by the farmer and his family. There appears to be little hope of the common use of mechanical milkers on small farms until it has been found possible to reduce the first cost very considerably. In the case of herds under 30 cows maintained on larger farms carrying on other branches of farming in addition to milk production, the difficulty as regards capital should be more easily overcome, and greater saving in labour should be possible.

Possibilities of improvement.—The improvement of mechanical milkers appears to be possible in the following directions:—

A. In general as to (1) ease of cleansing.

(2) method of cleansing.

(3) reduction in cost.

B. In general as to (1) reliability of pulsators.

(2) construction of teat-cups and linings.

(3) means of preventing teat-cups from falling off teats.

(4) means of conveying milk from teat-cups to milk receivers.

(5) relative positions of pulsator to other parts of the plant.

(6) construction of milk receiver for greater ease in handling.

Experiments with a view to improvements on the above-mentioned points can be carried out by:—

(1) Individual firms experimenting with their own plant.

(a) Independently of farms.

(b) At farms.

(2) Agricultural Colleges.

(3) Dairy Research Institutions.

Up to the present almost the only means of improvement available in this country has been the carrying out of experiments by firms manufacturing and installing plants, but as such firms often lack practical knowledge of dairy stock and technical knowledge of milk and its management, rapid development cannot be anticipated. Farmers cannot be expected to co-operate with firms in this work; they instal plants to get work done and not to experiment, and if a machine is unsatisfactory it is usually discarded.

As regards the Agricultural and Dairy Colleges of this country, those with the necessary facilities in the form of technical staff, farm, and herd of cows have not been sufficiently well supported financially to enable them to undertake experimental work. While several have had plants installed only one, *i.e.*, the Midland Agricultural and Dairy College, has carried out trials, these being confined to one milking machine of the suction type. The main object in these trials was to ascertain how machine milking compared with hand milking under ordinary farming conditions.

The first Research Institute in Dairying to be established in Great Britain was created as recently as 1913. Circumstances have not yet permitted the carrying out of either comparative trials or experiments under the direct control of the Institute, but the staff carried through the technical work in connection with the milking machine trials held under the auspices of the Royal Agricultural Society of England in 1913.

Suggestions.—(1) Detailed information as to a thoroughly satisfactory method or methods of cleansing suitable for any type of plant to be collected, published, and circulated amongst farmers.

(2) The Dairy Research Institute or one of the Dairy Colleges should be assisted financially or otherwise to such an extent as to enable it to instal and maintain all the equipment and to obtain any additional staff necessary in order to carry out an extensive series of experiments on mechanical milkers.

The existence of such a centre for trials of different kinds of milking machines and for experimental work on improvements of the various parts, and on the effect of the above on the bacterial content and flavour of the milk would aid greatly in the development of mechanical milking; much reliable advice to users and prospective purchasers would soon become available and, further, such a centre could provide at suitable times short courses of instruction for operators, as are suggested on page 65.

J. MACKINTOSH.

24th December, 1918.

REPORT ON THE METHODS AND EXTENT OF THE PASTEURISATION OF MILK IN SCOTLAND.

(1) METHOD OF ENQUIRY.

The information in this Memorandum is compiled from that given to me by the Medical Officers of Health of the largest burghs in Scotland and the principal milk-producing counties.

(2) BURGHS WHICH DO NOT PASTEURISE ANY MILK.

Name of Burgh.	Population.	Name of Burgh.	Population.
Motherwell	40,380	Musselburgh	15,938
Ayr	32,986	Port Glasgow	17,749
Hamilton	38,644	Renfrew	12,565
Perth	35,854	Dumbarton	21,989
Kilmarnock	34,728	Fraserburgh	10,574
Dunfermline	28,103	Galashiels	14,531
Falkirk	33,574	Bo'ness	10,862
Peterhead	13,613	Johnstone	12,045
Irvine	10,179	Forfar	10,849
Arbroath	20,647	Stirling	21,200
Montrose	10,974	Rutherglen	34,319
Cowdenbeath	14,029		

(3) BURGHS WHICH PASTEURISE MILK.

Glasgow (Population 1,008,487).—From 85 per cent. to 90 per cent. of the milk is pasteurised.

The milk so treated is sold as sweet milk and not by any other name.

The process is, generally speaking, as follows:—The milk is raised to a temperature of about 165° F., at which it is maintained for about 1½ minutes, after which it is cooled to ordinary water temperature. In summer time it is further cooled to a temperature of about 40° F. In one large establishment dealing with from 4,000 to 5,000 gallons per day, the milk is raised to a temperature of 165° F. and retained at that for about 20 minutes before passing it through the cooling plant. In another similar establishment the milk is raised to 152° F., at which it is maintained for about 30 minutes before being cooled down.

The age of the milk so pasteurised varies from 8 to 20 hours; so that when it reaches the consumer from 12 to 36 hours will have elapsed from the time of milking.

Mr. Fyfe, Chief Sanitary Inspector of Glasgow, adds—"The primary object of the dairyman is to lengthen the life of sweet milk by destroying as far as possible, or at all events reducing the number of putrefactive organisms, and, of course, incidentally those of pathogenic origin which may be present. There is no doubt that a good effect has followed this system of pasteurisation—so far, at all events, as the incidence of infectious disease in this city is concerned. There has been quite a remarkable decline in milk-borne epidemic diseases since this system was introduced, and such cases as arise have been traceable to milk which has not been dealt with in this way." Mr. Fyfe also encloses some tables prepared by the Corporation chemists and city bacteriologist, showing the result of analysis of samples of pasteurised milk and untreated milk, together with the comments of the Corporation chemist. I append these for the information of the Committee.

Leith (Population 80,488).—The Medical Officer of Health, Dr. Robertson, writes:—"The only pasteurised milk in the burgh of Leith is from one firm, who pasteurise the whole of their milk, amounting to about 12,000 gallons per day. The milk is not sold as pasteurised, but their customers understand that nothing but pasteurised milk is sent out from this depôt. I was entirely dissatisfied with the original plant installed. In fact, the method first pursued simply meant the heating of the milk for a few minutes with subsequent chilling and bottling. I undertook a series of tests, and proved that the pasteurised milk sold was richer in micro-organisms than the milk as it came from the farm. After a good deal of delay the present plant was put down. While the machinery is a great improvement upon the original plant, one is forced to the conclusion that pasteurisation has not yet been accomplished, because continuous heat from an outside agent, such as steam or hot water, is not being applied to the milk. Until this continuous heating for at least 20 minutes at a temperature of between 165° F. to 170° F. can be maintained, one is safe to assume that such pathogenic micro-organisms as apply to diphtheria, typhoid fever, tuberculosis, and presumably scarlet fever, are left more or less unharmed. I had complaints last summer that the milk said to be pasteurised was turning sour, when milk drawn under unfavourable conditions at our dairies was keeping quite well. When one knows that the lactic acid bacilli may be comparatively easily killed by heat,

the assumption that "pasteurisation" is merely a name, is assured. It is quite clear to me that more scientific methods will have to be employed if we are to secure a supply of milk that is actually pasteurised."

The process in this burgh is as follows:—The milk is passed into a pasteurising machine (upright cylinder) and heated to between 165° F. and 170° F. It is then passed on to a large tank, in which it is kept for 20 minutes. It then passes through a strainer to take out the dirt. It then passes over the cooling apparatus, where the temperature is first brought down to that of ordinary water, and then further cooled to nearly 32° F. It is then bottled while cold, and placed in a cold storage room until sent out for delivery. The manager states that the milk so treated keeps fresh for 36 hours after leaving the premises, and that the milk when pasteurised is about 5 hours old. He estimates the cost of pasteurising at about one penny per gallon, and complains that the Milk Order fixing prices hits them hard, because they cannot charge any more than milk vendors who do not pasteurise their milk.

Aberdeen (Population 163,891).—The Medical Officer of Health, Dr. Matthew Hay, has been good enough to send me in tabular form replies to the information asked for, showing that eight firms in Aberdeen pasteurise their milk. I append the entire table, which shows the proportion of the milk pasteurised in winter and summer, the temperature to which the milk is raised, the temperature to which it is subsequently cooled, the method of pasteurisation, and the fact that in every case the milk so pasteurised is sold as fresh milk. Dr. Matthew Hay makes the following remarks upon the results so tabulated:—"Although certain temperatures are stated by the various dairymen in pasteurising their milk, I am very doubtful if such temperatures are always being taken. The system in use here is the usual Flash system, by which the milk is kept at the stated temperature for not more than a minute or two minutes, if so much. We made some tests last year of one of the supplies, and found that the results were rather better than we expected. The present pasteurising methods certainly require carefully overhauling. There are some Medical Officers, like Dr. Kerr, of Newcastle, who think that, owing to the want of cleanliness in the Flash pasteurising apparatus, the milk is more polluted than purified; and he has published the results of some experiments in favour of this opinion. Of course, all of us are out for the milk being obtained from the cow under the best possible conditions for securing freedom from contamination, but most of us have come to recognise from experience that it will take a long time to secure that these conditions will be such that some process of sterilisation or pasteurisation, especially in the case of milk for children, will not be necessary. I am of opinion that while we should do our best to have improved conditions in the production of milk, we should at the same time endeavour to see provision made for the pasteurisation or sterilisation of milk until the time is reached when guaranteed pure natural milk is purchasable."

Dundee (Population 176,300).—The then Medical Officer of Health for Dundee, the late Dr. Templeman, informed me that only one company pasteurised milk in Dundee city. "They employ a pasteurising and separating (Swedish) mechanical plant, and treat 300 gallons daily. The temperature is raised to not less than 150° F., and not more than 160° F. It is impossible to say how long it is kept at that temperature as the process is a continuous one. The milk is put into a tank and passed through a condenser at the temperature mentioned, and from there it is passed into a cooler, and then into bottles or cans. I do not think that the milk is kept at the temperature sufficiently long really to pasteurise it, but the manager of the company says that the process is simply to make the milk keep. During the winter months the milk may be anything up to 36 hours old, and during the summer not more than 24 hours."

Paisley (Population 84,455).—About 20 per cent. of the milk supply of this burgh is pasteurised. It is not sold as pasteurised milk, but as ordinary sweet or fresh milk. The process, however, is not carried out within the burgh at all, so that the Local Authorities have no first-hand knowledge of the processes employed.

Kirkcaldy (Population 39,601).—The only place in the burgh where milk is pasteurised is the model dairy belonging to the Co-operative Society, with a daily average for the week ending December 6th, 1917, of 567 gallons. All the milk received is pasteurised and all sold as sweet milk. The process is that the milk as received from the various farmers is emptied into the receiving tank. Hence it passes through the pasteuriser, and in winter is heated to 170° F., while in summer to 180° F. It is then pumped up into the primary cooler, in which water is circulated, and then over the secondary cooler, where brine is being circulated, the effect of these two operations being to reduce the temperature of the milk to 40° F. The age of the milk pasteurised is from 14 to 16 hours in the case of the milk of the night before, and from 2 to 6 hours in the case of the morning milk.

Hawick (Population 16,877).—The Medical Officer of Health, Dr. McKellar, informs me that probably from one-half to two-thirds of the milk in the burgh of Hawick is supplied by the Teviotdale Dairy Company and the Co-operative Store. The former pasteurise five-sevenths of their milk, and they sell both pasteurised and ordinary milk. The former is heated to 160° F. for from 10 to 15 minutes, and then cooled to the temperature of 58° F. in summer and 34° F. in winter. One half of the milk is 12 hours old, the other half is from 1 to 3 hours old. In the case of this particular burgh the milk is also cooled upon being drawn from the cow.

The Hawick Co-operative Society, Ltd., pasteurise the whole of their milk in the summer time, and about 50 per cent. in the winter time. It is sold as pasteurised milk, except in the case of the early morning delivery (6 a.m.), when it is sold as morning milk. The milk when received is first cleansed, then heated to 150° F. in winter and cooled to 38° F. In summer it is heated to 165° F. and cooled to 48° F. The Society state that "momentary exposure to the above heats is best, as it reduces to a minimum the pasteurised flavour, which a large percentage of people object to." The milk varies in age from 14 to 20 hours old. The morning milk is from 2 to 6 hours old.

Greenock (Population 75,140).—The Medical Officer of Health, Dr. Cook, informs me that the only milk pasteurised in Greenock is that of the Central Co-operative Society, who distribute about one-third of the milk of the burgh. The amount for the week ending December 15th, 1917, was 7,844 gallons. It is sold as pasteurised milk, not fresh.

The milk is heated, after being strained, to a maximum temperature of 170° F., probably remaining at that figure for the matter of a minute at most. It is subsequently cooled to 42° F. The age of the milk is not more than 12 hours old, and may be 4 hours. The Medical Officer of Health doubts if the period of high temperature is long enough to kill dangerous organisms.

Clydebank (Population 37,548).—The Medical Officer of Health, Dr. Strang, informs me that from one-third to one-half of the milk is pasteurised. In June last, when the total daily supply averaged 2,961 gallons,

three of the largest dealers pasteurised. Two of them, however, ceased doing so in the winter months, but one continues to pasteurise 1,000 gallons per day. The milk is sold as fresh. It is heated from 160° F. to 180° F., and then cooled to 40° F. The age of the milk is from 6 to 8 hours.

Kirkintilloch (Population 11,932).—The Medical Officer of Health, Dr. Miller, informs me that more than three-quarters of the milk is pasteurised. It is sold as "Pure Sweet Milk," but is generally known, however, to be pasteurised. It is heated to a temperature of 170° F. for a few minutes, cooled to 40° F. and pumped to a large container, where it is bottled by syphon action, and then stored in a refrigerator. The night and morning milk are pasteurised together in the morning.

Barrhead (Population 11,387).—The Medical Officer of Health, Dr. Corbett, informs me that rather more than three-fourths of the milk is pasteurised and is sold as such, being in most cases put up in small sealed bottles. The milk is poured into a raised chamber, from which it passes by gravitation through a chamber heated by steam to a temperature of about 120° F. It is kept at this temperature for from 3 to 5 minutes, after which it is cleaned of all dirt by centrifugal action. It is then cooled down to between 32° F. and 40° F., and bottled by machinery. The age of the milk so treated is from a few hours to 12 hours.

Wishaw (Population 25,263).—The Medical Officer of Health, Dr. Duff, informs me that 50 per cent. (400 gallons) is pasteurised at two different premises. It is sold as fresh milk. In the one place the plant is the modern Flash apparatus, in which the milk is heated to 160° F. for 1½ minutes, then cooled to between 32° F. and 40° F. On the second premises it is treated by a simplified retainer apparatus, heated to 160° F. for 20 minutes, then cooled to the temperature of running water. None of the milk so pasteurised is more than 12 hours old.

Buckhaven (Population 15,149).—The Medical Officer of Health, Dr. Maxwell Dawson, tells me that about half the milk supply of the burgh is pasteurised. It is sold as fresh milk. It is heated to 160° F., passed through a cleanser and cooler, reducing the temperature to 40° F., and then bottled in paper-capped bottles. 25 per cent. is 12 hours old (brought from a distance), and 75 per cent. 2 hours old (local farms).

Coatbridge (Population 43,286).—The Medical Officer of Health, Dr. Hamilton, informs me that about one-third of the milk of the burgh is pasteurised. A few of the buyers ask for pasteurised milk; the majority, who do not ask for it, are aware that they get it.

The milk is raised to a temperature of 160° F., and immediately cooled to a temperature of about 50° F. The age of the milk is from 10 to 22 hours.

Lockerbie.—One firm pasteurises about 900 gallons per day, half of which is 12 hours old, and the other half 1 to 2 hours old. The milk is raised to a temperature of 150° F. to 155° F., and is cooled immediately to approximately 40° F. over a combined water and brine refrigerator. The milk is sold without any declaration. The cost of pasteurising is estimated at about one halfpenny per gallon. The reason given by the firm for their process is that it enhances the keeping qualities of the milk.

County of Ayr.—The Medical Officer of Health, Dr. Macdonald, says that, as far as he can ascertain, no milk is pasteurised by any of the farmers or dairymen in this county, but only at creameries or margarine works. At these he understands that the milk is kept at a temperature of about 75° C. (167° F.) for 15 minutes. Dr. Macdonald adds that he is not inclined to recommend the general adoption of pasteurisation of milk by farmers or other dairymen, as he would have no guarantee that the process would be favourably conducted. He considers that the pasteurisation of milk on any extensive scale should only be carried out in certain centres, under the supervision of Local Authorities or other responsible bodies.

County of Dumfries.—There are about 9,000 cows in registered burghs, producing probably 17,000 gallons daily. The Medical Officer of Health, Dr. Maxwell Ross, informs me that the milk is not pasteurised at any of the farms. There are, however, three creameries in the county, situated at Lockerbie, Dumfries and Gretna, where pasteurisation is carried out.

At Dumfries, 12,000 gallons in summer, and 700 gallons in winter, are pasteurised daily. At Gretna, 486 gallons are pasteurised daily.

At Gretna the milk has been sold either as pasteurised new milk or pasteurised separated milk. At the Dumfries Creamery the milk is raised to a temperature of 180° F., and immediately cooled to approximately 40° F. At Gretna two processes were carried out prior to the Cream Order:—

(a) The greater portion of the milk was raised to a temperature of 180° F. and immediately cooled to between 30° F. and 40° F.

(b) The remainder was raised to a temperature of 110° F., then passed through a separator, the separated milk raised to a temperature of 180° F. and immediately cooled to 40° F. The age of the milk is approximately the same in all creameries, one half being about 12 hours old and the other half 1 to 2 hours old.

County of Lanark.—The Medical Officer of Health, Dr. Wilson, regrets to say that to the best of his knowledge the pasteurisation of milk is not practised in his county area.

Comments.—The foregoing contains the results of my enquiries in every burgh in Scotland having a population of over 10,000, with three exceptions, from which no replies have been received. It may, therefore, be taken as practically covering the whole ground as far as Scotland is concerned.

The enquiry has brought out prominently the following facts. First of all, that a large number of burghs exist in which no milk at all is pasteurised, and these burghs are all, with the single exception of Edinburgh—where the amount treated is very slight—small burghs. Secondly, it shows that in most of the larger burghs from one-third to one-half of the milk is pasteurised. Thirdly, it is quite clear from the description given of the processes employed that the so-called pasteurisation consists in raising the milk to a given temperature for a moment or two, and then immediately cooling it. In other words, as usually carried out the process is quite useless from the point of view of killing bacteria, owing to the short period of time the milk is exposed to heat. Fourthly, the enquiry has also elicited the fact that in the majority of cases the night and morning milk is mixed together before being treated. Lastly, it will be found that in almost every case the pasteurised milk is sold as fresh milk, without any declaration at all.

(Signed) GERALD LEIGHTON, M.D.,

Mayor.

[COPY.]

GLASGOW PUBLIC HEALTH LABORATORY.
16th February, 1915.

NOTES ON TABULATED RESULTS.

Acidity.—Determined by titrating 10 cc. milk with $\frac{N}{10}$ caustic soda, using Phenol Phthalein as indicator.

The number of cc. of $\frac{N}{10}$ alkali required to render 100 cc. of milk neutral to Phenol Phthalein represents the degree of acidity of the sample. This test was made to determine the relation (if any) of the acidity of fresh milk to its bacterial content. In the non-pasteurised samples the degree of acidity shows some relation to the number of bacteria only in sample No. 12. In the pasteurised samples the degree of acidity affords no definite information on the point.

Cream.—The amount of cream rising to the surface in each glass shows a very notable variation; and while it cannot be regarded as a definite measure of richness, it is noted as a matter of interest. The very thin layer of cream in No. 10B may be taken as an indication that the milk was sterilised rather than pasteurised, and the low bacterial content lends support to this view.

Sediment.—It is understood that these milks have been sieved just before pasteurising. If this is so, it is probable that they have all been twice sieved—at the farm and at the dairy.

The sediment falling in 24 hours was measured in a long tube holding a litre, and gradually narrowed at the lower end for the attachment of a centrifugal tube. The extremity of the centrifugal tube is narrowed and graduated in tenths and hundredths of a cc. to measure the amount of sediment in parts per 100,000. This purely gravimetric result is regarded as the primary reading. But as the sediment does not fall in a compact column in each tube, centrifugal action (4,000 revolutions for one minute) is used to make the depth of the column in the different tubes more definitely comparable. The resulting average compression of the sediment is about 37 per cent.; in other words, the column of sediment is reduced about one-third, and this result may be regarded as the secondary reading. The average for the twelve samples comes out at 0.053 cc for the primary reading, and 0.033 cc. for the secondary reading.

Nature of Sediment.—The sediment is much alike in all the samples, the various components of it only varying in amount, as indicated by the number of + signs. It would be interesting to know if there were any conditions to account for the large proportion of mineral dust in sediments 3 and 7. In the sediment of sample 10 there were white, glistening, porcelain-like particles which appeared metallic under the microscope.

Those milks showing large quantities of leucocytes indicate the need for veterinary inspection.

Bacterial Content.—The non-pasteurised samples 1, 9 and 12 show large numbers of bacteria—numbers which, except in sample 1, are much too high for fresh milk, especially at this time of the year. The pasteurised milks, it will be seen, vary greatly in their bacterial content. The majority of them—notably, 2, 3, 5, 6, 7, 8 and 11—indicate either that (1) the pasteurising was very inefficient or (2) the after-treatment favoured re-contamination.

There would appear to be little use in going to the expense of pasteurising when this is the result obtained in the milk as it comes from the pasteurising plant. Much better results might be obtained by a more scrupulous regard to the cleanliness of apparatus and utensils—in other words, to the prevention of re-contamination. It is absurd to pasteurise milk, and then find the bacterial content *worse than it ought to be in the fresh untreated milk.*

The anomalous result obtained in sample 1 calls for investigation. This milk has a high acidity and is one of the dirtiest of the series, yet its bacterial content is notably low.

Coliform Bacilli.—These were absent in .001 cc. of non-pasteurised milk and .01 cc. of pasteurised milk.

(Signed) R. M. BUCHANAN

SAMPLES OF RAW AND PASTEURISED MILK FOR DETERMINATION OF SEDIMENT AND BACTERIAL CONTENT.

(Received, 2nd February, 1915.)

Number.	Pasteurised (P.) or not (N.P.).	Acidity in Degrees.	Cream.			Amount of Sediment.		Nature of Sediment.						Bacterial content per cc.			Coliform Bacilli in .01 cc. (P.), .001 cc. (N.P.).	
			Column of Milk.	Surface Layer of Cream.	Percentage.	Gravimetric (per Litre).	Centrifuged (per Litre).	Epthm.	Leucocytes.	Mineral Dust.	Lime.	Veget. Fibre.	Hairs.	Gelatine at Room Temperature.		Agar at 37° C.		
														4 days	6 days	2 days		
*1a	N.P.	24	14"	1.1"	7.86	.08 c.m.	.05 c.m.	++	+	++	++	++	++	++	27,000	52,000	29,500	No growth
2a	P.	21	14"	.9"	6.43	.03	.03	++	+	++	++	++	++	++	84,000	153,000	33,200	"
3a	P.	21	16"	1.4"	8.75	.025 "	.02 "	++	+	++	++	++	++	++	10,600	14,800	4,000	"
4a	P.	20	14.9"	1.2"	8.05	.03 "	.03 "	++	+	++	++	++	++	++	600	1,800	4,000	"
5a	P.†	23	14"	.6"	4.29	.025 "	.02 "	+++	+++	++	++	++	++	++	18,600	26,200	15,200	"
6a	P.	21	14.75"	1"	6.78	.03 "	.02 "	++	+	++	++	++	++	++	56,200	63,200	19,400	"
7a	P.	20	15.2"	.45"	2.96	.05 "	.03 "	++	+	+++	++	++	++	++	600	4,800	126,000	"
8a	P.	22	15.2"	.9"	5.92	.1 "	.07 "	++	+	++	++	++	++	++	15,400	41,000	7,000	"
*9a	N.P.	21	14.75"	.9"	6.11	.04 "	.03 "	++	+	++	++	++	++	++	306,500	370,000	191,500	"
10a	P.	20	15"	.15"	1.00	.15 "	.05 "	+++	+	++	++	++	++	++	1,000	1,200	800	"
11a	P.	20	14.4"	1"	6.1	.025 "	.02 "	+++	+	++	++	++	++	++	17,800	30,400	97,800	"
*12a	N.P.	26	14.5"	.7"	4.82	.05 "	.03 "	+++	+	+	++	++	++	++	525,000	820,000	215,000	"

* From city cowfeeders.

† Evidence of added annatto.

(Signed) R. M. BUCHANAN.

2nd March, 1915.

NOTES ON TABULATED RESULTS.

Acidity.—The average acidity of this series of samples is 21.3°. The average acidity of the previous series (1B-12B) was, for the non-pasteurised samples, 23.7°, and for the pasteurised samples 20.9°.

Cream.—The average amount of cream rising to the surface in each glass calls for no special note, except that it was comparatively low in No. 17B. Estimated by measurement of the column, it is found that the average percentage of 6.59 in previous milks (1B-12B).

Amount of Sediment.—The average for the twelve samples is 0.083 cc. for the primary reading and 0.055 cc. for the secondary reading. This is distinctly higher than for the previous series of samples (1B-12B), which gave an average of 0.053 cc. for the primary reading and 0.033 cc. for the secondary reading, but it is to be remembered that the previous samples were probably sieved twice.

Nature of Sediment.—The sediment presents the same general characters in all the twelve samples. Vegetable fibres and hairs were rather more numerous than in the previous series of samples, probably for the reason already given. It is noteworthy that lime concretions were not detected in six of the samples.

Bacterial Content.—This is stated as the number of organisms per cc., and was estimated by adding 1 cc. of milk to 99 cc. of sterilised water, and taking from this 1 cc. to make gelatine and agar plates and 1 cc. for taurocholate agar plates.

There is some relation between the amount of sediment and the bacterial content, but it is not constant. Samples 13, 20, 23 and 24 must be regarded as having an excessive bacterial content for fresh milk.

Coliform Bacilli.—These organisms were in excessive numbers in sample 23. The same quantity of milk (1 cc. of the dilution 1:100) failed to reveal the presence of coliform bacilli in the majority of the other samples.

Spoore-bearing Organisms.—These were present in 10 cc. in all the samples.

(Signed) R. M. BUCHANAN.

DETERMINATION OF INSOLUBLE DIRT, BACTERIAL COUNT, &C., IN MILK SAMPLES 13B-24B.

Received 16th February, 1915.

WARM MILK as received by Wholesale Dairymen in Glasgow from Farmers in the Country. (The samples were taken in the usual way, in course of delivery from the Farmers to the Dairymen.)

No	Degree of Acidity.	Cream.			Amount of Sediment.		Nature of Sediment.						Bacterial Content per cc.			
		Column of Milk.	Surface Layer of Cream.	Percentage.	Gravi-Metric.	Centrifugated.	Epithm.	Leucocyte.	Mineral Dust.	Lime.	Vegetable Fibre.	Hairs	Gelatine, Room T. 6 days	Agar, 37° C. 2 days.	Tauo Agar for Coliform Bacilli, 2 days, 37° C.	
13B	21	15.4"	1.2"	7.79	.10 cc.	.05	S+ L+	+	++	+	+++	+	1,104,000*	171,000	900	
14B	24	14.5"	.9"	6.20	.07 "	.04	L+	+	++	—	++	+	91,000	19,000	Coliforma	
15B	23	15.44	1.0	6.47	.07 "	.05	S+ L+	+	++	—	++	+	42,000	24,000	absent in	
16B	20	15.3"	.85"	5.55	.06 "	.05	S+ L+	+	++	—	+++	+	21,000	15,000	.01 cc.	
17B	18	14.1"	.60"	4.25	.08 "	.06	S+ L+	—	+	+	+++	+	110,000	99,000	100	
18B	24	15.1"	1.15"	7.61	.07 "	.06	S+ L+	—	—	—	+++	+	106,000	38,000		
19B	19	14.95	.85"	5.68	.06 "	.04	S+++L+++	—	+	—	++	+	37,000	56,000	Coliforma	
20B	21	14.93	.83"	5.55	.10 "	.09	S+++L+++	—	+	+	+++	+	588,000	397,000	absent in	
21B	21	14.8"	1.2	8.10	.08 "	.06	S+ L+	+	++	++	+++	+	84,000	109,000	.01 cc.	
22B	22	14.9"	1.2"	8.05	.075,"	.06	S+ L+	—	++	+	+++	+	145,000	66,000		
23B	23	14.9"	1.25"	8.39	.16 "	.10	S+++L+	++	++	+	+++	+	242,000*	264,000	22,900	
24B	20	15.4"	.9"	5.84	.07 "	.05	S++	+	+	—	+++	+++	285,000*	109,000	100	
Average	21.3			6.62	.083,"	.055										

* Counted at four days.

(Signed) R. M. BUCHANAN.

ABERDEEN MILK SUPPLIES.

Pasteurisation and Cooling of Milk.

Present Average Daily Supplies of Milk from Eight Firms.	Proportion of Milk Pasteurised.		Temperature to which Milk is raised.	Is Pasteurised Milk subsequently cooled, and if so, to what temperature?	Is such Milk sold as Pasteurised or as Fresh Milk?	Method of Pasteurisation.
	Present Time	Summer Time.				
Gallons.	Per cent.	Per cent.				
1,540	25	100	160° F.	48° F.	Fresh	Continuous flow.
750	—	50-75	160°-170° F.	40° F.	Do.	Do.
475	—	50-75	170°-175° F.	50° F.	Do.	Do.
400	—	50-100	160° F.	45°-50° F.	Do.	Do.
700	10	100	185° F.	35°-40° F.	Do.	Do.
350	—	25	180° F.	50° F.	Do.	Do.
725	100	100	170°-176° F.	50° F.	Do.	Pasteurising done for separation only.
300	50	100	140°-150° F.	50° F.	Do.	Continuous flow.
						Do.

Estimated amount of milk consumed in the city is about 10,000 to 12,000 gallons per day.

EXTRACTS FROM REPORT OF THE MAYOR'S COMMITTEE ON MILK

CITY OF NEW YORK.

December, 1917.

VALUE OF MILK AS A FOOD. (Pp. 18-21.)

Concerning the food value of milk, Professor Sherman points out that it is a superior food in three respects, as follows:—

- (1) Its food value in protein, carbohydrates and fats was partly realised a few years ago.
- (2) Its very exceptional value as the means of keeping a proper balance in the mineral constituents in a diet. (This refers to the salts of several kinds contained in milk.)
- (3) That it contains two growth-promoting substances called vitamins.

Concerning the last item of value mentioned above, namely, the vitamins, most important and interesting discoveries have been made in the last three years. The most recent work has been performed by Professor E. V. McCollum, of John Hopkins University, who has followed up the work begun by Professor Osborne, at Yale, and others.

These discoveries show that there are existing in milk and in some other foods two unknown substances which stimulate growth. One of these is found in the fat and the other is found in the water or solution. Their chemical character is unknown, and they have never been separated from the food materials with which they are associated.

Professor McCollum has pointed out that the seeds of plants are good food so far they go, but that they are deficient in these growth-promoting substances, which are found chiefly in the leaves of all trees and plants. They are found in such leaves as cabbage, lettuce, spinach and cauliflower, and above all in milk.

Concerning milk and milk produce, he says it is not generally appreciated that these articles have a dietary value far greater than can be expressed by their protein and energy contents.

In experiments on rats, Osborne, Mendel, and McCollum have shown that the feeding of butter fat and of milk promotes growth in a remarkable way, for the reason that the vitamins or growth-promoting substances are present in milk in an abundance and in a form which is readily available as in none other of our common foods.

Because of its nutritional value and particularly because of its growth-promoting value, milk is the ideal food for infants and children.

In testifying before the Committee, Dr. L. Emmett Holt, one of the leading specialists in children's diseases, stated as follows—

"For infants during the first year a quart of milk a day is necessary. For the second year, a pint and a half. There is no food as economical at present prices for the nutrition of infants as milk.

"The habit of giving tea and coffee to young children is positively injurious. For children between the ages of two and six years the daily ration of milk should be one pint per day as a minimum.

"Dr. Lucas, of Berlin, found very greatly increased susceptibility to tuberculosis as a result of under-feeding, particularly among children. I should think that after six years of age up to twelve or thirteen years, a pint of milk a day ought to be allowed to all children."

Professor Sherman, in his testimony, said:—

"We cannot expect a good community dietary if that community uses less than one-half quart of milk per capita per day. Unless there was that amount of milk the dietary would be seriously one-sided. The milk has exceptional value as a food for growth due to the so-called vitamins."

"It is the most important single food for adults. It is more economical to produce than meat. A man confined to a bread and meat diet will show deficiencies, while a man confined to a corresponding bread and milk diet will go on indefinitely. A vegetable diet will always be improved by an addition of milk. If it was a question of one or the other, I think it important that a man have milk rather than meat."

Professor Graham Lusk, in his testimony, says:—

"No family of five should buy meat until they have bought at least three quarts of milk. Milk contains not only protein of animal origin, but also a very valuable fat which has specific properties for growth. It also contains in aqueous solution materials which prevent the development of beri-beri and pellagra. Milk is the cheapest form of protein you can get. It is the most complete and sufficient food that can be had. Around the dairy farms centres the proper nutrition of a nation."

How much milk should be used for drinking purposes by New York City?—If we use the quantities recommended by Professors Sherman and Lusk, the city would consume the following amounts daily:—

Age.	Population.	Quarts of Milk which should be used daily.	
		Each.	All
Under 1 year	130,500	1	130,500
1-2 years	126,700	(1½ pt.)½	95,025
2-6, 6-14 years	1,387,900	(1 ")½	693,950
Over 14 years	4,092,392	(1 glass)½	1,023,098
Total	5,737,492		1,942,573

Milk which New York City should drink—1,942,573 quarts daily.

Actual amount used for drinking is probably about 707,486 quarts daily.

The food value of milk has been unappreciated by the public at large. While as a food for babies it is well known, it has been thought that it was not adapted to adults on the supposition that it contained less strength-giving materials than the so-called solid foods. Solidity in food is a mere incident due to the presence of fibre which holds vegetable and animal substances in shape. As a matter of fact, all food must become liquid in form before it can be assimilated. The liquid character of milk simply means that it is entirely free from the presence of any waste material. It is all food and in form which is most easily digested and assimilated by adults as well as infants.

For infants it is not merely a convenient food, but because of the presence of the so-called vitamins or growth-stimulating substances, it is vitally necessary for the development of infants and children. Its value as a food for adults is just beginning to be appreciated. It furnishes to the body those materials which are most necessary for the increase of strength and endurance.

It is believed by those who have investigated the subject that the nations and races of men which have done most in the development of the world, and have shown the greatest physical strength and vigour, are those nations which have depended to the largest extent on dairy products and milk for food.

ECONOMIES IN PRODUCTION.

ECONOMIES IN PRODUCTION. (Pp. 72-77.)

Larger Producing Cows.

For many years dairy farmers have been well aware of the economies in milk production resulting from the keeping of dairy cows which are large producers.

Numerous cow-testing associations have as their primary purpose the testing of cows in local dairy herds, in order to inform the dairymen as to those animals which are low and unprofitable producers and those animals which are high and profitable producers. Numerous statistics have been compiled to show the cost of producing milk as it is modified by the productivity of the individual dairy cow. A good example of this difference is shown in bulletin No. 501—United States Department of Agriculture—entitled "A Study in the Cost of Producing Milk on Four Dairy Farms." These figures are taken from data compiled several years ago on costs much lower than present costs. They show clearly, however, the relation of the productivity of the cow to the cost of milk, for the reason that the same costs were applied alike to all cows at that time:—

Production in Pounds		Cost of 100 lbs. of Milk.		
Per Cow.		\$	s.	d.
2,349	.. .. .	3.57	14	7-81
3,648	.. .. .	2.59	10	7-54
4,596	.. .. .	2.29	9	4-77
5,450	.. .. .	2.10	8	7-41
6,445	.. .. .	1.86	7	8-79
7,513	.. .. .	1.79	7	4-15
9,049	.. .. .	1.70	6	11-71

Another set of figures were presented by Professor W. P. B. Lockwood, of Massachusetts Agricultural College, in his testimony before the Committee. He showed statistics compiled by him indicating the following results:—

Production Per Cow		Cost Per Quart.	
Per Year.		\$	Pence.
Less than 5,501 lbs. ...	.. .. .	.0721	3-549
5,501—7,500 lbs. ...	.. .. .	.0624	3-073
Over 7,500 lbs. ...	.. .. .	.0552	2-718

The third set of figures was presented in the testimony of Professor George C. White, of Connecticut Agricultural College, Storrs, Connecticut. These results have been tabulated in the form of the charts shown on page 74 (reproduced on page 79).

The productivity of the dairy cows supplying milk to New York City market averages not more than 4,500 lbs. per cow per year. In the above tabulation such cows make milk at a cost of about 7 c. per quart, which price corresponds closely with the cost as determined by all of the data compiled on cost of production of the city's supply. There is no doubt that if the city's supply came from cows which were large producers the cost of production would be considerably reduced.

From this it appears that, in herds containing over ten cows, the production per cow and the cost per quart of milk gave the following figures:—

Production Per Cow		Per Quart.	
Per Year.		c.	Pence.
Over 7,500 lbs. ...	.. .. .	4.74	2-34
6,500—7,500 lbs. ...	.. .. .	5.48	2-70
5,500—6,500 lbs. ...	.. .. .	5.60	2-76
4,500—5,500 lbs. ...	.. .. .	5.82	2-86
Under 4,500 lbs. ...	.. .. .	7.02	3-46

Only a small percentage of the dairymen supplying New York City are members of the cow-testing associations. There is no doubt that there is a large percentage of cows standing in the herds of dairymen producing milk for New York City which are low and unprofitable producers of milk. These animals can be eliminated immediately by fattening and selling for beef. They are actually an expense to the dairyman and add an item to the cost of milk which is an improper tax on the consumer.

Larger Dairies.

Another factor which has not received the attention it deserves is the size of the dairy herd itself. It makes a great difference how many animals are included in the dairy herd. It is one thing for a farmer to devote his time and attention to the care of one dairy cow, and quite another thing for him to attend to the care of a large herd. The cost of keeping a cow by herself and as a member of a larger herd are very different.

It is clear that a number of the expenses included in the cost of production do not increase as rapidly as the size of the herd. This is well illustrated in a review of the statistics of 178 herds reported in Bulletin No 7 of the Connecticut Agricultural College.

When these herds are arranged in order of size, with the corresponding costs of milk production, it appears that herds of 50 or 60 cows produced milk at a cost of 4.65 cents per quart, while herds of only 7 to 10 cows produced milk at a cost of 6.67 cents per quart. If only these herds are selected which contain cows producing over 6,000 lbs. of milk per cow annually, we find that there are 85 of these, and that the decrease in the cost of production as the size of the herd increases is even more regular.

The results are shown in the chart on page 76 (reproduced on page 79).

The figures in this chart in the form of tabulation show the following:—

Number of Herds.	Number of Cows in Herd.	Cost per Quart.	
		c.	Pence.
6	30—40	4.65	2 29
21	20—30	4 97	2 45
45	10—20	5.45	2 68
13	7—10	5.92	2 92

Collective Hauling.

Statistics from 11 milk shipping stations show that 453 farmers' wagons are used to haul to the station 1,181 forty-quart cans of milk. This is a little less than three cans to a wagon, the average distance of the dairy farms being under three miles. On a two-horse country truck it is possible for one man to haul 30 forty-quart cans of milk. Through collective hauling by such trucks at these 11 stations it would require only 44 such wagons to haul the same milk that was hauled by the 453 wagons.

If these figures should be applied to the entire milk supply of the city, it would mean that there were now 12,000 farmers' wagons carrying milk from dairy farms to shipping stations, which could be carried by only 1,250 wagons. In other words, there are ten times as many farmers hauling milk to shipping stations as there need be. These figures are probably somewhat exaggerated, as many large shipping stations have instituted a system of collective hauling. It seems certain, however, that the duplication of wagons hauling milk to country shipping stations is much greater than the duplication of wagons delivering milk in the city. It is obvious that the saving through the institution of a proper system of co-operative hauling would be very great, and that this saving would be felt by the consumer who eventually must pay the bills for this service.

Collective Buying of Grain.

The largest single item in the cost of milk is the cost of grain. Little success has resulted from attempts so far made at collective buying. The dairymen shipping milk to New York City use approximately 671 car loads of grain per month, each car carrying 25 tons, amounting to 16,780 tons of grain, at \$55.00 per ton, which is \$923,230.00 per month, or \$11,078,760.00 per year. This makes the dairymen supplying milk to New York City, as a group, the largest single customer of grain in the world. It seems fair to assume that if this grain were purchased through one agent, and the size of the order were guaranteed, some consideration ought to be given to the size of the order. Inquiry of one of the largest grain merchants of the New York Produce Exchange has elicited a reply which is in part as follows:—

"The ordinary dairyman is not usually in a position to buy feed in car load lots, and must therefore buy from a retail dealer, who must charge about 10 per cent. more than he pays for the goods, and not having storage capacity must also buy frequently, preventing him from availing himself of markets when they are lowest. Collective buying through a purchasing agent of immense quantities makes possible purchases whenever the markets warrant, and the buying of enough to tide over what might appear to be a steady rising market. Under these conditions there should be saved at least 10 per cent. on the purchase of feed, as compared with the system under which feed is now purchased.

ECONOMIES IN DISTRIBUTION. (Pp. 79-81.)

Centralising Distribution.

In the report of the Milk Committee appointed by the Food Controller for Canada, published November 24th, 1917, the Committee says that the cost of distribution, or the "distributors' spread," varied, from the evidence submitted, from 2.75c to 6.50c. per quart, depending on local conditions, and that this excessive spread is chiefly caused by the excessive number of distributors, and varies about in the same ratio as the number of distributors. For example, in Ottawa, where one dairy handles about 75 per cent. of the milk supply, the "spread" is only 3.25c. per quart, while in Toronto, where there are about 90 distributors, it is 5.25c. per quart. The Committee says, further, the effects of the unnecessary duplication are:—

- (a) Excessive capital employed.
- (b) Excessive dairy costs.
- (c) Overlapping in delivery.
- (d) Excessive loss in bottles.
- (e) Diversion of great numbers of men and horses from productive employment.

In addition may be mentioned duplication of administration costs, selling costs, properties (including real estate, buildings, and machinery, both country and city).

On this subject Mr. Weiant, President of the Borden's Farm Products Co., Inc., in his testimony stated, "There are operating expenses in the country that are duplicated and could be removed. It would be possible to have full cars come through instead of part cars. Pasteurising plants could maintain a full flow and at a maximum capacity. Wagons could be filled to capacity and operated in a small area. If the plan were worked out completely, there would be necessarily no duplication. I believe if the dealers are given an opportunity to work on that problem they will solve it.

The data collected by this Committee shows that there is duplication of effort in the country at collecting stations, inefficiency in transportation because of broken car load lots, duplication in hauling from railroad platforms to the city, duplication of bottling and pasteurising in city stations, and, above all, duplication in the delivery wagons on the streets.

Statistics of the delivery system suggest saving that would result from the elimination of competition and the substitution of a single-service delivery. The statistics for the New York City are as follows:—

Bottled Milk Supply	...	...	...	...	...	704,318	quarts.
Milk in Cans	...	...	...	...	...	896,405	„
Retail Wagons	...	...	...	...	...	4,978	„
Wholesale Wagons	...	...	...	...	...	1,522	„
Average Load of Retail Wagons	...	...	...	...	...	142	„
Average Load of Wholesale Wagons	...	...	...	...	...	14.7	cans.

Investigation shows that the minimum load for a retail wagon is 428 quarts, consequently if the total volume of retail milk, amounting to 704,318 quarts, were carried on retail wagons handling only full loads, the bottled milk of New York City would be handled by only 2,243 retail wagons instead of the 4,978 actually in use at the present time. This would mean only 45.3 per cent. on the present number, or a saving of 54.7 per cent. of the total.

In wholesale milk the minimum load for a two-horse wagon operated by one man is 75 cans per day. If all the wholesale milk, amounting to 896,405 quarts, or 22,410 cans, were carried on wagons handling only maximum loads, the number of wagons required would be only 300, as compared with the 1,522 wholesale wagons now operating. This would be a saving of 81.3 per cent.

These estimated savings of 54.7 per cent. on retail wagons and 81.3 per cent. on wholesale wagons are, of course, ideals assuming a perfect delivery system in every section of the city and that every wagon carries only a full load. Under practical conditions this would be impossible, even if delivery were in the hand of a single public service corporation.

For a number of years milk has been retailed in Philadelphia for 2 cents less than in New York City. Philadelphia retail loads have averaged 300 quarts to the wagon, while in New York retail loads have averaged less than 200 quarts to the wagon. This difference in load is chiefly responsible for the difference in retail price.

In the city of Ottawa, Canada, 75 per cent. of the business is in the hands of one distributing firm, which operates at a margin of only 3.25 cents above the cost of production, as compared with the margin of distribution in Philadelphia of 5 cents and in New York of 7 cents.

The Milk Committee appointed by the Food Controller for Canada reported on November 24th, 1917, in favour of the "unification and reorganisation of the milk distributing business," and cited the experience in the adoption of a single delivery system of the City of Regina, Saskatchewan, where a net saving of at least 1½ cents per quart over the previous cost of milk resulted from the adoption of this system.

SUMMARY OF FOREIGN AND COLONIAL LAWS OTHER THAN THOSE OF UNITED STATES RELATING TO MILK.

Classification.—Laws relating to:—

- Milk.
- Certified Milk.
- Pasteurised Milk.
- Sterilised Milk.

MILK.

CANADA. (*November 14th, 1910.*)

Definition.—Fresh, clean, and unaltered product, obtained under proper sanitary conditions, of healthy cows, excluding that obtained within two weeks before, and one week after calving, and contains—
not less than 3.25 per centum of milk fat, and
not less than 8.5 per centum of milk solids other than fat.

COMMONWEALTH OF AUSTRALIA. *Statutory Rules, 1913 347.*

Definition.—Milk shall be the milk of cows, whether mixed or not; it shall contain not less than 3.0 per centum of butter fat, nor less than 8.5 per centum of solids not butter fat.

SOUTH AUSTRALIA. *Sale of Foods and Drugs Act. No. 968, 1908.*

Section 25 gives powers to fix standards.

Section 31 prohibits sale of milk of diseased cows.

VICTORIA. *Standards of Foods and Drugs. 1916.*

Definition.—Milk from udder of healthy cows, excluding that of seven days after parturition. It shall contain —

- not less than 12.0 per centum of total solids,
- not less than 8.5 per centum of solids not fat,
- not less than 3.5 per centum of milk fat,
- nor more than 0.9 per centum of ash, nor any foreign substance.

Note this excludes any preservatives, but does not exclude milk in month before parturition.

TASMANIA. *Regulations under Food and Drugs Act, 1910.*

Definition.—Milk shall be the normal, clean, and fresh secretion obtained by completely emptying the udder of the healthy cow, properly fed and kept, excluding that got 15 days immediately before and 10 days after parturition.

- It shall contain more than 8.5 per centum solids not fat,
- shall contain 3.5 per centum milk fat,
- shall contain 12.0 per centum total solids

The freezing point of milk shall be not higher than 0.55° C.

Further regulations prohibit the handling of milk by persons suffering from phthisis, chronic cough, or venereal disease; and also prohibit the exposure of milk to contamination by dust or flies.

These regulations, which came into force on September 1st, 1911, would tend to secure the handling of milk under clean conditions.

WESTERN AUSTRALIA. *Health Act of 1911. (No. 34).*

Section 169. Excludes—Impure and unwholesome milk; or milk from diseased animals; or milk obtained within 30 days before or 5 days after parturition.

Section 172. Prohibits the sale of stale milk.

This prohibition is important as it forbids the sale of milk once sent out for delivery and returned to the retailer, except for industrial purposes. Such a prohibition prevents the sale of milk already stale but treated or pasteurised to prevent its being obviously sour. Such milk contains the products of bacterial activity, and differs chemically from pure sound milk. It frequently curdles when warmed in the house of the consumer owing to these chemical changes although not obviously sour when purchased from the retailer.

WESTERN AUSTRALIA. *Regulations under Health Act (Amendment) of 1918.*

Definition.—It shall contain 8·5 per centum solids not fat; shall contain 3·2 per centum milk fat; shall contain 11·7 per centum total solids.

The remarkable feature of this definition is the low content of milk fat permitted, viz., 3·2 per centum. The next lowest, New Zealand, requires 3·25 per centum, but all the other Australasian colonies stick to 3·5 per centum and this appears sufficiently low to include genuinely sound milk.

NEW ZEALAND. *Regulations under Food and Drugs Act.*

Definition.—Milk shall be the normal, clean, and fresh secretion obtained by completely emptying the udder of the healthy cow, properly fed and kept, excluding that got during seven days immediately following on parturition.

It shall contain not less than 8·5 per centum solids, not fat; shall contain 3·25 per centum milk fat

It shall not contain any added water nor any foreign substance.

This definition, though allowing a low content of milk fat, expressly excludes the addition of any preservatives.

DENMARK. *Sekretæren, Landburgsministeriet, København. 11/4/19.*

'Just now (11th April, 1919) nothing can be said about the proper fixation in normal times of the lower limits for fatty substances or total solids.' Landburgsministeriet, København

SWITZERLAND. *Regulations—Berne, 1919. Manuel Suisse des Denrées Alimentaires.*

Definition.—Milk from well-nourished cows; specific gravity, 1·030 to 1·033; fat content, minimum 3 per centum; total solids, minimum 12 per centum; solids other than fat, 8·5 per centum; acidity, maximum 9°; freezing point, between 0·54° and 0·57°; clotting in less than 20 minutes; leucocytes less than 0·05 per centum by volume.

This is a somewhat exhaustive definition.

As regards the freezing point, it is suggested that tuberculosis, and other febrile disorders, will raise the freezing point of the milk from such diseased cows to 0·48° C.

CERTIFIED MILK.

CANADA.

Milk sold as certified milk shall comply with the following requirements:—

- (a) It shall be taken from cows semi-annually subjected to the tuberculin test, and found without reaction.
- (b) It shall contain not more than 10,000 bacteria per cubic centimetre from June to September, and not more than 5,000 bacteria per cubic centimetre from October to May inclusive.
- (c) It shall be free from blood, pus, or disease producing organisms.
- (d) It shall be free from disagreeable odour or taste.
- (e) It shall have undergone no pasteurization or sterilization, and be free from chemical preservatives.
- (f) It shall have been cooled to 45° Fahr. within half an hour after milking, and kept at that temperature until delivered to the consumer.
- (g) It shall contain 12 to 13 per centum of milk solids of which at least 3·5 per centum is fat.
- (h) It shall be from a farm whose herd is inspected monthly by the veterinarian, and whose employees are examined monthly by a physician.

These regulations for certified milk are precise and somewhat exacting. One of the most important is (e) in that it requires the milk to be produced under clean conditions, and does not allow any "doctoring" or "cooking" of dirty milk to pass the requirements of (b). This means that the milk is sold to the consumer without any of the chemical changes produced by either bacteria or heat. The value of fresh milk as an infant's food depends in part at least upon the presence of certain accessory food substances or vitamins, and as these are unstable it is important that the milk is subjected to no treatment that may destroy them.

PASTEURISED MILK.

CANADA. (*Ottawa, November 14th, 1910.*) *Department of Inland Revenue. Standard of Quality.*

Definition.—Pasteurised milk is milk that has been heated below boiling, but sufficiently to kill most of the active organisms present; and immediately cooled to 45° F. or lower, and kept at a temperature not higher than 45° F. until delivered to the consumer, at which time it shall not contain more than 10,000 bacteria per cubic centimetre.

Note that this is rather a vague definition. It does not prescribe any definite period of heating or temperature to be attained; neither is it specified that the heating must suffice to kill the commoner pathogenic bacteria, *e.g.*, B: tuberculosis.

The Dominion Dairy Conference, held at Ottawa, November 25th-28th, 1918, in their report on page 14 change the bacterial content to 100,000 per cubic centimetre, without reason given.

Further on page 57 they record a recommendation for the pasteurisation of milk and cream in the manufacture of all butter made in Canada, and urge its adoption at once.

After discussion, wherein lower temperatures were condemned as ineffectual, the Conference decided that the standard minimum for pasteurisation should be a temperature of 170° Fahr. held for at least ten minutes (page 75).

This recommendation of the Conference on the pasteurisation of milk for butter-making is further supported by a resolution (page 78) that the Dominion Government be requested to make it compulsory to pasteurise or sterilise all dairy factory by-products.

The importance of sterilising dairy factory by-products, *e.g.*, separated milk, was demonstrated by reference to the large proportion of swine affected with tuberculosis, the number for all Canada being 19 04 per centum. Dr. F. Torrence, Veterinary Director-General, points out that this tuberculosis arises by infection conveyed in milk from tuberculous cattle (pages 75 and 76).

If there be a necessity to pasteurise milk and milk by-products to save swine from tuberculosis, it adds another argument to the case for the protection of the human subject from infection by the same means.

PASTEURISED MILK.

COMMONWEALTH OF AUSTRALIA. *Statutory Rules*, 1913. 347.

Pasteurised means subjected to heat in such a manner as to destroy fully developed micro-organisms but not necessarily the spores thereof.

This definition is rather an explanation of what happens to milk subjected to heat than a requirement of any specific process. It depends entirely on what bacteria are at present in the fresh milk.

VICTORIA. *Standards of Foods and Drugs*, 1916.

Definition.—

Pasteurised milk is milk heated to 156° F. (69° C.) for 20 minutes
 " " " " 165° F. (73·9° C.) for 10 minutes
 " " " " 170° F. (76·7° C.) for 5 minutes

and immediately cooled to 10° C.

It shall not contain any living *Bacillus coli*.

Note that this specification insists that pasteurised milk shall be free from *B. coli*, one of the chief putrefactive organisms found in milk.

DENMARK *Sekretæren, Landburgsministeriet, København*. 11/4/19.

Pasteurisation is understood to mean the heating of milk to 80° C.

The test, devised by Dr. Storch for testing whether milk has been heated sufficiently, depends on the fact that the enzyme peroxidase contained in fresh milk, is destroyed at this temperature. Hence heated milk fails to give an indigo blue colour reaction with paraphenylendiamine and hydrogen peroxide.

SWITZERLAND. *Manuel Suisse des Denrées Alimentaires, Berne*, 1919

Definition.—Pasteurised milk is milk freed of pathogenic organisms by heat at a temperature below boiling point, and whose keeping qualities are a little better than unheated milk in consequence of the destruction of lactic fermentation. The important question as to the freedom of pasteurised milk from *Bacillus tuberculosis* can only be solved by inoculation tests.

This definition of pasteurised milk is vague, but the addition of the rider in the last sentence shows that Swiss authorities accept nothing short of boiling as an efficient means of destroying *B. tuberculosis* in milk.

CANADA. (*November 14th*, 1910.)

Definition.—Sterilised milk is milk heated to 100° C. or higher, sufficiently to kill all micro-organisms present. It must be delivered sterile; and sold in closed containers marked "should be used within 12 hours after opening."

This definition is precise. But the caution as to use within 12 hours is needless and founded on the erroneous idea that, in the absence of lactic acid fermentation, milk is more liable to putrefactive changes.

DOMINION OF NEW ZEALAND.

New Zealand Government Offices,
 415, Strand, W.C.2.
 31st July, 1919.

SIR,

FURTHER to your correspondence with the Veterinary Officer in March last, in relation to the public administration and legislation governing the milk supply in New Zealand, I now have pleasure, by direction of the High Commissioner, in stating that, having forwarded your enquiry to his Government, he is now in receipt of a reply over the signature of the Minister of Agriculture. A full copy of this is enclosed herewith and the information will, it is hoped, be of assistance to your Department.

I am, Sir,
 Your obedient Servant,
 (Signed) P. OSBORNE,
 Secretary to the Department.

G MONTAGUE HARRIS, Esq.,
 Intelligence Department,
 Local Government Board,
 Whitehall, S.W.1.

FROM THE ACTING PRIME MINISTER TO THE HIGH COMMISSIONER.

29th May, 1919.

Memorandum for the High Commissioner for New Zealand, 413-416, Strand, W.C.2.

I have to acknowledge receipt of your letter P/O./C/M. No. 1692, of the 20th March, covering copy of one to you from the Intelligence Department of the Local Government Board asking for information regarding the pasteurization and grading of milk in New Zealand, and, in reply, to inform you that no official definition of the terms pasteurization, as applied to milk and cream, has yet been adopted in New Zealand. It may be mentioned, however, that all cream for the manufacture of creamery butter intended for export or for sale on the local market is pasteurized. The temperature to which the cream is heated varies from 176° to 200°, according to the class of cream dealt with. This system was introduced about twelve years ago under the direction of the Instructors of the Dairy Division, and has since been continued with much success.

The same principle has also been introduced at cheese factories on a modified scale. At a large number of these the milk is pasteurized, but in this case it is not found expedient to raise the temperature much above 160°, owing to the fact that the manufacturing process is interfered with when higher temperatures are used.

Grading of Milk.

No arrangements are in existence for the grading or classifying of milk, as sold to the public, and no restriction is placed thereon apart from the regulations under the Sale of Food and Drugs Act, whereby the milk must be up to the standard required in the case of the percentage of butter fat and milk solids other than fat, together with the control exercised in connection with the registration of dairies from which milk is received for human consumption.

A voluntary system of cream grading has been introduced by a number of the dairy companies, and the cream received is therefore classified according to its flavour and general condition. Two grades have been adopted, and a lower price is paid for that of the second grade. All cream is paid for on the basis of its butter fat content—second grade usually at the rate of 1d. per lb. less than that of first grade.

(Signed) W. D. S. MACDONALD.

For the Acting Prime Minister

RESULTS OF THE EXAMINATION OF MILK SUPPLIED BY 28 DAIRYMEN TO MOTHERS ATTENDING SEVEN LONDON SCHOOLS FOR MOTHERS.

No.	Date	Description of shop.	No. of Bacteria per c c	Presence or absence of Bacilli Coli	Tubercle
	1916				
1	July 4	Cowkeeper	98,000	Present	No evidence
2	"	Dairy and Post Office	500,000	"	"
3	"	Dairy selling eggs and butter	3,300,000	"	"
4	" 11	" " " " " "	11,000,000	"	"
5	"	Dairy	860,000	"	"
6	"	" " " " " "	9,000,000	"	"
7	"	" " " " " "	700,000	"	"
8	" 18	Dairy selling biscuits and tinned food	1,190,000	"	"
9	"	Dairy selling eggs, butter, bread, etc.	4,800,000	"	Microscopic evidence confirmed by guinea pig test.
10	"	Cowkeeper	65,400,000	"	No evidence
11	"	Dairy selling ham, cheese, butter, etc	1,070,000	"	"
12	" 25	Dairy	279,000	"	"
13	"	Dairy selling tea, butter and bread	531,000	"	"
14	Aug. 29	Dairy	3,695,000	"	"
15	Sept. 5	" " " " " "	13,180,000	"	"
16	" 20	Cowkeeper	2,250,000	"	"
17	"	Restaurant	5,780,000	"	"
18	"	Dairy selling eggs and butter	1,650,000	"	"
19	"	Dairy	8,590,000	"	"
20	Oct. 9	Cowkeeper	12,590,000	"	"
21	"	Dairy selling ham, eggs, butter, tinned foods.	20,300,000	"	"
22	"	Dairy	5,000,000	"	"
23	"	" " " " " "	466,000	"	"
24	"	" " " " " "	1,564,000	"	Microscopic evidence confirmed by guinea pig test.
25	"	" " " " " "	300,000	"	No evidence
26	" 23	" " " " " "	6,600,000	"	"
27	Nov. 14	Milk dealer and general provision merchant.	104,300,000	"	"
No.	Date 1916.	No. of Bacteria per c c.	Coli in dilution.	Tubercle.	
28	*April 4	12,500,000	280,000	Guinea pig test confirmed by microscopic evidence	

* Sold by a London dairyman as "Certified Milk, in Glass Bottles. Direct from Farm to Customer."

It will be noticed that every sample contained Bacillus Coli, a micro-organism derived from manure.

DECREASE IN COST OF PRODUCING MILK AS AMOUNT OF MILK PER COW INCREASES

Based on data from Bulletin No 7

Connecticut Agricultural College

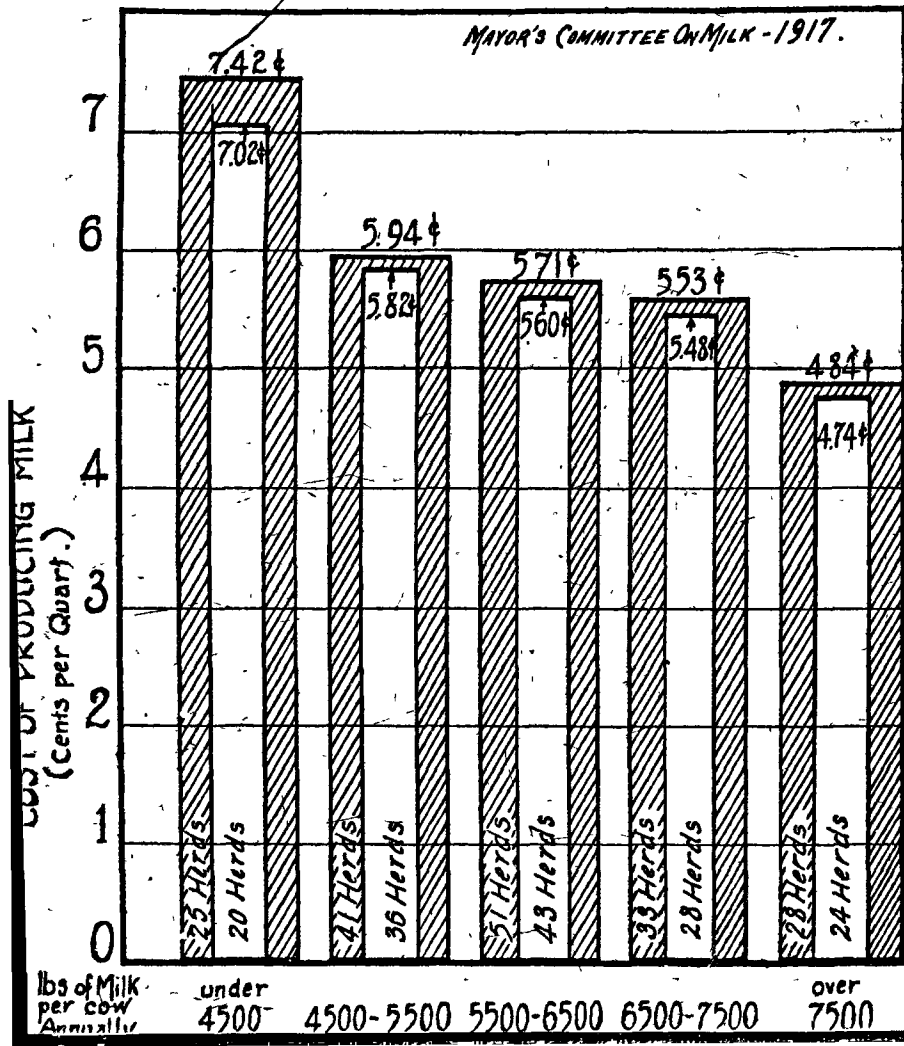
Extension Service

For all 178 herds listed

For 151 herds containing over 10 cows



MAYOR'S COMMITTEE ON MILK - 1917.



DECREASE IN COST OF PRODUCING MILK AS SIZE OF HERD INCREASES.

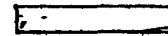
Based on data from Bulletin No 7

Connecticut Agricultural College

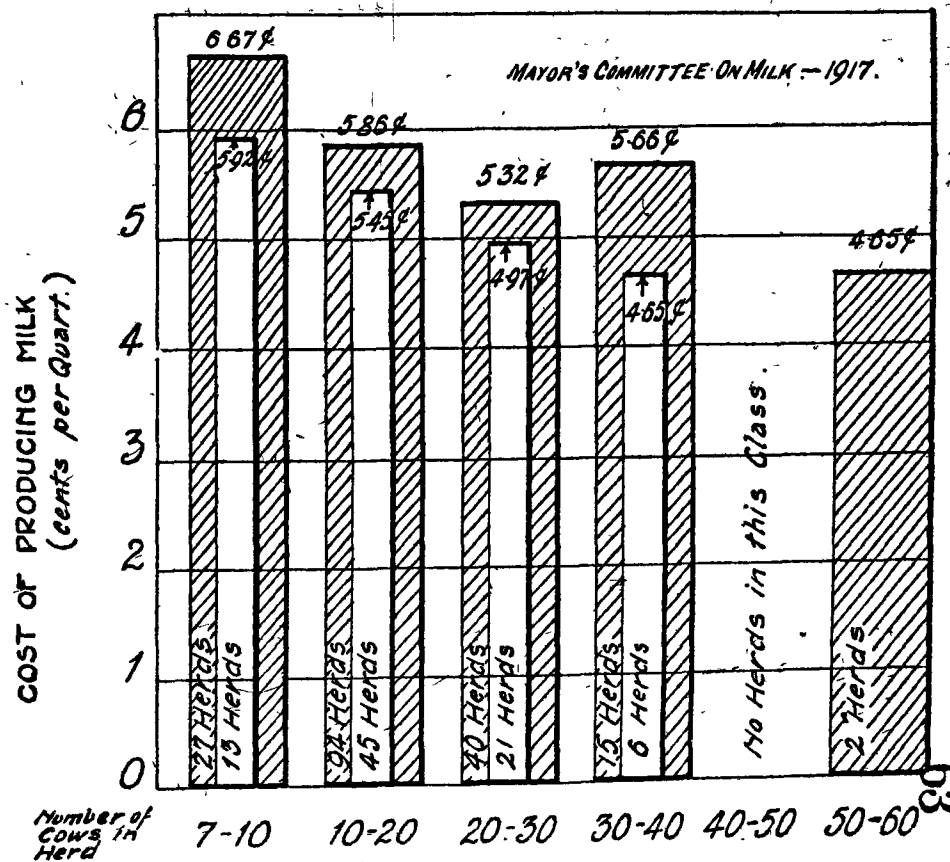
Extension Service

For all 178 herds listed




For 85 herds producing over 6000 lbs of Milk per Cow annually

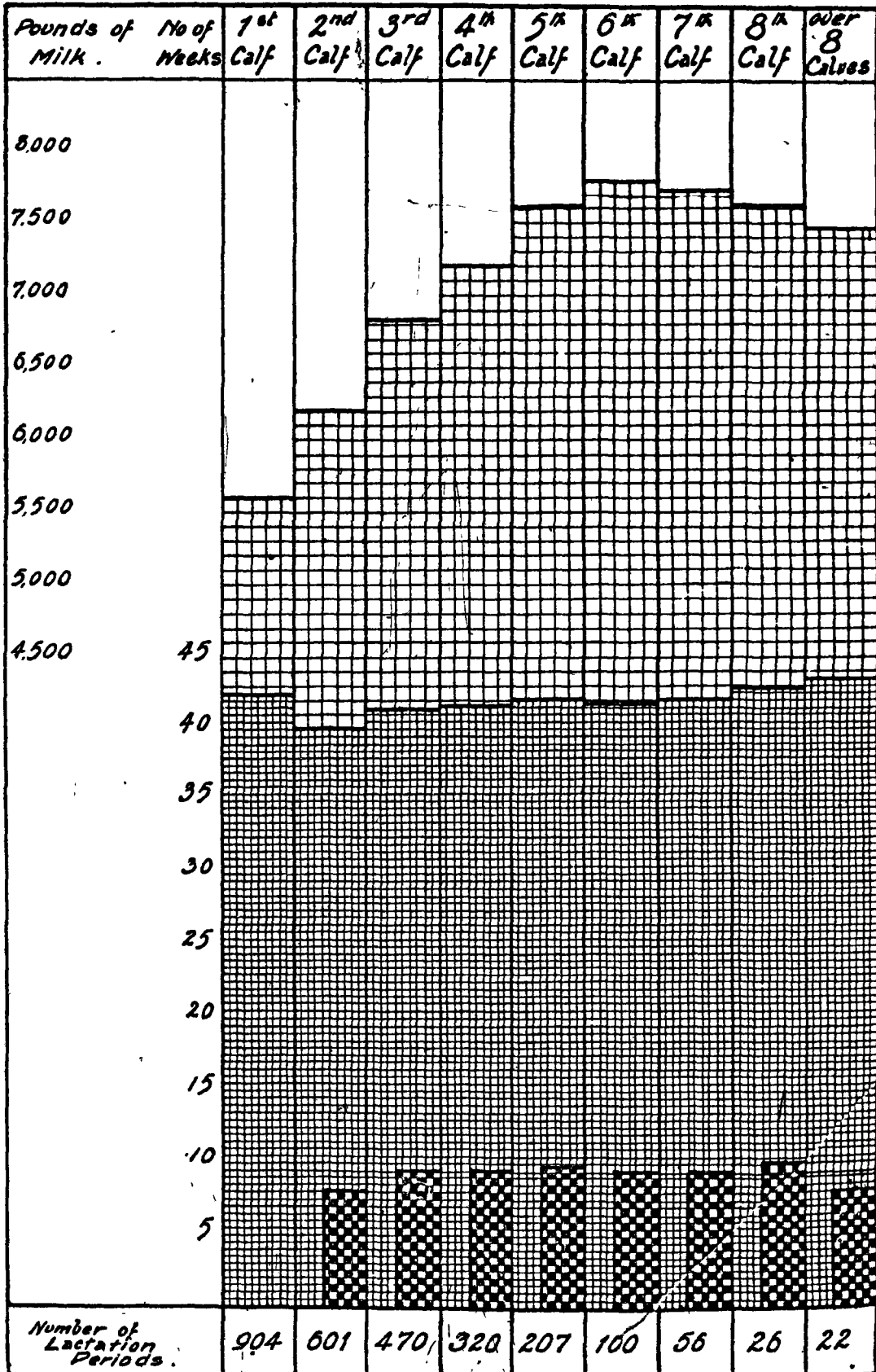


MAYOR'S COMMITTEE ON MILK - 1917.



VARIATION IN YIELDS OF MILK FROM COWS OF DIFFERENT AGES.

Pounds of Milk during Lactation Period _____ 
 Number of Weeks in Milk _____ 
 Number of Weeks Dry _____ 

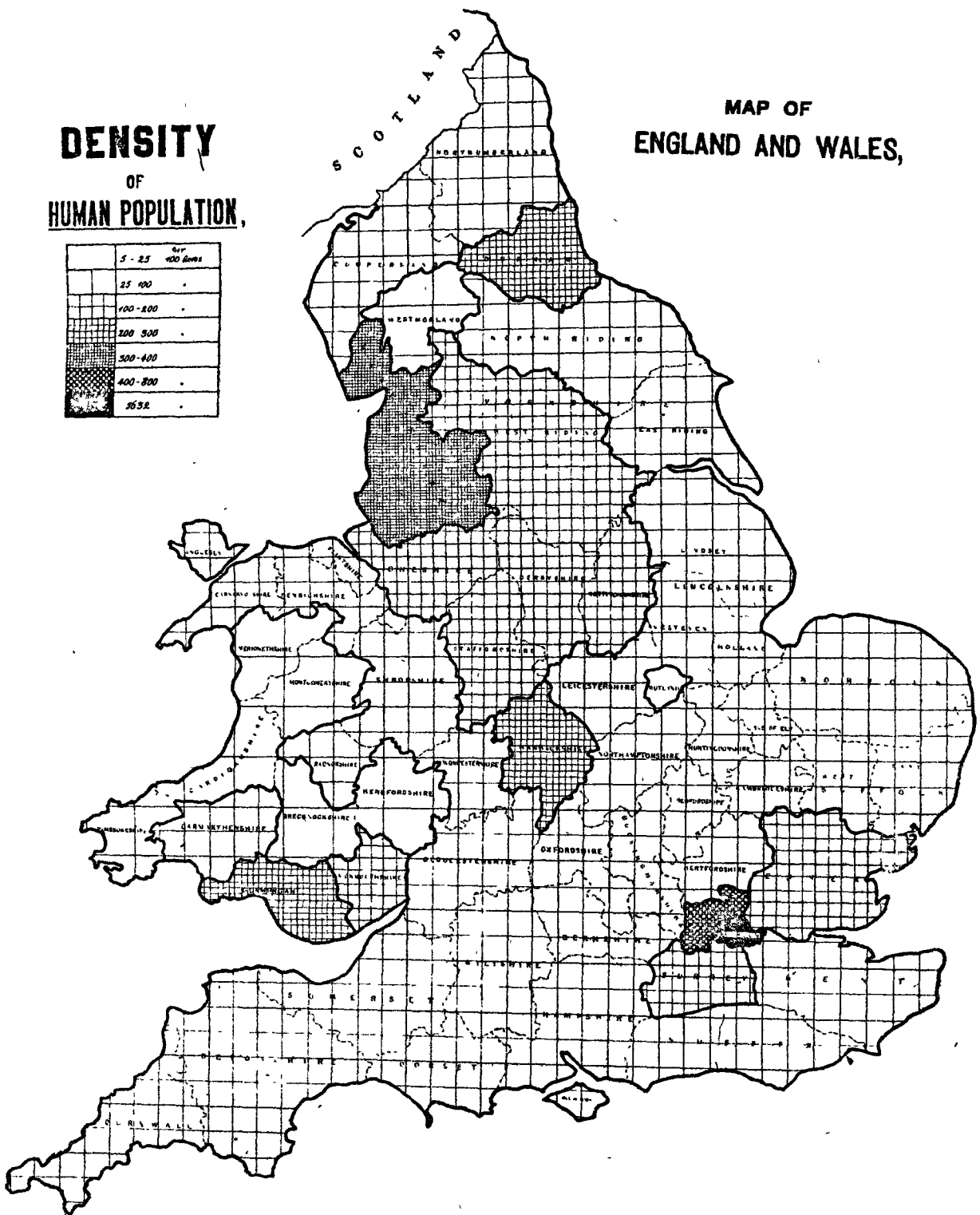


Based on Records covering 2706 Lactation Periods, yields from Cows which did not calve again within 14 Calendar Months (60 weeks) excluded.

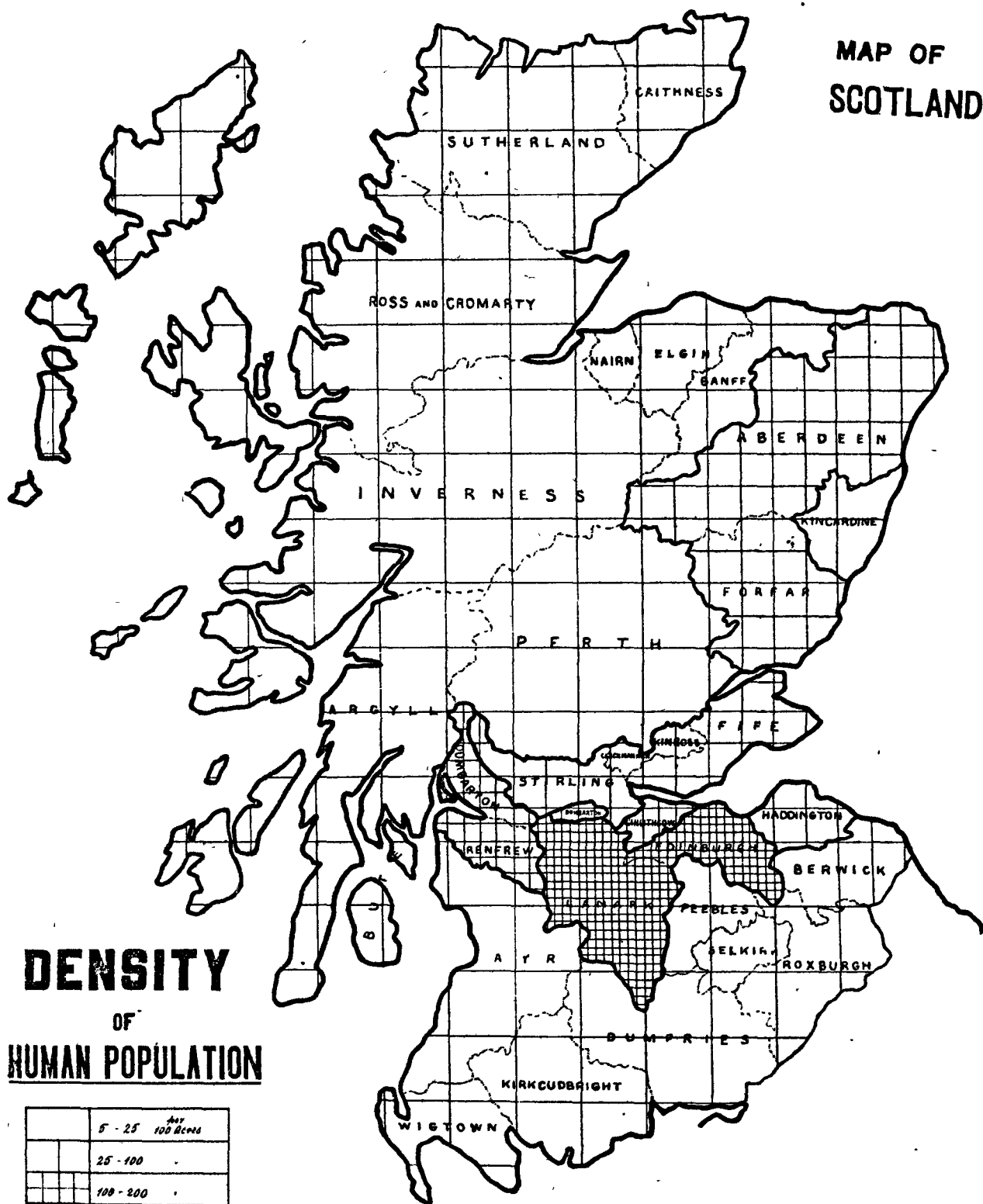
DENSITY OF HUMAN POPULATION,

	5 - 25	per 100 acres
	25 - 100	.
	100 - 200	.
	200 - 300	.
	300 - 400	.
	400 - 800	.
	3532	.

MAP OF ENGLAND AND WALES,



MAP OF SCOTLAND,

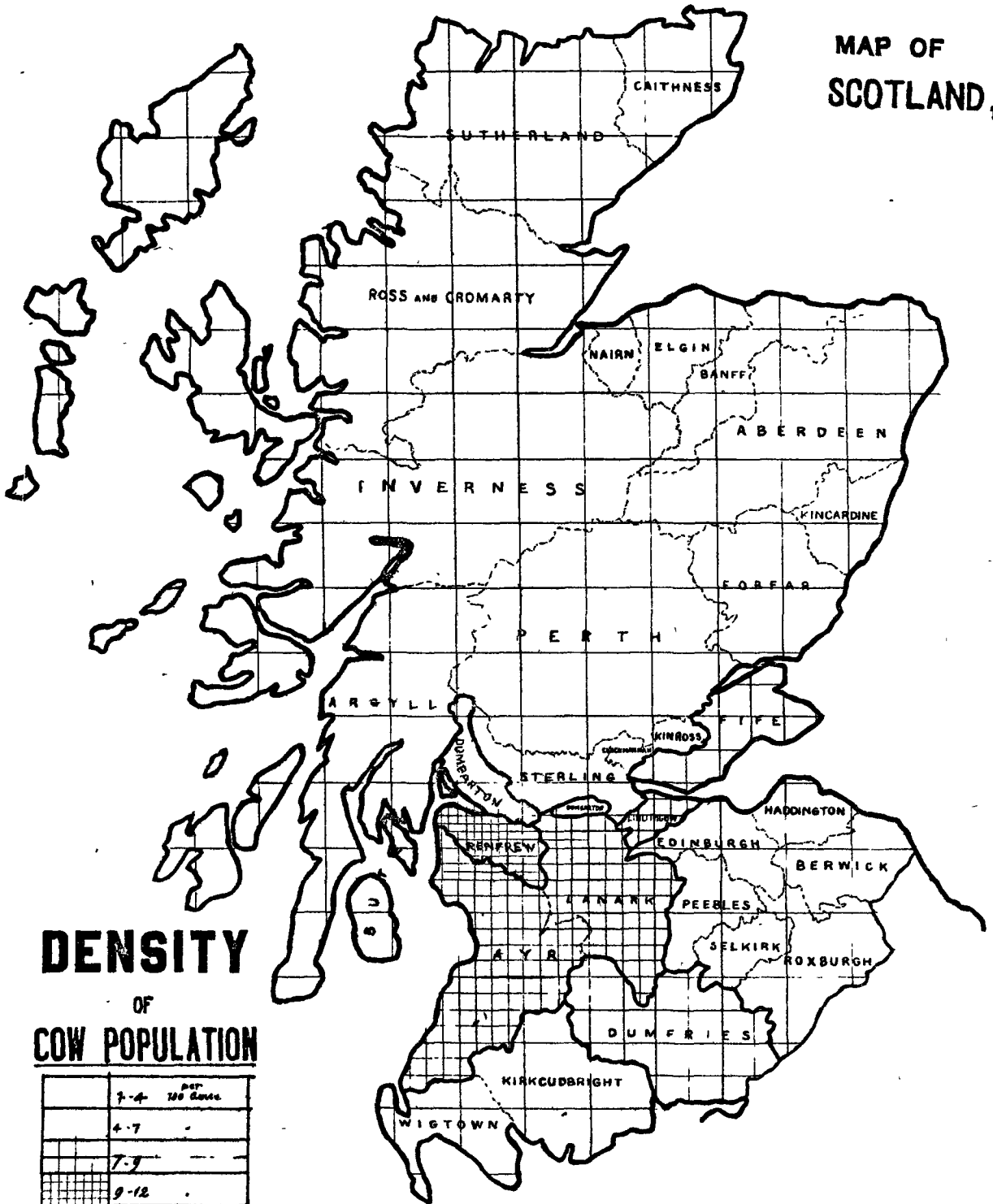


DENSITY OF HUMAN POPULATION

•	5 - 25	per 100 Acres
- - -	25 - 100	
| | |	100 - 200	
| | | | |	200 - 300	

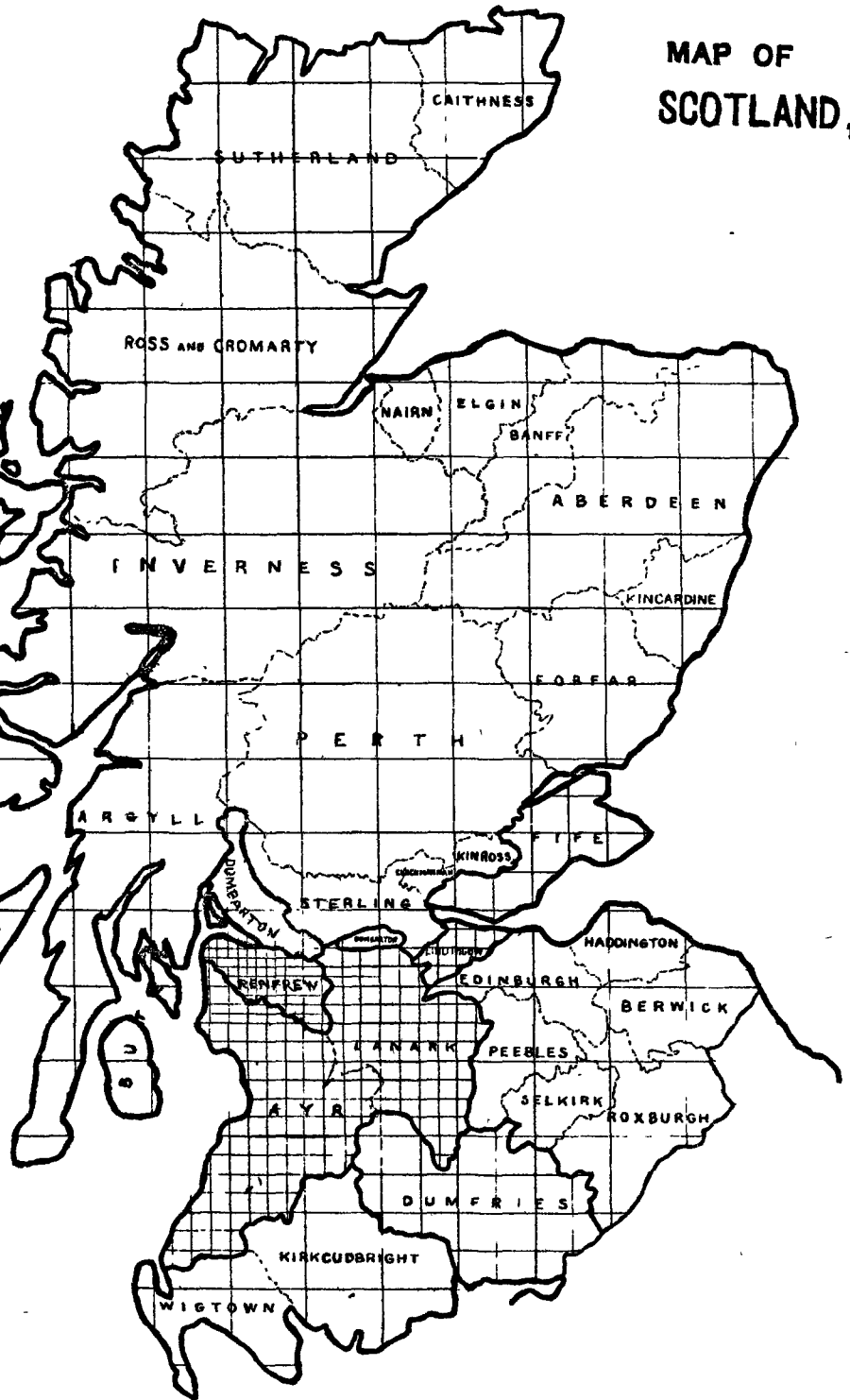
CAITHNESS
SUTHERLAND
ROSS AND CROMARTY
NAIRN
ELGIN
BANFF
ABERDEEN
INVERNESS
KINTYARDINE
FORFAR
PERTH
ARGYLL
FIFE
STIRLING
HADDINGTON
BERWICK
RENFREW
DUMFRIES
PEEBLES
SELKIRK
ROXBURGH
AYR
KIRKCUDBRIGHT
WIGTOWN

MAP OF
SCOTLAND,



DENSITY
OF
COW POPULATION

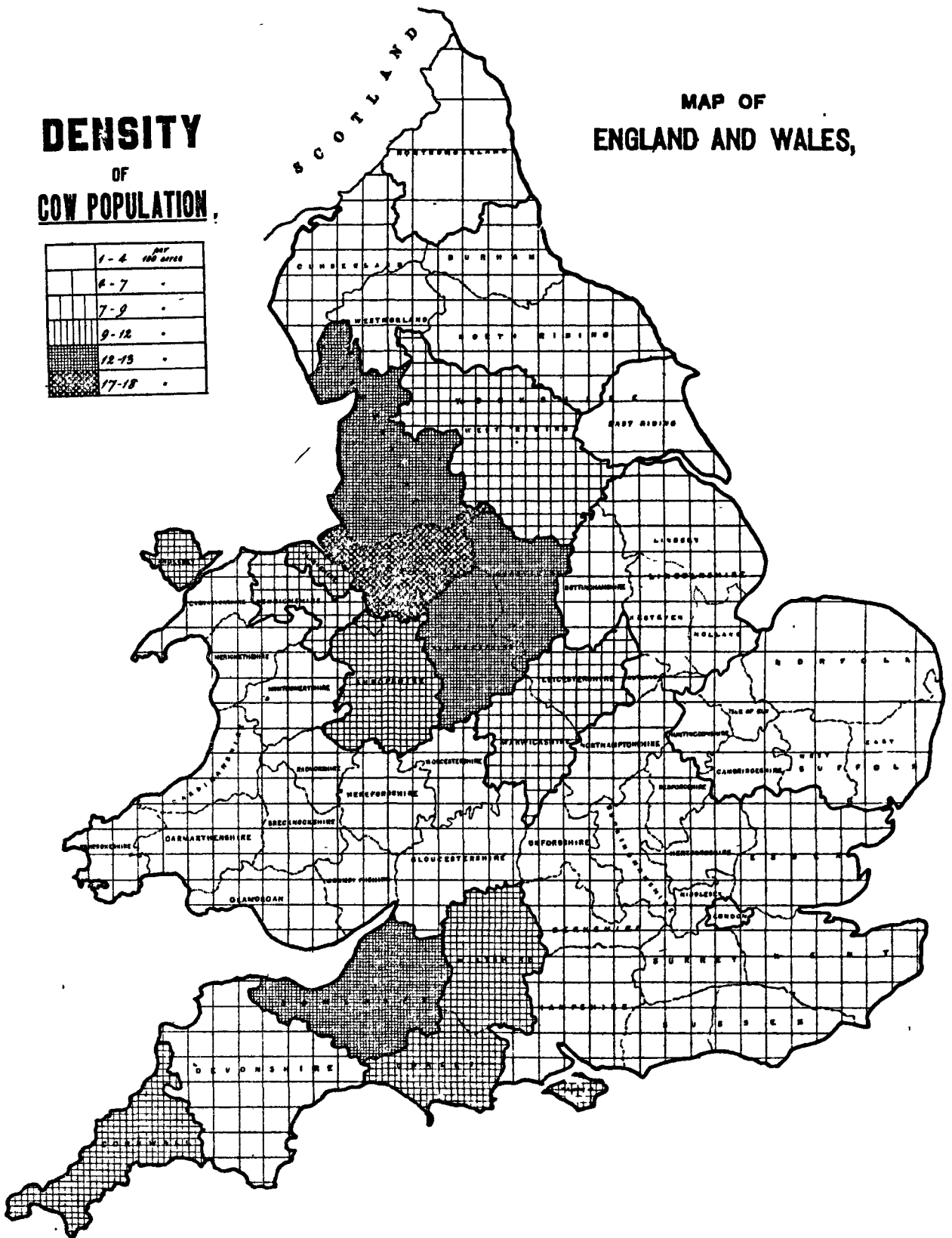
	Cows per 100 Acres
[Single grid lines]	3-4
[Double grid lines]	4-7
[Triple grid lines]	7-9
[Quadruple grid lines]	9-12



DENSITY OF COW POPULATION

	1-4	per 100 acres
	4-7	"
	7-9	"
	9-12	"
	12-15	"
	17-18	"

MAP OF ENGLAND AND WALES,



MAP OF SCOTLAND,



MAP OF SCOTLAND,



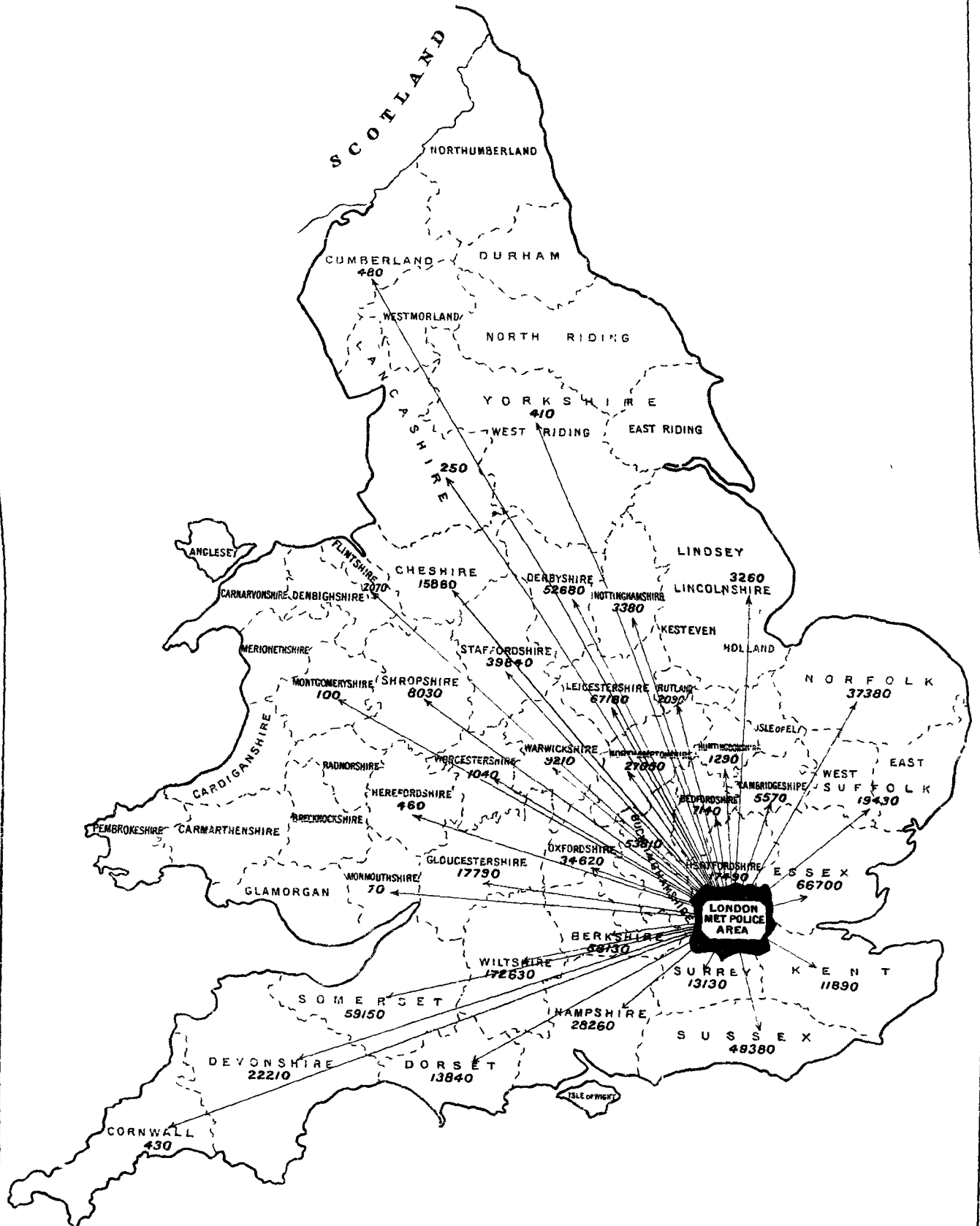
MAP OF ENGLAND AND WALES.

SHOWING

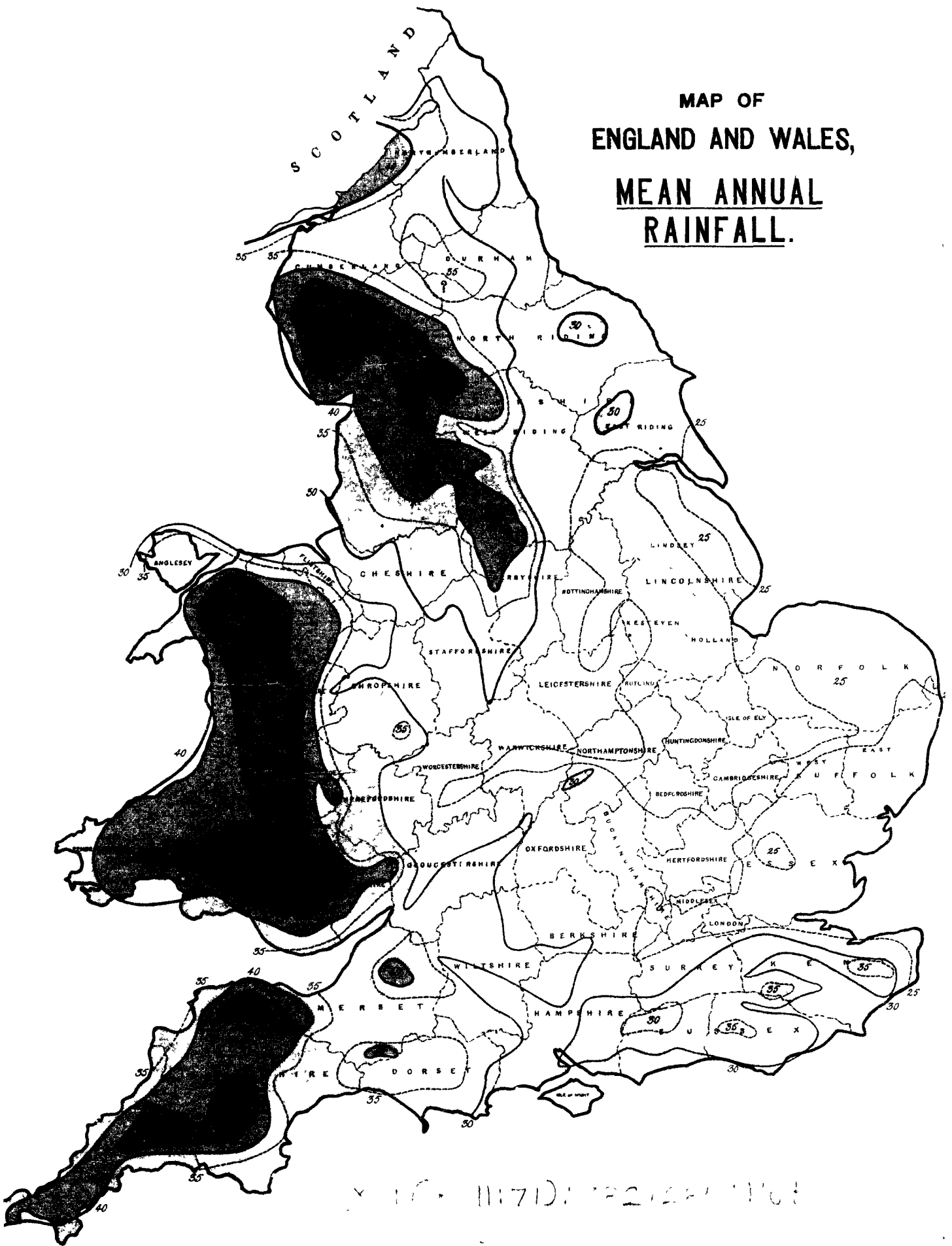
Total number of Gallons of Milk(923,730)from 38 Counties supplying London(Metropolitan Police Area) during one week.

Diagram drawn from information furnished by Producers. Figures taken from CENSUS for week ended December 7th 1918.

NOTE In certain cases the figures include Milk shown by Producers as sold in Distributing Agencies in London, no information being available as to its actual destination.

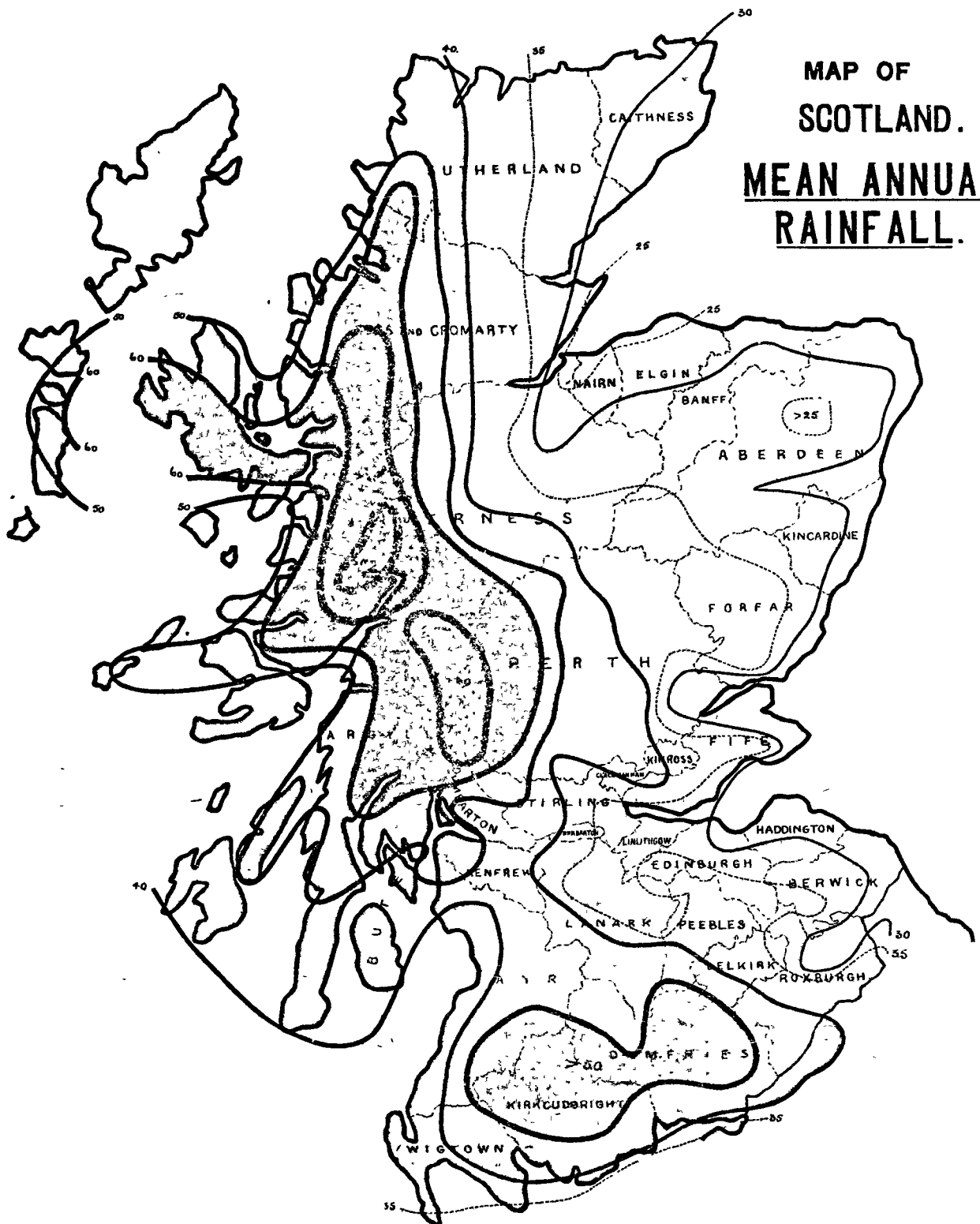


MAP OF
ENGLAND AND WALES,
MEAN ANNUAL
RAINFALL.



X 10 111710 122 124 1161

MAP OF
SCOTLAND.
MEAN ANNUAL
RAINFALL.



Malby & Sons, Lith

DEPARTMENT OF AGRICULTURE AND TECHNICAL INSTRUCTION FOR
IRELAND.

N 268

S. 2139

REPORT



OF THE

DEPARTMENTAL COMMITTEE

ON THE

4

DECLINE OF DAIRYING IN IRELAND.

Presented to Parliament by Command of His Majesty.



DUBLIN:

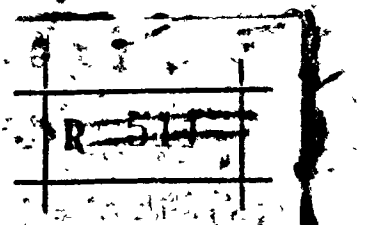
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1920.

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TO HIS EXCELLENCY JOHN DENTON PINKSTONE, VISCOUNT FRENCH
OF YPRES, K.P., G.C.B., O.M., G.C.V.O., K.C.M.G., FIELD MARSHAL,
LORD LIEUTENANT-GENERAL AND GENERAL GOVERNOR OF IRELAND.

MAY IT PLEASE YOUR EXCELLENCY,

I am desired by the Vice-President to submit to Your Excellency the Report of the Departmental Committee on the Decline of Dairying in Ireland.

I have the honour to remain,

Your Excellency's faithful Servant,

T. P. GILL,

Secretary.

DEPARTMENT OF AGRICULTURE
AND TECHNICAL INSTRUCTION FOR IRELAND,
DUBLIN, *11th June, 1920.*

DUBLIN CASTLE,

22nd June, 1920.

SIR,

I have to acknowledge the receipt of your letter of the 11th instant, forwarding, for submission to His Excellency the Lord Lieutenant, Report of the Departmental Committee on the Decline of Dairying in Ireland.

I am,

Sir,

Your obedient Servant,

JAMES MACMAHON.

The Secretary,
Department of Agriculture and
Technical Instruction for Ireland,
Dublin.

S 2134

4

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DEPARTMENTAL COMMITTEE ON THE DECLINE OF DAIRYING IN
IRELAND.

COPY OF MINUTES APPOINTING THE COMMITTEE.

I HEREBY nominate and appoint a Committee to inquire into and report upon the causes of the decline of dairying in Ireland, and to submit recommendations with a view to the improvement of the supply of milk and of milk products in this country.

The Committee will consist of the following :—

BERTRAM H. BARTON, D.L.,
Straffan House, Straffan, Co. Kildare (*Chairman*) ;

ROBERT A. ANDERSON,
Secretary, Irish Agricultural Organisation Society,
The Plunkett House, Dublin ;

HAROLD A. M. BARBOUR,
Strathearne, Dunmurry, Co. Antrim ;

THOMAS DUGGAN, J.P.,
The Castle, Two-Mile-Borris, Thurles.

(Signed), HUGH T. BARRIE,
Vice-President,

Department of Agriculture and Technical
Instruction for Ireland.

Dated this 11th day of September, 1919.

I also nominate and appoint the following to be members of the Departmental Committee on the Decline of Dairying in Ireland :—

PATRICK BRADLEY,
President, Irish Land and Labour Association, Cork ;

ALBERT R. LOCKETT,
National Amalgamated Union of Labour, Belfast.

(Signed), HUGH T. BARRIE,
Vice-President,

Department of Agriculture and Technical
Instruction for Ireland.

Dated this 22nd day of September, 1919.

DEPARTMENTAL COMMITTEE ON THE DECLINE OF DAIRYING IN
IRELAND.

REPORT.

To HUGH T. BARRIE, Esq., M.P.,
Vice-President of the Department of Agriculture
and Technical Instruction for Ireland.

SIR,

By your minutes dated 11th and 22nd September, 1919, we were appointed a Committee "to inquire into and report upon the causes of the decline of dairying in Ireland, and to submit recommendations with a view to the improvement of the supply of milk and of milk products in this country."

PROCEDURE.

In accordance with these Minutes the following steps were taken with a view to obtaining evidence regarding all aspects of the dairying industry which would be as comprehensive as possible and would be representative of the different interests involved :—

- (1) Advertisements and notices were issued to the Press, setting forth the objects of the Inquiry, giving particulars as to the arrangements for sittings, and inviting evidence from associations and persons interested who might desire to lay their views before us.
- (2) Special letters were issued to numerous associations and societies connected with the industry, and to a number of the County Committees of Agriculture, inviting them to appoint witnesses who could furnish us with authoritative evidence on their behalf. A gratifying degree of co-operation was received in this connection and a large number of the witnesses examined were gentlemen deputed by these bodies to appear before us.

In addition to the witnesses who were present at our sittings, a number of persons who found it inconvenient to attend submitted statements of their views, which have been duly considered along with the evidence taken orally.

- (3) Sittings for the purpose of hearing evidence were held in Dublin and at the following provincial centres :—

Belfast.	Cork.	Tralee.
Coleraine.	Limerick.	Sligo.
Londonderry.	Thurles.	Mullingar.
Omagh.	Waterford.	Galway.
Enniskillen.	Mallow.	Castlebar.

The sittings at Mullingar, Galway, and Castlebar were held specially with a view to obtaining evidence as to the difficulties attending the production of milk in areas of the country in which dairying generally is not a prominent feature of local agricultural industry, and as to the difficulties experienced in towns situated in such areas in securing an adequate supply of milk. The three towns referred to were regarded as typical of their class.

In all, 29 sittings were held and 206 witnesses were examined. All the sittings were open to the Press and the public, and the number of letters received as a result of Press reports indicate that a wide interest has been taken in our proceedings.

SECTION I.

IS THERE A DECLINE?

Broadly speaking, the evidence submitted to us would show that during the past few years there has been a steady decline in the dairying industry throughout the country. Our conclusion in this respect is based on the following considerations:—

(a) *Evidence from Individual Milk Producers.*—Farmers engaged in dairying have been almost unanimously of opinion that milk supplies in their districts have been falling off for a number of years.

(b) *Milk Supplies to Creameries.*—We have obtained a very large amount of evidence as to the milk supplies to Irish creameries during the past few years, and almost without exception a decrease is recorded. The following summaries of returns furnished in this connection may be regarded as typical:—

	1916. (Gallons).	1917. (Gallons).	1918. (Gallons).
15 Creameries in Co. Fermanagh and adjoining counties ...	10,851,343	9,521,343	8,394,610
18 Creameries in Mid-Ulster ...	7,767,985	6,873,145	5,753,278
6 Creameries in Counties Limerick and Kerry ...	4,067,000	3,840,000	3,420,000

It has been estimated by the Secretary to the Irish Creamery Managers' Association that between the years 1915 and 1918 there was a decline in the production of milk in Munster of from 10 per cent. to 15 per cent., in Ulster and Connaught of from 35 per cent. to 40 per cent., and in Leinster of from 10 per cent. or 15 per cent. in County Kilkenny to 50 per cent. in Counties Wicklow and Wexford. These estimates are based on creamery records of the actual supplies received in each season.

(c) *Exports of Dairy Produce.*—The following table shows the quantities of dairy produce exported from Ireland during each of the years 1910-1919:—

YEAR.	Butter.	Cheese.	Condensed Milk.	Milk and Separated Milk.	Cream.	Casein and Milk Powder.
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
1910 ...	698,907	3,365	292,346	5,836	13,809	—
1911 ...	688,362	6,031	254,560	7,164	15,162	—
1912 ...	778,778	5,451	246,723	5,271	13,016	4,810
1913 ...	725,368	6,102	270,362	3,637	16,836	270
1914 ...	855,608	9,591	309,658	4,917	26,947	—
1915 ...	838,089	15,711	278,238	10,595	24,345	—
1916 ...	764,456	13,418	249,991	3,692	33,097	—
1917 ...	675,530	18,085	237,278	8,193	19,250	—
1918 ...	455,911	136,452	269,914	—	22	—
1919 ...	323,820	277,400	254,640	—	—	—

Exports reached their maximum in 1914, since which year there has been a steady decline, the figures for 1919 showing a decrease of almost 30 per cent. on those for 1914.

(d) *Census of Dairy Cattle*.—The following table shows the number of milch cows in Ireland during each year since 1910 :—

<i>Year.</i>		<i>Number of Milch Cows.</i>
1910	... ..	1,470,972
1911	... ..	1,468,545
1912	... ..	1,508,662
1913	... ..	1,533,517
1914	... ..	1,548,790
1915	... ..	1,509,723
1916	... ..	1,506,433
1917	... ..	1,504,033
1918	... ..	1,481,291
1919	... ..	1,471,240

The decrease in the number of milch cows is not serious, but it must be borne in mind that it has taken place in the face of restrictions on their export, and this would point to the fact that large numbers of milch cattle have been disposed of and that the breeding of such cattle has declined.

While the falling off in the supply of milk to creameries and the decreased export from the country of dairy produce appear to us sufficiently serious to justify the opinion that the production of milk has been for some years on the decline, it is not possible to base upon either of these factors any estimate of the extent of the shrinkage. In each case we consider that the decline has been due to some extent to the greatly increased home consumption of dairy produce occasioned by the abnormal conditions in regard to foodstuffs obtaining during the war period. Owing to the large reduction in the imports of American bacon (the principal source of cheap fat) and of winter butter into Ireland, which is practically a summer dairying country, farmers have found it cheaper to use more home produce than to buy bacon and other foods at a high price. It has, moreover, been represented to us that in many cases milk producers ceased to supply milk to creameries, manufactured butter at home, and disposed of it at prices in excess of those which the creameries were in a position to pay. It is in view of this fact, but more especially having regard to the practical impossibility of arriving at even an approximate estimate of the increase in home consumption, that we do not consider it practicable to attempt to offer an estimate of the decline in production which could be regarded as reasonably accurate.

We have, however, received no evidence which would show that there is a general shortage of milk for human consumption, and any difficulties experienced in obtaining an adequate supply in certain cities and towns throughout the country must be regarded as due to the lack of a satisfactory system of distribution.

SECTION II.

CAUSES ASSIGNED FOR THE DECLINE, AND SUGGESTIONS FOR ENCOURAGING IMPROVEMENT IN THE INDUSTRY.

The causes to which the falling off in milk production may be attributed have been of varying effect in different districts, and we do not accordingly propose to endeavour to place them in any relative order of importance. It will, we think, suffice to examine the principal factors which have contributed throughout the country as a whole to lessen the output of dairy produce.

(a) LABOUR ON DAIRY FARMS.

Evidence as to the increasing difficulty of procuring sufficient and reliable skilled labour on Irish dairy farms has been general. Milking is probably the least popular of all branches of work on the farm, involving as it does long hours, no weekly holiday, and, above all, a seven-day working week. To obtain the maximum yield of milk, cows must be milked as nearly as possible at twelve-hour

intervals, and their regular milking will permit of no break and of no dislocation. The milker must be a person possessed of a high degree of skill and of gentleness, as the milch cow is an animal which responds in an especial degree to sympathetic treatment. If both the qualities referred to are lacking in the milker there is danger of injury to the milking capacity of the cow.

While some improvement in the conditions under which work on the average dairy farm is at present carried out may be effected by economical re-arrangement of the homestead with a view to saving labour, such work must always be arduous in nature, and, accordingly, if the best and most careful class of workers is to be secured, they must be recompensed at a rate commensurate with the heavy and responsible work they are required to perform. In short, persons engaged in milking belong to a special category which requires special treatment in the matter of wages. On this class of worker depends not only the well-being of the milch cow but also the supply of the one article of food which is really indispensable. While we recognise that the difficulty of obtaining men or women who will be willing to work on seven days of the week is not always a question of the rate of wages obtaining for Sunday work, we cannot but feel that the difficulty is one which could, in many cases, be overcome by increased remuneration. We are satisfied from the evidence submitted to us by many successful farmers that dairy farming, carried out on sound economic lines, will permit of the payment of good wages, and the majority of such farmers have informed us that they have had no labour trouble whatever. We fear that in many districts there has been a tendency for the minimum wage fixed by the Agricultural Wages Board to become, in effect, the maximum wage, and where this is the case there appears to us to be little inducement, where work such as the milking of cows is involved, for the labourer to take that interest in his employer's business which is essential to its success. The fact that the employer and the labourer have an identity of interest is too frequently lost sight of. The whole question of the seven-day week is one of exceeding difficulty, and we can only suggest that if an inducement, possibly by way of bonus, in addition to the ordinary wage for Sunday work, were held out for regular attendance, complaints as to the failure of milkers to put in an appearance on Sundays would, in all probability, be much less frequent.

There is, however, a further aspect of the labour problem to which great prominence has been given in the evidence we have received. We refer to the question of strikes. There is no doubt that the fear of strikes is, to a rapidly increasing extent, inducing the larger dairy farmers either to turn to other branches of farming which are at present as remunerative as dairying and much less troublesome, or to reduce their dairy cattle to such numbers as could be looked after in an emergency by their own families. We have found this fear of strikes general throughout the dairying districts of the South, in which large dairy herds have hitherto been chiefly maintained. The following evidence from County Limerick is illustrative of the difficulties which have arisen in this connection:—

"It is, first of all, the seven-day-week work, with twelve to fourteen hours a day. They could probably get over that, but there is a new introduction which is the cause of all the trouble—that is the extension of the 'sympathetic' and the 'lightning' strike. These are the two worst features we have to deal with in the district—not the question of the amount of wages. The cost of living is striking the labourer pretty hard, too, and the farmer does not grumble so much at the wages. . . . The best dairying district in all Ireland is the West of this county (Limerick). The system there in dealing with the servant boys and girls is as follows—At the beginning of March these men and girls are hired and paid anything from £30 to £45 for a period of twelve months, and boarded and lodged on the farm. That is the usual agreement here. Coming to the 1st of August this year (1919) farm hands in the Newcastle West district struck work for a bonus of £4 harvest money. I am not saying that they were not entitled to strike, but the result was that in the event of the farmer refusing the bonus, his servants went out in the morning and there was nobody to milk the cows. Cows must be milked twice a day. Supposing his own family milked, what happened? A number of men attended the creamery and threatened the manager that if he took this farmer's milk they would call out the creamery staff. If the creamery refused his milk they might leave themselves open to an action, as some of them have an agreement that they cannot refuse a supplier's milk without sufficient cause."

Q—"Do these conditions obtain in many cases?"

A.—"I don't know whether the people would like their names published. It occurred in five places. The farmers there say that they were caught once, and, perhaps, a second time, but they would not be caught a third time. Take the case of a farmer with no trouble at all with his servants. If I have trouble with my servants, and I am only one out of a hundred and fifty suppliers to a creamery which is bound to take my milk, the staff comes out, and the other hundred and forty-nine farmers must keep their milk. That is the difficulty here."

Similar situations have arisen in other districts, and the prospect of the staff of a creamery with a large number of suppliers being called out as a protest against receiving milk from a single supplier who has had disputes with his workers is a danger which many dairy farmers are reluctant to face.

It is to be feared that in many cases the organisers of agricultural labour are men with an insufficient knowledge of the difficulties peculiar to dairy farming, and that they frequently do not understand the damage caused by leaving cows un milked. It cannot be too strongly emphasised that the care of milch cows will not permit of any cessation of work, and we are of opinion that a strike on a dairy farm can only be justified when every effort made to reach agreement has failed.

The problem of labour on dairy farms is, in this country, of the most pressing importance, as there is every reason to fear that unless a satisfactory solution is found to the difficulties which have arisen, and which we have outlined above, the number of large dairy herds in the country will be seriously reduced in the near future. The dairying industry will be stabilised and progress made only when on the one hand the labourer is satisfied with the conditions under which he has to work, and on the other the farmer has obtained security that contracts with employees will not be broken without sufficient warning and sufficient cause. We have given our most earnest consideration to this aspect of the industry, and are of opinion that the whole question of labour in relation to dairying is one which should be dealt with at a round-table conference representing the different organisations of farmers and of labourers. We have no doubt that a satisfactory settlement could be arrived at in regard to the different points at issue, and particularly those relating to Sunday work and to the provision which might be made with a view to the enforcement of agreements.

In view of the urgency of the matter, we adopted at a meeting held on the 4th February last a resolution requesting the Department to take immediate steps to arrange for a conference of this nature. We understand that a resolution on similar lines had already been adopted by the National Association of Insurance Committees (Ireland).

With regard to the question of arbitration in case of disputes, it appears to us that the recently created District Wages Committees, consisting as they do of equal numbers of employers' and labourers' representatives, with a neutral Chairman, are excellently adapted for the purpose, and we recommend that they should be empowered to act accordingly.

The Saving of Labour on the Dairy Farm.—We are satisfied that there is ample room on the majority of Irish dairy farms for improvement in the arrangement of the homestead with a view to securing the elimination of unnecessary labour in regard to such work as the handling of foodstuffs and the clearing of manure. The actual physical work could be materially reduced, for instance, if the "feed" were stored adjacent to the byre, and if manure had not to be carted a long distance to be disposed of. On small farms in particular, much could be done at little expense to reduce the laborious nature of dairy work and to render it more acceptable to the labourer. Owners of large holdings could afford with advantage to instal labour-saving devices, appliances for preparing food, etc. Elaborate byres are unnecessary and in the construction of new cow-houses simplicity should be aimed at, so that dirt could be easily seen and readily removed.

The water supply is of especial importance. At most farms water is supplied from a well, which may, in some cases, be in the farmyard, and in others a considerable distance away. From the point of view of the production of clean milk it is essential that water in adequate supply should be readily available. If water is at an inconvenient distance, such as is obtained is liable to be used over and over again for the washing of utensils, with the result that the cleanliness of the milk is adversely affected. We are of opinion that it would be to the interests of all creameries, both co-operative and proprietary, to consider the provision of facilities which would enable their suppliers to sink wells, which might be either of the open or the

artesian type, according to the nature of the soil. Once a well has been provided, a tank could be readily constructed from which water could be run to the byre, the dairy, and for household purposes. This would ensure a supply not only for the cleansing of utensils, but also for the cooling of the milk. We do not think that the importance of this matter has yet been fully realised by creameries. An ordinary creamery could obtain two or three outfits, employ a few well sinkers, and, taking the suppliers in turn, could undertake to sink wells where necessary on their farms, so that water would be readily available. The labour saved to the farmer by the adoption of a scheme of this sort would, in the case of most dairy farms, be very great, and would soon repay the outlay.

Milking Machines.—The evidence which we have been able to obtain as to the working of mechanical milkers has been insufficient to enable us to arrive at any definite conclusions as to their efficiency from the point of view of saving labour. Moreover, opinions as to their merits are very varied. We recommend that a series of comprehensive tests should be carried out by the Department with machines of different types so as to render available for the dairy farmer expert advice as to the desirability of their installation.

(b) THE DISPARITY IN THE PRICES OBTAINING DURING THE WAR PERIOD FOR BEEF AND FOR DAIRY PRODUCE.

There has been an undoubted tendency during the past few years on the part of many farmers hitherto wholly or partially engaged in dairying to abandon the production of milk in favour of the raising of dry stock. Not only has beef production during the war been exceedingly lucrative, but it has also offered to the farmer a ready solution of the important problem of labour. The evidence furnished in this connection by a County Fermanagh farmer is indicative of the growing disposition amongst dairy farmers to turn to the store cattle trade :—

“Up to the beginning of this year (1919) I kept about 15 or 16 dairy cows, but found that they had not paid during 1917 and 1918 in comparison with store cattle. The average yield was about 400 gallons—a high average for the district. The average price of the milk at the four local creameries in the two years 1917-1918 was about 9·15d. per gallon. Thus on the foregoing yield of 400 gallons the total income from a herd of 15 cows amounted to £228 15s. 0d. On the other hand, the same land carried 22 store cattle. The profit on the sale of these as 1½ year olds, after a year's feeding, was £14 each, or a total of £308, showing a balance in favour of the store cattle of about £80. The store cattle were bought in the months of March, April, and May, and were sold again about the same time in the following year. The cost of winter feeding was about the same for both the milch cows and the store cattle. As a set-off against the £80 extra from the store cattle, there was the value of the skim milk returned, which I estimated at a maximum of £4. This would just pay for the labour involved, and still left a big margin in favour of the store cattle. There was, in addition, the advantage of having no trouble in regard to labour.”

The large increase, amounting to nearly 70,000, in the exports of fat cows for the year ended 31st May, 1919, as compared with the previous twelve months, must be attributed largely to the increasing tendency to dispose of cows at an earlier age than formerly. The high price obtaining for beef would appear to have resulted in the fattening off of cows which have produced only a few calves. There is evidence to show that ten or twelve years ago cows were generally retained with calf after calf until they were six or seven years old, but that at present there may be seen passing through Irish ports as fat cattle cows of excellent quality, young animals which have in all probability produced only one or at the utmost two calves.

The Relatively Low Price of Butter.—We have had evidence in every creamery district visited as to the falling off in the manufacture of butter owing to the fact that the prices obtainable, particularly in the early stages of control, did not yield a return comparable with that derived from other farm produce.

So far as dairy produce is concerned, the following table illustrates, in columns (b) and (c), the prices which should be paid for butter and cheese respectively in

order to yield a return equal to that from whole milk for human consumption, taking the value of the milk at the prices stated in column (a) * :—

(a). Price of Whole Milk, f o r., per gal.		(b) Butter, per cwt. f.o.r.		(c). Cheese (hard) per cwt. f.o.r.	
s.	d.	s	d	s.	d.
1	0	250	0	119	0
1	1	273	0	128	6
1	2	296	0	138	0
1	3	318	0	148	0
1	4	341	0	157	0
1	5	364	0	167	0
1	6	387	0	176	0
1	7	411	0	185	6
1	8	434	0	195	0

* Assumptions :—

That one lb of butter requires 2 457 gallons of milk
 That one gallon of milk will yield 976 lb of hard cheese
 That separated milk is worth 3d per gallon for the feeding of stock
 That 80 per cent separated milk is returned to the farmer
 That whey is worth 1½d per gallon for the feeding of stock
 That 80 per cent whey is returned to the farmer
 That cost of manufacturing and packing butter is 30s per cwt.
 That cost of manufacturing and packing cheese is 16s per cwt

The price of first-grade Irish butter for the British market has never exceeded 290s. per cwt., and for the home market, 331s. 4d. per cwt., while the price of hard cheese has reached 242s. 8d. per cwt., and the price of whole milk for direct human consumption has, of course, exceeded the prices stated above.

The encouragement given to the manufacture of cheese during the period of the war on account of its food value as a substitute for meat has undoubtedly contributed to a considerable extent to preventing the decline in the dairying industry from becoming much more marked, but the general disparity in prices as indicated in the foregoing table has reacted very unfavourably on the manufacture of butter. The effects of this reaction must be seriously considered, as butter-making is a key industry, the rearing of store cattle and pigs depending largely on its bye-products, and here we consider it right to remind the public of a fact realised by some, but by no means all, that it is upon this country that Great Britain depends entirely for its supply of store cattle. The importation of such cattle from overseas is still prohibited and prohibition is likely to continue. Ireland cannot possibly maintain its supplies of store cattle unless butter-making, on which these supplies largely depend, is maintained on a paying basis. It may be added that the manufacture of butter has also a very important bearing on the development of the poultry industry.

In our opinion, the logical result of a continuation of the policy of fixing a price for butter which renders it less remunerative than other farm produce will be that so far as this country is concerned both the store cattle trade and the pig-breeding industry will be very adversely affected, and we recommend that in any steps which may in future be taken to regulate the price of foodstuffs, the prices of dairy produce should be placed on a parity and should be comparable with those of beef and of other farm produce, so that neither would the manufacture of butter be discouraged, nor dairy farmers be obliged in their own interests to abandon dairy farming in favour of some other system which would either leave them greater profit or involve less risk and labour.

(c) **DECLINE IN THE MILKING QUALITIES OF IRISH COWS.**

The majority of the witnesses examined have been of opinion that the milking capacity of Irish cows is declining, the deterioration being generally attributed to the fact that the bulls selected for premiums under the Department's Scheme for the Improvement of Cattle have been mainly of a beef-producing type. We have disregarded in this connection all evidence other than that based on actual facts elicited by cow-testing, unless witnesses were in a position to offer irrefutable evidence that the alleged decline had been demonstrated to their satisfaction. It has not been possible to obtain generally figures as to milk yields in support of the opinion, and some records have been submitted showing that it is still possible to purchase in the open market cows equal in milking quality to those obtainable so long ago as 1891. Notwithstanding this, however, there is evidence to show that such cows have latterly become more scarce. No evidence has been produced from any quarter to show that the milking qualities of the cows of the country as a whole have improved. In view of the fact that the number of cows under test in Ireland is estimated at less than 1 per cent., it may reasonably be assumed that any improvement effected either through existing cow-testing schemes or the Department's Dairy Cattle Scheme has so far been insufficient to affect the general average.

We feel that we cannot but concur in the consensus of opinion that the bulls generally selected for premium purposes, while undoubtedly improving the beef producing qualities of Irish cattle, have achieved this object at the expense of their milk yields.

The Improvement of Dairy Stock.—Success or failure in dairying must largely depend upon the quality of the stock kept for breeding purposes, and we are satisfied that there is in this country excellent material for breeding high-class dairy cows, provided sufficient care and attention be devoted to its development. Having regard to the fact that at least 90 per cent. of Irish cattle are of the Shorthorn type, we consider that improvement can better and more rapidly be effected by concentrating on the grading up of this breed, which is thoroughly acclimatised and admirably adapted to the requirements of the country as a whole, than by the introduction of any other breed.

A number of the witnesses whom we examined expressed the opinion that from the point of view of improving the milk yield of our cows the introduction of Friesian cattle and the selection of bulls of this breed for premiums under the Department's Scheme would be desirable. Recognising, as we do, that records are available showing exceedingly high milk yields from a large number of Friesian cows, we have considered the question of their introduction very carefully, and, having regard to the following considerations, do not feel that any amendment to the Department's Cattle Breeding Scheme with a view to the inclusion of Friesian bulls for premium purposes can be recommended:—

(1) While records are available showing that many British-Friesian cows are heavy milkers, there does not appear to be any evidence that the milk yield of the average herd is exceptional.

(2) Generally speaking, the milk of British-Friesian cows would appear to have a low percentage of butter-fat. This was demonstrated at the Royal Show at Cardiff in June, 1919, when of ten cows entered in the class for this breed only one cow reached the standard required to qualify for a prize. In a similar class at the Dairy Show held in London in October, 1919, only one cow from amongst five entered reached the necessary standard. It may be taken for granted that some of the best specimens of the breed were exhibited at these Shows.

If butter-making is to continue as the main object of Irish dairy farmers, the percentage of butter-fat is a very important factor.

(3) The beef and store cattle trade of this country is a very valuable asset, and, so far as we have been able to ascertain, Friesian cattle are not so good a general

purpose breed as the Shorthorn. It appears to us very doubtful whether the crossing of the two breeds would produce a type which would be acceptable either to farmers or to dealers.

We do not wish to exclude from consideration by the Department the desirability of encouraging the establishment of pure-bred herds of cattle of a milking strain, such as Friesians or Ayrshires, where a plentiful supply of milk is the main consideration. But we do not consider that, taken as a whole, either the dairying industry or the farming industry generally would be permanently benefited by the crossing of our deep-milking Shorthorns—whether pure-bred or half-bred—with a strain of cattle which might produce good milkers, but inferior stores.

In considering any scheme for improving the dairy stock of the country, the importance of the store cattle trade cannot be overlooked; the value of the store cattle exported in 1918 amounted to nearly £8,000,000. It is upon the dairying districts that the store-raising areas depend for their young stock. To maintain this important industry it is essential that there should be cows which will return a reasonable profit as dairy animals, and will also produce calves which can readily be converted into beef. We are of opinion that the ideal cow for the country would be one giving an annual yield of from 700 to 800 gallons of good quality milk, be a regular breeder, and produce good store stock, and we consider that efforts in the direction of the improvement of our dairy cattle should aim at the production of an animal of this type. We are aware that there are in the country many Shorthorn cows giving an average annual yield of over 1,000 gallons, but the expert evidence we have heard would show that an abnormal yield of milk is likely to be produced at the expense of the animal's constitution.

The improvement of dairy cattle can be effected only by testing and selecting the best milkers, and mating them with bulls of their own type, showing several crosses of a milking ancestry on both the male and female sides. It is of importance to emphasise the fact that a pure-bred animal is more likely to perpetuate milking qualities than a cross-bred. The present inadequate supply of pure-bred dairy bulls is the chief obstacle to the development of the dairy stock of the country. The number of bulls standing for service under the Department's Scheme in 1919 was 651, of which only 79 were pure-bred animals with milking pedigrees. We have been glad to learn, however, that there appears to be amongst farmers a growing appreciation of the merits of dairy bulls, and that the demand for them is rapidly increasing, and we consider it accordingly of the utmost importance that the Department should take all possible steps to arrange for a satisfactory supply. This may be done in the following ways:—

(1) By the encouragement of the production of pure-bred dairy cattle by private breeders, by (a) supplying them with high-class stock bulls of milking strain at a nominal sum for hire; (b) extending the Department's Loan Scheme so as to afford reasonable credit facilities to small breeders who desire to purchase pure-bred high-class dairy stock (both bulls and cows); (c) by increasing to £30 the premium for bulls with milk records on both the male and female sides of their ancestry. In this connection we recommend also that the Department's Cattle Breeding Scheme should be amended so as to permit of such bulls standing for service under the Scheme for a longer period than five years, provided there is evidence that their service condition is sound. Under the Scheme as it at present stands, dairy bulls are disposed of before the milk yields of their first-calf heifers are available, and before anything is known as to their value as producers of good stock.

(2) By the establishment by the Department at their own farms of herds of pure-bred dairy Shorthorn cattle. These herds would be centres from which both bulls and surplus females would be available for distribution.

In view of the great importance of the dairying industry, we consider it absolutely essential that the Department should take a large part in the breeding of pure-bred dairy stock, to be used for raising the general standard of the dairy cattle of the country.

Prizes for Dairy Cattle.—We recommend that the Department should give grants to the principal agricultural societies to enable them to provide substantial prizes for pure-bred dairy Shorthorn cattle, both male and female.

In adjudicating in classes for such cattle, the milk records of the animals, or of their ancestors, should be given relatively more importance than shape or appearance.

The Disposal of Dairy Bulls at Shows and Sales.—It has been represented to us that under the existing arrangements at the various Shows and Sales at which bulls are approved for premium purposes, the animals are sold in the order in which they are catalogued, with the frequent result that applicants selected under county live-stock schemes to hold pure-bred dairy bulls have preferred to purchase animals not of milking strain, in the fear that dairy bulls which might be sold later would reach prices beyond their means, and that they would accordingly be forced to go without a bull. We would suggest that the Department should approach the societies and firms responsible for these sales, with a view to arranging that in all cases dairy bulls should be put up for auction before other animals, so that persons desiring to obtain one of these bulls would be afforded an opportunity of bidding, with the practical certainty, if unsuccessful, of being able to acquire in the last resort one of the ordinary type.

The Licensing of Bulls.—We have received a great deal of evidence as to the general use throughout the country of "scrub" bulls, and as to their very injurious effect on the milking as well as the beef-producing qualities of Irish cattle. It is obvious that the use of such bulls must nullify to a considerable extent any schemes for the improvement of cattle which may be in operation, and we consider that their use should be prohibited. We recommend, accordingly, that only those bulls which conform to a definite standard of quality should be approved for service, and that the Department should take steps to obtain the necessary powers in this connection, and to put into force as soon as practicable a measure for the licensing of bulls.

Kerry Cattle.—While of opinion that the milking strain of Shorthorn is the type most suited from a dairying point of view to the country as a whole, we think it is to be regretted that there is not a more general appreciation of the merits of the Kerry breed, and of their exceptional suitability for mountainous districts. Kerry cattle will thrive well where a larger breed could not be kept, and in the poorer districts every encouragement should be given to their breeding. We have also had evidence to show that the Shorthorn-Kerry cross is a satisfactory beef animal.

The following particulars of yields of milch cows entered on the Kerry Cattle Register have been furnished to us as giving an indication of the milking qualities of the breed; in all, eleven herds, with a total of 92 cows, were under test:—

- 12 cows gave over 700 gallons.
- 23 cows gave between 600 gallons and 700 gallons.
- 43 cows gave between 500 gallons and 600 gallons.
- 14 cows gave between 450 gallons and 500 gallons.

The majority of these fourteen were heifers in their first period of lactation.

The highest yield was 855 gallons of milk.

As compared with other breeds, the butter-fat percentages were remarkably high. Eight cows gave over 5 per cent. butter-fat; sixty-two cows yielded milk containing between 4 per cent. and 5 per cent. butter-fat; and of the ninety-two cows whose records are published only two gave under 3.5 per cent. butter-fat.

No breed other than the Kerry is kept by small holders throughout the whole of the mountainous districts of County Kerry and in the Berehaven district of County Cork, and the breed is general amongst cottiers in Counties Limerick, Cork, and Tipperary. We recognise, however, that much as the keeping of these cattle would appear desirable in many districts of the West, where milk is scarce, the demand in these districts is rather for beef-producing animals of the Galloway type, and in the circumstances any effort to introduce Kerry cattle would meet with little or no support, unless and until their undoubted qualities as milk producers are better known and appreciated.

The Keeping of Milk Records.—It is estimated that the average milk yield of Irish cows is at present little over 400 gallons annually, and as we have received evidence to show that there are many cows giving an annual yield of from 600 to 1,200 gallons, it is clear that a large number must give yields of less than 400 gallons each. A cow giving such a low yield can hardly be kept by a dairy farmer, except at a loss. As one witness stated, "there are far too many cases of the farmer keeping the cows instead of the cows keeping the farmer!" We are satisfied, however, that many farmers do not know which of their cows are, from the milk-producing point of view, the good ones and which the bad, and the only way in which they can learn with certainty which of their cows are profitable is by the systematic keeping of records of their yields.

Having regard to the milch cow population of the country, and taking milk at the comparatively low price of 10*d.* a gallon, an increase in the average milk yield per cow of 200 gallons, which all expert witnesses have agreed would be attainable with the general adoption of cow-testing, coupled with breeding from suitable bulls, would represent an additional annual sum of approximately £12,000,000 to the wealth of the country, and would, moreover, be the most certain method of reducing the cost of milk. In herds in Canada in which records have been systematically kept, the average annual milk yield per cow has been increased by 245 gallons, and in Sweden the yield has been increased by 200 gallons. The possibility of improvement in this country is even more promising, in view of the fact that both its climate and soil render it particularly adaptable for dairying. The practice of keeping milk records must, accordingly, be regarded as a work of national importance, and as experience has shown that in the formation of cow-testing associations, which form the best means of developing the system, local organised effort is not always forthcoming, the provision of ample State assistance with a view to its extension is both justifiable and desirable.

While we do not think it necessary to advert at length to the value of cow-testing, we think the following table, which shows the difference between the average yields, &c., in 1918 of the ten best and of the ten worst cows in each of six cow-testing associations in various parts of the country, worthy of record:—

No	Cows.	Average number of days in milk	Average quantity of milk produced.	Average butter-fat test	Average yield of butter fat.	*Average value of milk per cow	Average difference in favour of each of the ten best cows
		Days.	lb.	%	lb.	£ s. d	£ s. d
1	Best ten ...	306	8,744	4.24	396 00	45 5 0	31 19 4
	Worst ten .	189	2,769	4.16	115 00	13 5 8	
2	Best ten ...	286	8,455	3.88	329 43	38 8 0	30 13 4
	Worst ten ..	137	2,026	3.13	64 30	7 14 8	
3	Best ten ..	273	8,557	3.60	320 11	37 10 8	29 0 8
	Worst ten ..	161	2,100	3.40	71 49	8 10 0	
4	Best ten ...	280	8,796	3.70	321 90	37 17 2	27 2 4
	Worst ten ...	196	2,566	3.50	90.83	10 14 10	
5	Best ten ...	291	8,289	3.67	307 68	36 2 4	24 5 4
	Worst ten ...	203	2,868	3.40	100 02	11 17 0	
6	Best ten ...	294	8,053	3.68	297 32	34 18 8	22 4 6
	Worst ten ...	203	3,179	3.30	106 58	12 14 2	

* The value of milk is calculated at 2s. per lb. of butter-fat and 2*d.* per gallon of separated milk (80 per cent of whole milk) These prices are very much below the present values, but serve for the purpose of comparison

An examination of the circumstances which would appear to have hindered the more general adoption of the keeping of milk records by farmers in Ireland would seem desirable. It appears to us that the propaganda work which has

hitherto been carried out by the Department has not been sufficient to bring home to farmers the advantages to be derived from cow-testing, and that the majority have not yet realised its great possibilities. In this connection we welcome the energetic and practical steps which the Department are now taking to bring its importance before them. It is difficult to convince most farmers that good milking cattle cannot be judged by appearance, and that the yield of a cow cannot be ascertained without testing for a full lactation period. Generally speaking, they appear content so long as they are satisfied that their herds as a whole are paying. Instances in which the work has been taken up and subsequently discontinued would seem to be due in some measure to the fact that the benefits are not immediate, and that owing to the difficulty of replacing bad cows by good ones it may be necessary to wait for four or five years for results; but we fear that the chief reason in most cases has been, as many farmers examined admitted, that the work of weighing and sampling the milk was regarded as "too much trouble." Such farmers have, however, invariably also admitted that their action has been short-sighted. We have been glad to learn that in a number of districts where cow-testing associations have fallen through, there are farmers who still continue the practice of milk recording for the information it affords, and also that a number of these associations have been revived, while a considerable number of new ones are being formed.

It has been stated in evidence that some farmers have objected to joining cow-testing associations on account of the small contribution (one shilling) required in respect of each cow. We believe that such cases are very exceptional, and have, in fact, been informed that in some associations members are now paying as much as six shillings per cow. We consider some payment by members of associations to be essential, as experience shows that they will undoubtedly take a greater interest in work towards the cost of which they have themselves contributed.

The following is a brief outline of the two classes of cow-testing associations at present recognised under the Department's Scheme :—

Class A, in which it is required that milk records shall be kept in respect of at least 100 cows throughout the entire milking period, each member undertaking to weigh and take samples of the milk of each of his cows on every seventh day, the weights being duly recorded, and the samples submitted for testing.

Class B, in which each association must have a minimum of 200 cows on test, the members as in the case of the Class A association weighing and recording the milk yields on every seventh day. In this class of association the services of a whole-time supervisor are available. This officer visits each member's herd at least once a month, checking the weighings and sampling the milk of the cows.

There appears to be no doubt that, provided funds are available for their development, associations of the Class B type are more likely to be widely adopted than those of the nature of Class A. The independent check on the yields and quality of the milk exercised by the supervisor are generally regarded as adding to the reliability of the farmer's records, and accordingly as being of special value in cases where bull calves are available for disposal.

From the evidence received it would appear that the difficulty in establishing cow-testing associations in districts where the farms are small, and the number of cows kept by individual farmers rarely averages more than three or four, has been in large measure due to the fact that it is almost impossible to get together the minimum number of cows required before an association will be recognised for a grant. We think that in this respect the Department's Scheme is not sufficiently elastic, and suggest that the Department should consider the advisability of amending it so as to admit in special circumstances of the recognition, in so far at least as Class A associations are concerned, of those in which less than the minimum number of cows at present prescribed has been secured.

As already stated, however, from the point of view of the extension of cow-testing, we consider that associations of the Class B type are to be preferred, and we recommend that the efforts of the Department should be mainly directed towards the establishment of associations of this class. Successful development must depend

largely upon the possibility of obtaining suitable supervisors, and it is in this respect that difficulty at present exists. A supervisor must be a man of character, in whom members will have absolute confidence, and who can be relied upon not to be influenced in the carrying out of his duties by interested persons. If enthusiastic and energetic supervisors are available, the growth of cow-testing associations will, in our judgment, be assured. The question is almost entirely one of finance, as if the right type of men are to be secured they must be adequately remunerated. In an association with 200 cows, the supervisor's salary at present would be about £30 per annum, the members contributing at the rate of one shilling, and the Department at the rate of two shillings per cow. In cases where the members are willing to contribute two shillings we understand that the Department will increase their grant to three shillings per cow. This rate of pay appears to us to be hopelessly inadequate, having regard to the great importance of the work, and we strongly recommend that the Department should be provided with funds sufficient to enable them to adjust their grants on a basis which will ensure that no supervisor shall receive a salary of less than £150 per annum. It is essential that supervisors should be paid at a rate which will attract a good type of man.

Cow-testing Associations in relation to Creameries.—In the early days of cow-testing in Ireland, an association was usually formed in connection with a creamery, the manager of which acted as secretary and tester. For various reasons, however, creameries gradually gave up the work. For example, once an association had got into working order there arose the necessity for constant supervision of the member's work, with insistence on the need for accurate and regular weighing and sampling of the milk of each cow, and for the general education of every member from the results of the testing carried out in his own herd, not only in regard to breeding, but also in regard to economical feeding and general management. A creamery manager could not, as a rule, afford the necessary time for these important duties, and in any event his remuneration—two pence for each test—was altogether insufficient to encourage him to continue the work.

We are, nevertheless, of opinion that cow-testing can the more rapidly be extended if the co-operation of the creameries can again be secured, under conditions satisfactory to them and their managers. We understand that the Department have under consideration the amendment of their existing scheme with this object in view. A creamery, whether proprietary or co-operative, is, to all intents and purposes, an association of cow-keepers, and the creamery manager is in daily touch with the individual milk producer, being accordingly in a position to explain to him the advantages of testing his cows in a manner which is more likely to be effective than education by means of leaflets or the Press. There is, moreover, already available at the creamery all the apparatus necessary for the carrying out of the work. The creamery itself stands to benefit considerably, as an increased local supply of milk means a larger turnover, with a corresponding decrease in working expenses.

Necessity for Dairy Bulls in conjunction with Associations.—If cow-testing associations are to attain their maximum value it is essential that there should be available for the use of the members pure-bred bulls of milking strain. If these are not forthcoming there is every probability that the work of grading up the cattle will be seriously handicapped. This may be illustrated by the following extract from the evidence of a Tipperary farmer :—

“ I have been a member of a cow-testing association since 1908. I bought three premium Shorthorn bulls, of which only one could be considered reasonably satisfactory. They were not of a milking strain. With the exception of one of these bulls, which was a good dual-purpose animal, their progeny reduced the quality of my herd after eleven years' cow-testing, although I bred only from my best cows ”

We recommend that the Department should provide special credit or other facilities to associations to enable them to acquire bulls of milking type, and would suggest that where associations are working in connection with creameries it would be to the advantage of the latter to contribute towards the cost of suitable sires. Some, indeed, have already done so.

The Compulsory Keeping of Milk Records.—Very many witnesses have expressed the view that the keeping of milk records should be compulsory. We do not, however, consider that any efforts at compulsion in this direction are desirable, and, moreover, do not think that any satisfactory method of administering an Order issued in this connection could be devised. We prefer that education and propaganda should be relied upon to bring about the desired result.

Necessity for Increased State Aid for the Improvement of Dairy Stock.—We are of opinion that the funds available for the Department's Dairy Cattle Schemes are altogether inadequate, and strongly recommend that the allocations under this head should be very considerably increased, so as to permit of the development of the schemes on the lines we have indicated. Provision should also be made for the appointment of additional officers, as it would appear that the existing staff could not cope with any substantial increase or new development in the work.

Injudicious Disposal of Good Cows.—No suggestions as to possible methods of improving the dairy stock of the country would be complete without a reference to the regrettable practice, which is far too prevalent, of selling off the best cows on account of their present enhanced price. Such cows are generally shipped out of the country, or disposed of to town dairymen, by whom they are sold fat after a single milking period, while second and third-rate heifers are retained to form the basis of future herds. It is a sacrifice of a potential milk supply to fatten off a good cow which is still in her prime, and the practice cannot be too strongly condemned. Even where the farmers retain their best milkers there is a tendency to sell the foundation stock, and this is especially to be deprecated on account of the increasing difficulty of purchasing good cows. It is to be hoped that with the development of cow-testing the practice will rapidly disappear. We have, in fact, been informed that in districts where testing is at present carried out farmers are not now so ready to dispose of their good cows as they have been in the past.

Necessity for a Better Distribution of Dates of Calving.—Practical experience has amply demonstrated the fact that cows calving in the autumn will give a greater yield of milk than if they had calved in the spring, and that their calves are more easily reared, and develop into better animals than those born in the latter season. There is evidence to show that 70 per cent. of Irish calves are born in the months of March, April, and May, and this is a factor which is accountable to no small extent for the shortage of milk in the winter months, particularly in December and January. It is very desirable that, both in their own and the public interest, dairy farmers who produce milk for town supply should effect such re-arrangement of their herds as would ensure that a proportion of their cows would calve in the autumn or early winter months.

(d) **THE SHORTAGE OF IMPORTED FEEDING STUFFS, AND OF FERTILISERS FOR PASTURES.**

As a result of the abnormal conditions obtaining during the past few years, cake and other feeding stuffs have been both scarce and dear. The following table shows the quantities of the feeding stuffs most generally used in Ireland imported into the country for each year since 1913:

YEAR	Linseed Cake	Cotton- seed Cake.	Oilcake (Unclass- fied)...	Bran and Pollard.	Maize.	Total.
	(Tons).	(Tons).	(Tons).	(Tons).	(Tons).	(Tons).
1913	27,930	20,538	13,967	58,174	744,009	869,618
1914	27,166	15,796	20,125	67,334	656,407	786,828
1915	25,183	17,504	20,053	67,209	685,955	815,904
1916	22,046	17,501	17,454	54,392	509,816	621,209
1917	18,143	7,666	12,490	45,265	371,182	454,746
1918	12,824	2,192	5,788	2,124	107,747	130,675
1919	26,701	8,005	12,890	17,651	231,963	297,210

The effects of this shortage have, we think, been somewhat exaggerated, but at the same time it has been an undoubted factor in the falling off in milk production during the period of the war; and its effects have, of course, been most marked in those districts where winter dairying is carried out, particularly where the farms are small, and the proportion of purchased foodstuffs relatively high.

We have occasionally found the impression existing that the position of Ireland during these years in regard to the supply of imported feeding stuffs has been unfavourable as contrasted with that of Great Britain. From the evidence submitted to us, however, we are satisfied that this is not and has not been the case. The Department, who have been represented on the administrative committees concerned with the distribution of these feeding stuffs in the United Kingdom, appear to have been most successful in securing for this country its fair proportion of the supplies available. The demand for all feeding stuffs has, of course, been checked by their high prices.

As to the present position regarding feeding stuffs, statistics show that during the three months August to October, 1919, the imports of cotton, linseed, and other cakes were on a level with the imports during the same period of 1913, and it may be taken that there is now in the country as much decorticated cotton cake as is required. The supply of linseed is still short, but palm nut cake is available in reasonable quantity. Maize, of which the supply has hitherto been exceptionally small, is now available in more ample quantity.

We think it well to add that farmers do not yet appear to recognise the value for feeding purposes of some of the more recently introduced foods, such as dried grains, dried yeast, palm nut cake, and cocoa-nut cake. These foodstuffs are relatively much cheaper and better than many of those commonly used, notwithstanding which considerable quantities of dried grains and dried yeast are being exported owing to insufficient home demand.

Necessity for Increased Home Production of Foodstuffs.—The only remedy for the decreased milk yields due to the scarcity of imported feeding stuffs lies in the increased home production of roots, grain crops, and forage crops. This would ensure a regular supply of food for cattle at all seasons, and help to prevent a falling off in milk yields during periods of scarcity, *i.e.*, in winter and in dry summers. Practically everything necessary to keep up a good milk supply can be grown on the farm, and where a proper system of tillage is carried out the quantity of cattle food to be purchased is small. There is no better food for dairy cattle than home-grown crushed oats, turnips and hay, and we regret to have received evidence to the effect that there has been a demand from some Irish dairying districts for an outlet for oats, and also that the ready market and remunerative prices prevailing for roots and grain have, in many cases, led to farmers disposing of even such supplies as were necessary to ensure that their cows would milk to their maximum capacity. It would appear from this that the fact that the good wintering of cattle means a substantial increase in their milk yields in the following season is not yet sufficiently widely appreciated, and requires to be brought home to many dairy farmers.

Ensilage.—The system of ensilage is one which we think might be more generally encouraged. Silage is a useful and economical food for cattle, being especially suitable for the winter feeding of milch cows. In districts where for any reason, such as scarcity of labour or the unsuitability of the land, root crops cannot be produced, the growing and conversion of such crops as vetches, oats, peas, &c., into silage is to be recommended. Where there is difficulty in making first-class hay, the grass, if converted into silage, will have a higher feeding value than badly-made hay, but silage of this nature is not so good as that made from fodder crops.

We recommend that a comprehensive series of experiments should be carried out by the Department with a view to ascertaining the relative merits and economic possibilities of silage as compared with other cattle foods.

Effect of the Tillage Orders.—It has been represented to us that the Tillage Orders have adversely affected the production of milk, owing partly to the fact

that the breaking up of fresh land lessened the amount of labour available for looking after cows, and partly to the fact that a reduction in the number of cows occasionally became necessary on large farms where there had not previously been much tillage, owing to the difficulty of procuring feeding stuffs. We recognise that the smaller farmer has generally had a certain amount of home-grown cattle food available, and that where there was little but grass to fall back upon the breaking up of a certain amount of pasture may, in some cases, have resulted in the disposal of cattle. Experience, however, would show that in such cases in the following season the stock-carrying capacity of the farms should be substantially increased. In this connection, it is worthy of note that the total number of cattle in the country on 1st June, 1919, was 5,029,450, the highest figure yet recorded, except that for 1914, when, owing to restrictions on export in consequence of foot-and-mouth disease, the cattle population was abnormally large.

Deterioration of Pastures owing to Lack of Basic Slag.—We have received a great deal of evidence as to the effects of the shortage of basic slag on pasture land throughout the country. Slag is the fertiliser most generally used in Ireland for this class of land.

As in the case of feeding stuffs, every effort appears to have been made by the Department to obtain for the country its fair proportion of the supplies of slag and other fertilisers available. Officers were stationed in London, Liverpool, Middlesborough (the centre from which, in previous years, the largest supplies of basic slag were obtained) and Wales. The following figures as to the imports of slag during each year since 1913 show that the efforts made in this connection must be regarded as having borne as satisfactory results as have been in all the circumstances possible, and that during these years supplies were up to pre-war level :—

			<i>Tons.</i>
1913	...	...	33,474
1914	...	...	37,868
1915	...	...	30,861
1916	...	...	29,767
1917	...	...	46,191
1918	...	...	58,493
1919	...	...	48,772

Owing, however, to the increased demand by all classes of farmers for this fertiliser on account of the shortage of other manures, the quantity available for pasture lands has considerably diminished, with the result that the capacity of such lands for carrying stock has been impaired. It is in the improvement of the stock-carrying capacity of the land, rather than in its effect on the actual milk yields of the cattle, that the manuring of pastures is of advantage.

During the past year the position in regard to basic slag has not been so satisfactory, but at the same time it may be assumed that supplies in this country are at least as good as in any other part of the United Kingdom. Hitherto, most of the slag imported has been of high grade, but alterations in the process of manufacture of steel, of which slag is a by-product, will necessitate farmers being prepared in future to accept slag of a lower grade. The new process enables manufacturers to produce steel at a reduced cost, but at the same time the quality of the slag is lowered. Farmers will accordingly in future be obliged to use larger quantities of this fertiliser than has hitherto been necessary to obtain the same results, and generally speaking they will not receive the same value as heretofore.

The price of basic slag to Irish buyers has also increased during the past year. This has been due to the fact that in the endeavour to secure better supplies of high grade slag it was pointed out to manufacturers that the effect of the high transit charges to this country would be to increase the cost of low-grade slag, even although the initial price was less, up to seven shillings per unit of phosphates, whilst reducing the total cost, in the case of the high-grade commodity, down to four shillings per unit. Under the arrangements existing in 1918, slag was delivered f.o.b. at Irish ports. During the past year, however, it has been delivered free only at the English ports, and Irish buyers have had to pay for its transit across Channel. Together

with the cost of handling at the ports in this country, this has meant an addition of roughly thirty-five to thirty-eight shillings per ton, all of which has, of course, increased the price of the slag to the farmer.

As regards superphosphate, which is also of especial value to dairy farmers, the position cannot be regarded as very satisfactory. Most of the supply of this fertiliser required to meet Irish needs is manufactured in the country, but is dependent on shipping facilities for the raw material from Florida and from North Africa. The tonnage available has unfortunately not been adequate, and supplies of this material have in consequence been short. As a result of representations made some months ago to the Controller of Shipping, a proportion of cargo space, which had previously been requisitioned for other purposes, was allotted for the carriage of rock phosphates, and more satisfactory supplies have since become available. The demand is still greatly in excess of the supply, but it is hoped that additional transport facilities will be forthcoming in the near future.

(e) **EFFECT OF THE RESTRICTIONS ON THE EXPORT OF FEMALE CATTLE.**

A good deal of prominence has been given in the evidence we have received as to the effect on the production of milch cattle of the Orders issued during the war period regulating the export of springers and of milch cows.

The Order, which is still in force, prohibiting the export of springers, was issued in 1914 with a view to safeguarding against a dearth of good calves owing to the increasing export from the country of its best cows. As a result of the Order, on its first issue, many farmers in dairying districts who had been accustomed to produce a certain proportion of in-calf heifers for shipment were obliged to retain such animals as they had on hand, a proceeding for which in most cases they would not appear to have been prepared. Facilities for treating the cattle on calving and for milking were frequently absent, and the prices obtainable in the home market were low in comparison with the prices of beef animals. As a result, the majority were fattened off and sold for slaughter, and it is to be feared that many of those retained deteriorated in value on account of inadequate milking. Owing to the absence of a market for superfluous animals at satisfactory prices, many dairy herds would appear to have been reduced, and the stock from which heifers were bred disposed of. The result of the Order would generally seem to have been that breeders to some extent gave up the practice of putting heifers to the bull.

Notwithstanding the restrictions imposed from time to time on the export of milch cows, the number of such cattle in the country has declined, while, as has been already pointed out, there has been a marked increase in the number of fat cows exported.

The restrictions on the slaughter of immature female cattle were undoubtedly desirable and necessary, but it is very doubtful whether the prohibition of the export of in-calf heifers has achieved the purpose for which it was intended. On the contrary, the effect of the Order appears to have been to discourage the retention of such animals throughout the country. It must be remembered that the owners of heifers had open to them a very remunerative market in the fat stock trade, and, as a result of the Order, many heifers which might have been kept for dairy purposes found their way to the abattoir.

The balance of evidence goes to show that this Order has tended to discourage the breeding of dairy stock, and we recommend, accordingly, that it should be rescinded.

(f) **CONTAGIOUS ABORTION.**

In almost every district visited we have received evidence as to the very general prevalence of contagious abortion, and its effects in dairy herds. It appears to us that sufficient attention has not yet been given to investigation into the causes and treatment of this disease, and accordingly we recommend that the Department should take steps to institute in this connection a thorough system of research with

a view to discovering means of combating the disease which will be more effective than those at present available. Interesting evidence has been furnished to us regarding inoculation experiments carried out since 1916 by Mr. J. F. Healy, M.R.C.V.S., of Midleton, County Cork, under arrangements made by the Governors of the Munster Dairy School and Technical Institute, and while these experiments would appear to have been on the right lines, they have been too limited in extent to provide a basis upon which reliable conclusions in regard to the disease might be founded.

From the evidence we have heard, stock raisers do not generally appear to be aware that the Department will supply, free of charge, vaccine for the preventive treatment of cows by qualified veterinary surgeons; neither does it appear that farmers have been made sufficiently aware that facilities are afforded for the treatment of animals suffering from the disease. More effective steps should be taken to make these facts more widely known.

We have given our serious consideration to the suggestion put forward by many witnesses that contagious abortion should be scheduled as a notifiable disease, and while we recognise that there are many difficulties in the way of enforcing an Order issued to this end, amongst them the general lack of knowledge regarding the disease, and the obscurity of its symptoms, we consider the present unrestricted movement of infected cattle very undesirable, and that such an Order would help considerably in the direction of combating the ravages of the disease. We recommend, accordingly, that notification of the suspected existence of contagious abortion should be compulsory. At the same time, every effort must be made to educate public opinion as to the necessity for stringent regulations in regard to the disease.

SECTION III.

MILK SUPPLY TO CITIES AND TOWNS.

Notwithstanding the general impression which appears to prevail that there is a shortage of milk for consumption in cities and urban areas throughout the country, we have been unable, as has already been indicated, to obtain any evidence which would show that any such shortage exists, and we consider, accordingly, that in those towns where there is a scarcity the absence of any properly organised system of distribution must be regarded as the prime cause. So far as the large centres of population are concerned, we have received evidence which would show that the supply is sufficient to meet requirements. For instance, both the Medical Superintendent Officer of Health and the Chairman of the Public Health Committee for Belfast have expressed the opinion that the city's supply of milk is adequate, while we are aware that in Dublin a large quantity of milk, primarily intended for human consumption, is being churned daily on account of insufficient demand. It must, accordingly, be concluded that the consumption of milk in such centres is at present regulated rather by its price than by an inadequacy of supply. We have, moreover, had evidence to show that the practice of purchasing condensed milk on the part of the poor is on the increase, notwithstanding a growing appreciation of the value of whole milk as a food.

There are at present two sources of supply to large towns, *i.e.*, the milk produced by town dairymen, and that received from rural producers, and a consideration of each of these sources is necessary.

Town Milk Production.—This system is, in our opinion, entirely uneconomic. The town dairyman owns no land, breeds no milch cattle, and produces no feeding stuffs. He must purchase in the open market, frequently at inflated prices, everything necessary for the carrying on of his business, and must compete with graziers and others for pasturage in the neighbourhood of the town, for which in recent years he has as a rule had to pay an excessive rent. The result is that to allow of an adequate return for milk produced under such conditions, the price charged must be altogether out of proportion to that at which milk produced by the dairy farmer could be retailed. The prevailing system of distribution tends still further to increase the price. It is common to see four or five different

distributors delivering milk at as many adjacent houses. In the circumstances, the present high prices of milk in Dublin and Belfast can be regarded only as a subsidy to uneconomic production and distribution, and we have found that they have led to a tendency to increase prices throughout the country. In Omagh, for instance, up to 10d. a quart was charged for milk by local producers until a control price of 8d. was fixed. Moreover, the usual result of a system of control is that the maximum price fixed becomes in practice the minimum, and both in Dublin and Belfast milk brought by rail and purchased at a relatively low cost is widely retailed at the price fixed to meet the demands of the town producer. For example, we found that milk for which the rural producer received 1s. a gallon, delivered f. o. r. at Belfast, was sold during last summer at 2s. 4d., thus allowing to the retailer a margin of 1s. 4d. per gallon, which no system of distribution, however uneconomic, could justify.

Probably, however, the most serious effect of the town dairying system, from a national point of view, is that it results in the depletion of the best dairy stock of the country. The town dairyman pays a high price and purchases the best milch cows available. Owing to the absence of facilities for retaining animals not in milk, such cows are disposed of after a single period of lactation, the vast majority being sold fat and slaughtered for beef. We have had evidence from every part of the country as to the increasing difficulty of obtaining good cows largely as a result of this practice, and if for no other reason the system of town dairying must be condemned.

Milk Supplies from Rural Districts.—The following table shows the annual quantities of milk received by rail at Dublin, Belfast, and Cork for approximately the past two years:—

Twelve Months.	Dublin.	Belfast	Cork	Total
	<i>Gallons.</i>	<i>Gallons</i>	<i>Gallons.</i>	<i>Gallons</i>
Ended 4th January, 1919 ...	1,755,473	1,350,422	556,575	3,662,470
Ended 5th April, 1919 ...	1,809,417	1,448,666	545,293	3,803,376
Ended 5th July, 1919 ...	1,847,520	1,515,743	525,209	3,888,472
Ended 6th September, 1919 ...	1,841,728	1,535,604	485,154	3,862,486
Ended 6th December, 1919 ..	1,770,859	1,487,444	458,258	3,716,261
Ended 3rd January, 1920 ...	1,742,862	1,479,520	448,802	3,671,184

It will be observed from these figures that a substantial amount of the milk consumed in these cities is produced in rural districts, and as such milk could undoubtedly be sold at a lower price than can that produced under town conditions, we are of opinion, in view of the urgent necessity for reducing the present prices so as to bring an adequate supply of milk within the reach of the poorest families, that every effort should be made to secure that the whole supply necessary for towns should be obtained from rural sources. We have had expert evidence to show that clean, cooled milk can be sent by rail from any part of this country to any other part, without pasteurisation, even in the hottest weather, in perfect condition for human consumption.

The Transit of Milk by Rail.—The most general complaint received from producers who send milk by rail has been with reference to the loss of cans. It has been suggested that with a view to obviating such losses the Railway Companies should charge for and waybill empty cans, thus undertaking responsibility for their satisfactory return to the senders. In this connection we have been informed by Mr. E. A. Neale, General Manager of the Great Southern and Western Railway, that a large milk purchasing firm had stated that a charge of even 2d. on each can would amount, in the year, to considerably more than the value of the cans lost, and that such an arrangement would not pay them. This has been borne out by other evidence received.

The chief causes of lost cans may be summarised as follows:—

- (1). They are not always properly labelled, the labels being frequently of a kind (*i.e.*, scraps of paper or cardboard) which will not stand handling.
- (2). The lids are often not firmly secured.
- (3). Empty cans are, occasionally, sent to a station other than that of their owner, showing that the consignees sometimes used the cans for other persons'

milk. Cans which, owing to this practice, get off their normal track are easily lost or stolen.

Mr. Neale stated that of 35 cans examined at Kingsbridge Terminus, 5 had loose lids, which would fall off if the cans were placed on their sides, and 4 had labels of ordinary paper. Of another batch of 21 cans, 4 had loose lids and 4 had no labels. The name of the originating station had, at one time, been painted on these cans, but this had been almost completely obliterated. It may be assumed that these were typical consignments.

The only remedy we can suggest with a view to reducing losses of cans to a minimum is that they should be marked in a permanent and easily discernible manner with a brass plate, bearing the name of the owner and of the originating station. This would help considerably to ensure that empty cans would not be returned to stations other than those of their owners. We consider rigorous insistence by the railway companies on the proper labelling of cans desirable.

It has been represented to us that the arrangements at many railway stations for the handling of cans are very unsatisfactory, and we think it essential that there should be provided, at all stations at which milk is received, adequate cool storage accommodation, where cans would be protected from dust and dirt, and from the sun, pending their being taken over by the consignees. We cannot but think that complaints as to the rapid souring of milk brought by rail are, to a large extent, due to the fact that the cans are frequently allowed to stand in the sun at railway stations without protection of any sort.

With regard to suggestions which have been made as to the provision of refrigerated vans, we fear that apart from any other consideration the cost of ice in this country would preclude their adoption. We think, however, that there is room for considerable improvement in the type of van at present employed for the transit of milk. In this connection, we understand that the subject of refrigerator vans is engaging the attention of a sub-committee of the Engineering Committee of the Investigation Board appointed by the Committee of the Privy Council for Scientific and Industrial Research.

Town Distribution.—To prevent the possibility of the overlapping of deliveries, which at present helps to render milk so costly, we are of opinion that town distribution should be on the lines adopted by the postal authorities in regard to the delivery of letters. This would render necessary in every town a central receiving depot, where the milk could be tested, and from which a district scheme of distribution could be organised. In the case of large towns a number of auxiliary depots would probably be required. Having regard to the fundamental importance from the point of view of the public health of a pure and adequate milk supply, we are strongly of the opinion that the provision of such a supply should not be a matter for private enterprise alone, and we consider that the time has come when municipal and urban authorities should be empowered to undertake this work, thus enabling a better supply of milk to be secured at a reasonable price. We understand that it is proposed to amend the Milk and Dairies (Consolidation) Act, 1915, so as to confer upon local authorities in England and Wales power to undertake the supply and sale of milk, and to provide the necessary buildings, plant, and machinery for handling, treatment, and distribution, and we recommend that similar powers should be conferred upon local authorities in this country. It is largely by the elimination of unnecessary distributive services that the price of milk to the consumer can be reduced. Of the alternative methods of securing such elimination, one, a combination of retailers and the pooling of their supplies, might tend to the creation of a monopoly and subsequently to the exploitation of the public, and the other, co-operation amongst bodies of consumers with a view to obtaining contracts for supply at a reasonable price, is not at present practicable on account of the extreme improbability that organised co-operative effort in this direction would be generally forthcoming. It is hardly necessary to point out that active participation in the supply of milk by a local authority would secure to a great extent to the consumer the benefits of co-operation. In addition to obtaining economy in distribution, the following advantages would be derived from such participation:—

(1). The undertaking of contracts for town supply would give a material stimulus to winter dairying, and would result in milk being obtainable in bulk at lower rates than those which could be secured by individual retailers.

(2). The fact that the local authority was itself directly concerned in the supply would tend to raise the general standard of quality of the milk. So far as we have been able to ascertain, the number of samples at present generally taken in urban areas with a view to safeguarding against adulteration is not nearly sufficient.

In this connection also, we feel that we must endorse the views expressed by many witnesses as to the inadequacy of the fines generally imposed in this country in cases of conviction for milk adulteration. Except in the case of one or two of the larger centres, magistrates do not, as a rule, appear to realise the responsibility which is vested in them in this regard, and fines of 1s. and 2s. 6d. are common. The imposition of nominal fines can never be effective in stamping out malpractices of the nature referred to, and we are of opinion that in all cases in which a conviction is obtained a very severe penalty should be inflicted.

We are glad to note the increasing publicity given by the Press in general to cases of conviction for adulteration, as there can be no doubt that such publicity acts as an exceedingly valuable deterrent.

(3). The system of purchase of milk for human consumption on the basis of its quality could be instituted. This we consider especially desirable. At present the producer of milk for town supply need only conform to the legal standard for butter-fat, *i.e.*, 3 per cent. (or even a lower percentage, provided he can prove that the milk is sold as it has come from the cow) and he is paid the same price as the producer of milk containing 4 per cent. or 4.5 per cent. of butter-fat. There is in consequence no inducement to the supplier to produce rich milk.

Testing and grading could be carried out at the central receiving depot.

(4). In poor or thickly populated districts, where people are willing to forego the convenience of having milk delivered at their doors, local authorities might consider the establishment of depots where milk could be sold over the counter at a price less than that charged for milk delivered.

(5). In the case of country towns, particularly those situated in non-dairying districts, arrangements could be made, if necessary, to obtain supplies from a distance by rail. At present the milk supply of such towns, especially in winter, appears to be much more inadequate than that of large centres, as the supplies forthcoming from local producers, on which these towns mainly depend, are frequently not nearly sufficient to meet the demand. Many farmers will not undertake the local supply of milk on account of the trouble involved in its distribution, with the accompanying fear of bad debts, etc. All this would be eliminated by the establishment by the urban authority of a central depot to which milk could be delivered, and we believe that the existence of such a depot would lead to a substantial increase in the amount of milk produced in the neighbourhood of these towns.

We have received interesting evidence as to the value of depots for the supply of milk to the poor established by voluntary effort in towns such as Galway and Mullingar. The successful working of these depots, limited even as they are in scope, encourages the belief that the widespread extension of the system would bring about satisfactory results.

SECTION IV.

EDUCATION AND RESEARCH.

The existing facilities in Ireland for education in regard to dairying briefly comprise:—

(1). A system of itinerant instruction by instructors appointed by the various County Committees of Agriculture.

(2). The courses in dairying provided at the various schools of Rural Domestic Economy, and at the Munster Institute and the Ulster Dairy School, for farmers' daughters.

(3). The provision by the Department of courses of training for creamery managers, butter-makers, and cheese-makers.

(4). An advanced course of four years' duration in dairy science at the Royal College of Science.

To consider first the instruction afforded under the county schemes, we are of opinion that it is insufficient to meet what must be regarded as a basic requirement, i.e., the education of the rural producer as to the necessity for and best methods of producing clean milk. This is a matter of the highest importance, as without clean milk good dairy produce cannot be made, and this branch of the work has been hitherto somewhat neglected. It appears to us accordingly that at any rate in dairying counties instructors should be available who would visit dairy farms in order to afford personal instruction in the production of clean milk according to the actual conditions prevailing on each farm; that is to say, to demonstrate what could be done with the facilities at hand and without additional outlay. In view of their existing duties neither buttermaking nor cow-testing instructors could be expected to carry out this work. Instructors of the type suggested could also advise farmers as to the most advantageous methods of disposing of surplus milk; at present, where such milk is available, more of it frequently goes to the feeding of stock than is, perhaps, always necessary, and instruction in the farmer's own home as to how to turn surplus milk into palatable hard or soft cheese would be of great advantage.

We do not know how far the suggestion that such itinerant instruction should be provided is feasible, having regard to existing training facilities, but we commend it to the consideration of the Department. We understand that some instruction of this nature is already provided for students at the Department's various Institutions, but so far as we are aware it does not appear to be given sufficient prominence in the curriculum. Moreover, a considerable time must elapse before the younger generation now going through these schools will be able to effect a general improvement on present methods of milk production and handling.

We come now to the other branches of dairying education. With regard to that provided at the Munster Institute and the Ulster Dairy School, we understand that the demand for admission to both these institutions is so great that applicants must wait two years in the case of the former and one year in the case of the latter before they can be admitted. It would accordingly appear that there is ample room for another school of this type, and we recommend that the Department should take the necessary steps with a view to its establishment. In our opinion, however, both the training provided at these schools and that provided for creamery managers, which consists of courses partly at the Royal College of Science and partly at a selected creamery, are capable of substantial improvement. Neither is sufficiently comprehensive, and this we believe to be due to the fact that under present conditions their scope cannot be sufficiently extended.

There is no question that in this country there is pressing need for a properly equipped institute, which will provide still higher and more specialised education than is at present possible, not only in the scientific, but also in the practical side of dairying; no scheme of training can be regarded as satisfactory which does not permit of both these aspects being dealt with side by side. We understand that a number of representative bodies connected with the Irish dairying industry have repeatedly asked for further and better facilities for education and research, but before research workers can be procured suitable training must be provided.

The immediate educational requirements of the country may thus be described as follows:—

- (1). The establishment of a dairy institute, with a creamery and cheese factory, and experimental plant for condensing in bulk and drying milk, separated milk, and whey.
- (2). Provision at such an institute for a practical and scientific training for persons of the following types:—
 - (a) Instructors in cow-testing and the production of clean milk. This must be regarded as the foundation of all other work.
 - (b) Creamery butter-makers and cheese-makers.
 - (c) Managers of creameries, milk depots, and cheese factories. The present course at the Royal College of Science for persons of this category is weak by reason of the separation between science and practice entailed.
 - (d) Short winter courses for existing managers and makers who desire to refresh their knowledge of any particular branch of their work.

We accordingly strongly recommend that the Department should be provided with a grant sufficient to permit of the establishment of an institute of the type indicated in the preceding paragraphs. We think such a grant should be obtainable from the funds at the disposal of the Development Commissioners.

Research.—With regard to the question of research, we are of opinion that so far as this country is concerned the subject cannot be satisfactorily approached until an institute such as we have described is available.

Research work may be roughly divided as follows :—

(a) Pure research, dealing with underlying or fundamental principles.

(b) Industrial research, dealing with the efficient application of principles.

(c) Routine laboratory work, dealing with the control of materials and processes.

Of these divisions, (b) and (c) could be carried out at the dairy institute provided laboratory accommodation was available. The work under (a) would be divided into pure laboratory work, involving no field work, which could be dealt with at the Royal College of Science, and laboratory work necessitating field work, which could be carried out at the proposed institute.

Provided it is found possible to establish this institute, we recommend that efforts should be made to obtain funds for research work either from the Development Commissioners or from the Committee of the Privy Council on Scientific and Industrial Research.

SECTION V.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS.

The following is a summary of our principal conclusions and recommendations :—

(1). During the past few years there has been a steady decline in the dairying industry throughout the country generally, the falling off in milk production being particularly marked in Ulster. It has not been possible to obtain evidence which would show that any general decline was noticeable prior to the period of the war.

(2). Of the factors which have contributed to the decline, the increasing difficulty of obtaining sufficient and reliable skilled labour must be regarded as one of the most important.

The labour problem, which is especially acute in districts in which large dairy herds are maintained, has several aspects, of which the chief are :—(a) Sunday labour, and (b) strikes, both “sympathetic” and “lightning.” We consider that any solution of the labour question must be based on the creation of a better understanding between the dairy farmer and the labourer, and recommend that the whole problem of labour in relation to dairying should be referred to a conference between representatives of the farmers’ and of the labourers’ unions, with a view especially to arriving at agreement as to the terms on which Sunday work will be carried out, and as to the steps which might be taken to ensure that contracts will not be broken without sufficient notice and sufficient cause. The Department should take steps to arrange for such a conference.

We recommend that the District Wages Committees appointed by the Agricultural Wages Board should be empowered to arbitrate in cases of disputes.

(3). On the majority of Irish dairy farms there is scope for improvement in the arrangement of the homestead with a view to the elimination of unnecessary labour. Much could be done at little expense to render dairying more acceptable to the labourer.

It is particularly important that arrangements should be made on every dairy farm to ensure that an ample supply of water is available, and we commend to creameries the desirability of considering the provision, where necessary, of facilities for the sinking of wells on their suppliers' farms.

(4). Opinions as to the merits of existing types of milking machines are very varied, and we recommend that a comprehensive series of tests of such machines should be carried out by the Department, so that expert advice might be available for the dairy farmer as to the desirability of their installation.

(5). The high price of beef during the war period has induced many dairy farmers to turn from milk production to the raising of dry stock. This tendency has been accentuated by the difficulty of obtaining labour for dairying.

The relatively low price fixed for butter, hitherto the chief Irish dairy product, has reacted very unfavourably on the manufacture of this commodity. The encouragement given to the manufacture of cheese has helped to prevent the falling off in milk production from becoming more serious, but as butter-making is a key industry, it is essential in the interests of both the store cattle trade and the pig-breeding industry that it should not be discouraged. We recommend, accordingly, that in any steps which may be taken in future to regulate the price of foodstuffs, parity prices should be fixed for dairy produce generally, and that such prices should be established on a basis which would leave a return equal to that from beef or other farm produce.

(6). We are of opinion that the improvement effected in the beef-producing qualities of Irish cattle by the bulls selected for premiums under the Department's Cattle Breeding Scheme has been achieved at the expense of their milk yields. Special attention must, accordingly, be devoted in future to the grading up of the country's dairy stock, which are almost entirely Shorthorn in type, by the provision of pure-bred Shorthorn bulls of milking strain, and by the mating of such bulls with selected cows. Having regard to the importance of the store cattle trade we do not consider any amendment of the Department's Scheme so as to include for premium purposes bulls of a purely milking breed, such as the Friesian, is to be recommended.

With a view to the Department's arranging for a satisfactory supply of pure-bred dairy Shorthorn bulls we recommend:—

(a) The supply of high-class stock bulls to private breeders at a nominal sum for hire.

(b) The extension of the Department's Loan Scheme so as to afford reasonable credit facilities to small breeders to enable them to purchase pure-bred high-class dairy stock (both bulls and cows).

(c) The increase to £30 of the premium for pure-bred dairy bulls with milk records on both sides of their ancestry. The Department's Cattle Breeding Scheme should also be amended to permit of such bulls standing for premium purposes for a longer period than four years, provided their service condition is sound.

(d) The establishment by the Department at their own farms of herds of pure-bred dairy Shorthorn cattle, to serve as centres from which both bulls and surplus females could be distributed.

(7). We recommend the provision by the Department of grants to the principal agricultural societies for prizes for pure-bred dairy Shorthorn cattle. In judging such cattle, milk records should be given relatively more importance than shape or appearance.

(8). In connection with the disposal of dairy bulls at shows and sales, we would suggest that the Department should request the societies or firms concerned to

arrange for such bulls to be put up for auction before other animals, so as to afford persons desirous of obtaining one of these bulls an opportunity of bidding, with the prospect of being able to fall back, if unsuccessful, on a bull of the ordinary type.

(9). The improvement of cattle in this country is greatly handicapped by the far too general use of "scrub" bulls. We consider that only bulls which conform to an approved standard of quality should be approved for service, and recommend that the Department should take steps as soon as practicable to obtain the necessary powers, and to put into force a measure for the licensing of bulls.

(10). Farmers throughout the country do not yet appear to realise the great possibilities of cow-testing, and vigorous propaganda with a view to the widespread extension of the practice of keeping milk records is necessary. We consider that the Department should mainly direct their efforts towards the establishment of Cow-testing Associations of the Class B type, as there can be no doubt that associations of this class are more likely to be generally adopted than those of the nature of Class A. The present remuneration of supervisors is altogether inadequate, having regard to the importance of the work and the necessity for obtaining a good type of man, and we recommend that grants to associations should be on a basis which would ensure that no supervisor should be paid less than £150 per annum.

We consider that the existing scheme for the establishment of Cow-testing Associations should be amended with a view to securing as far as possible the co-operation of creameries.

(11). We are of opinion that the funds at the disposal of the Department for the improvement of dairy cattle are insufficient, and we strongly recommend that they should be very substantially increased, so as to permit of development on the lines we have indicated.

(12). Every effort must be made to educate farmers as to the necessity for retaining their best cows for breeding purposes. The practice of disposing of such cows on account of their present high prices, and retaining second or third-rate heifers to form the basis of future herds, cannot be too strongly condemned.

(13). It is desirable that dairy farmers who produce milk for town supply should so re-arrange their herds as to secure that a proportion of their cows would calve in the autumn or early winter months. At present the majority of calves in this country are born in the spring, which is a factor accountable to no small extent for the shortage of milk in the winter months.

(14). The shortage during the past few years of imported feeding stuffs has adversely affected the production of milk, particularly in winter dairying districts. We think, however, that the effects of the shortage have been somewhat exaggerated. Every effort appears to have been made by the Department to secure for this country its fair proportion of the supplies available for the United Kingdom, and we think that in this respect they have been most successful. The imports of cotton and other cakes are now up to pre-war level, but the demand for all classes of feeding stuffs has been checked by their high prices. The attention of farmers generally might be directed to the feeding value of some of the more recently introduced and relatively cheap foods, such as dried grains, dried yeast, palm-nut cake, &c.

(15). Many dairy farmers do not appear to realise that practically everything necessary for the maintenance of a good milk supply can be grown on the farm. The remedy for decreased milk yields due to lack of imported stuffs lies in the adoption of a proper system of tillage. We are unable to agree with the view submitted by one or two witnesses that the Tillage Orders have been one of the chief causes of the falling off in milk production, by creating a necessity for the disposal of milch cattle. All experience would go to show that after one season their effect would be quite the reverse.

(16). We consider that the system of ensilage should be more widely encouraged, and recommend that the Department should carry out a scheme of experiments with a view to ascertaining the relative merits and economic possibilities of silage as compared with other cattle foods.

(17). There is general evidence as to the depreciation in the stock-carrying capacity of pastures owing to the scarcity of basic slag and superphosphate. While so far as quantity is concerned the conditions in regard to the former have somewhat improved, owing to alterations in the process of manufacturing steel farmers will in future be unable to obtain slag of such high grade as formerly. The supply of superphosphate, which is still inadequate, is dependent upon shipping facilities for the raw material. These are not yet very satisfactory.

(18). The evidence received regarding the effect of the restrictions on the export of milch cows and of in-calf heifers would show that these restrictions have not had the effect intended, but that, on the contrary, they have discouraged breeding throughout the country. We understand that the restrictions on the export of milch cows were withdrawn in April, 1919, and we recommend that the Order prohibiting the export of in-calf heifers should be rescinded.

(19). Contagious abortion is very prevalent, and the steps at present taken to combat the disease do not appear adequate. The fact that the Department will supply vaccine for the treatment of animals requires to be made more widely known. The present unrestricted movement of infected animals is very undesirable, and we recommend that the disease should be scheduled as notifiable.

(20). We have received no evidence which would show that there is in the country any general shortage of milk for human consumption, and where scarcity exists the lack of a proper system of distribution must be regarded as the chief cause. In the larger centres the demand for milk is regulated by its high price rather than by any inadequacy of supply. We have found that the prices fixed to meet the requirements of town dairymen in Dublin and Belfast have led to a tendency to increase prices throughout the country.

(21). We consider the system of town dairying altogether uneconomic, not only in that it raises the price of milk unnecessarily high, but in that it results in the serious depletion of the best dairy stock of the country. We are accordingly of opinion that milk for town supply should be obtained solely from rural sources.

(22). With a view to obviating losses of cans, where milk is sent by rail, we recommend that the various railway companies should insist upon cans being properly stamped with the owner's name, and with the name of the originating station. A large percentage of the losses at present must be attributed to defective labels. We understand that a proposal to charge for and waybill empty cans, thus rendering the railway company responsible for their satisfactory return to the senders, would be too costly to be acceptable.

(23). At all stations at which milk is received adequate storage accommodation should be provided, where cans could be protected from dust and dirt, and from the sun.

(24). There is room for considerable improvement in the system of milk distribution obtaining in Irish cities and towns. The adoption of a proper scheme is essential if a material reduction in the price of milk to the consumer is to be effected. We recommend, accordingly, that municipal and urban authorities in this country be empowered to undertake the supply and sale of milk, and to provide the necessary buildings and machinery for its handling, treatment, and distribution.

(25). We believe that participation by the local authority in the supply of milk would tend to raise the general standard of quality. The number of samples at present taken with a view to safeguarding against adulteration is altogether insufficient. In cases in which convictions for adulteration are obtained, the penalties inflicted should be much more severe than those at present imposed.

(26). We consider that milk for human consumption should be purchased on the basis of its butter-fat content, so as to encourage the production of rich milk.

(27). Local authorities undertaking the supply of milk might consider the establishment in poor or thickly populated districts of depots, where milk could be sold over the counter at a price less than that charged for milk delivered.

(28). We are of opinion that the establishment by the local authority in country towns of depots for the reception of milk would give a material stimulus to the production of milk in the neighbourhood of such towns.

(29). Under the schemes for education in dairying, provision should be made for the training of instructors who would educate the rural producer as to the best methods of producing clean milk, having regard to the actual facilities obtaining on the farm.

(30). There is ample room for another school of the type of the Munster Institute and the Ulster Dairy School, and we recommend that the necessary steps be taken with a view to its establishment.

(31). There is urgent need in this country for a properly equipped Dairy Institute, which will provide higher and more specialised education than is at present possible, both in the scientific and practical sides of dairying. At such an Institute, courses should be provided for (a) Instructors in Cow-testing and the production of clean milk; (b) Creamery butter-makers and cheese-makers; (c) Managers of creameries, milk depots, and cheese factories; (d) "Refresher" courses for existing managers and makers.

We recommend that the Department should be provided with a grant sufficient to permit of the establishment of a Dairy Institute of the type indicated.

(32). We are of opinion that in this country the question of research cannot be adequately dealt with until a well-equipped Institute is available. If such an Institute is established, we recommend that efforts be made to obtain funds for research work either from the Development Commissioners or the Committee of the Privy Council for Scientific and Industrial Research.

We desire to place on record our great appreciation of the services of our Secretary, Mr. J. E. Hanna. Throughout the whole course of our Inquiry he has taken all possible steps to meet the convenience of the witnesses, and to see that the objects of the Inquiry were made known to everyone likely to be able to offer evidence of value. He has displayed marked ability and great industry in assisting us in every way, and in the drafting of the Report has given evidence of his thorough grasp of the very complicated question with which we have had to deal.

We have the honour to be,

Sir,

Your obedient Servants,

BERTRAM H BARTON,
Chairman.

R. A. ANDERSON

H. BARBOUR.

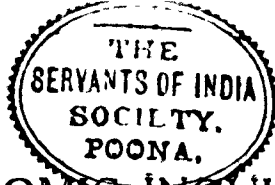
P. BRADLEY.

THOMAS DUGGAN.

A. LOCKETT.

J. E. HANNA, *Secretary,*

DUBLIN: Dated this Twelfth day of May, 1920.



OF ECONOMIC INQUIRY, PUNJAB

RURAL SECTION PUBLICATION—2

S 2139

A PAPER

ON

ILK SUPPLY OF LAHORE

IN

1921

BY

SHIVA DATTA, M.A.,

Fellow of the Royal Economic Society.

NOTE.

This inquiry was conducted under the auspices of the Panjab University with funds supplied by the Board of Economic Inquiry, Punjab, and the publication was also undertaken by the Board. The Board, however, does not hold itself responsible for any opinions expressed or conclusions reached by the writer.

Lahore :

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRINTING, PUNJAB.

1924.

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PREFACE.

THE Milk supply of Punjab Towns is admittedly the reverse of satisfactory.

Underfed cattle are housed under most insanitary conditions ; milkers have no conception of personal or instrumental cleanliness : the milk is transported under conditions favourable to contamination with dust and dirt, the usual method being an open mouthed brass receptacle plugged with grass or straw carried by open cart or pack transport ; the milk is adulterated and sophisticated according to the whim of the various vendors, the fluid which finally reaches the consumer not infrequently containing a sample of the nearest drain in addition to ordinary dust and dirt.

In fact the milk supply of towns has been allowed to develop haphazard without any official attempt at regulation. The general lines of attack on a problem of this nature are well-known but before measures can assume a practical form a fairly accurate knowledge of the economics of the trade is necessary.

Mr. Shiva Datta's investigation into the milk supply of Lahore is the first of a series of investigations planned by the Punjab Board of Economic Inquiry on the basis of which it is hoped suitable remedial measures may be designed. A careful perusal of the report will show that the problem is an exceedingly complicated and difficult one. The supply is not equal to the demand, the deficit being made up by adulteration ; dairy farming will never successfully compete with ordinary agriculture where the land admits of cultivation ; there is no organised system of transport by rail and the radius of road transport is limited by the use of carts or pack transport ; milkmen have no conception of cleanliness.

The author makes various suggestions for improving matters which will receive the consideration they merit ; but if the Ghi problem, which is inseparably connected with the milk problem, is also taken into consideration, it will be evident that the problem must be tackled on a large scale by Government Agency.

With the extension of the canal system it should be possible to reserve large areas for dairy farming conducted by selected experts—under the control of the Agricultural Department. Before a concrete proposal of this nature can be submitted to Government Mr. Shiva Datta's valuable work will have to be supplemented by very careful expositions of the economics of dairy farming as practised by the Military Department and the Salvation Army.

Such expositions will constitute the next step in the inquiry which has been so ably initiated by Mr. Shiva Datta.

W. C. H. FORSTER, LIEUT.-COL., I.M.S.

Director of Public Health, Punjab.

CHAPTER I.

GENERAL.

THIS inquiry comprehends the area lying within the Municipal limits of Lahore, *viz.*, the parts known as the City of Lahore proper and the Civil Station.

Introductory.

The two main sources of milk supply are : the inside and the outside sources. To take the outside source first.

The two sources of milk supply are :—

We find according to an estimate made by the Octroi Department of the Lahore Municipality that for the 24 hours ending 15th April 1921 a little over 350 maunds of milk were imported through twelve of the more important entrances of the town. The largest part of the total quantity, roughly about 95 per cent., was received in the morning between 8 A.M. and 1 P.M. and the rest of it in the evening. The latter part of the supply comes from villages situated very close to the town. Nearly 90 per cent. of the whole is buffaloes' milk, the rest being a mixture of cows' and goats' milk.

Most of the milk is brought on horse *ekkas* though a part is brought by rail. The *ekkawalas* bring milk from the suburban villages. In the following table these villages have been grouped according to their distances from the centre of Lahore and their relative importance in regard to the milk supply :—

From villages lying within a radius of 4 miles or less—95 maunds, *i.e.*, 27 per cent. of the total.

From villages lying within a radius of 4 to 12 miles—225 maunds, *i.e.*, 64 per cent. of the total.

From villages lying within a radius of 12 miles or more—80 maunds, *i.e.*, 9 per cent. of the total.

The above estimate is strictly rough, and its value is chiefly indicative. It shows that the greater part of the supply (about 64 per cent.), comes from villages that are situated at a distance of 4 to 12 miles from the town. This is not because these villages have more milk to sell than those nearer, but because the interests of the middleman who carries most of this milk to the town incline him to collect milk from places where he can secure the greatest margin between the purchase and the sale prices. It was found that this margin increased with the distance.

We may well illustrate this by giving certain figures* pertaining to some of the villages lying along the Ferozepore Road :—

Names of villages.	Distance from Lahore in miles.	Middleman's † purchase contract rate of milk per maund of 50 seers at the place.		Middleman's contract sale rate of milk to the <i>Halwars</i> per maund of 50 seers.	Margin.	
		Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Galvehra ...	21	7 0 0	...	11 4 0	4 4 0	...
Kahna Nau ...	12	7 8 0 to 8 4 0		11 8 0	4 0 0 to 3 0 0	
Kot Mela Ram ...	10	8 0 0 to 8 8 0		11 8 0	3 8 0 to 3 0 0	
Ballhar ...	9	8 0 0 to 8 8 0		11 8 0	3 8 0 to 3 0 0	
Plindi ...	8	9 8 0 to 10 0 0		12 4 0	2 12 0 to 2 4 0	
Jiwan Haria ...	6	10 0 0	...	12 4 0	2 4 0	..
Ishhra ...	3	10 8 0 to 11 4 0		13 0 0	2 8 0 to 1 12 0	

* The figures are dated 25th, 26th and 27th April 1921. The rates are all for buffaloes' milk.

† There are always some variations in the contract rates according as the suppliers have or have not received advances, people belonging to the latter class generally getting more favourable rates. But the former class is the more numerous, and their rates may be taken as the basis of our comparison.

From the foregoing figures it is clear that the interest of the middleman lies in collecting the milk from as distant places as he possibly can. But he cannot go too far, for then his milk might either reach the market too late or get spoiled on the way, particularly in the summer months. He, therefore, takes his supplies from places that are neither too distant nor too near the town.

The principal reasons why milk is so much cheaper in villages at good distances from the town are :—

Reasons why milk is cheaper at a greater distance.

- (a) Its lower cost of production. The villagers are generally fond of keeping milch cattle. Owing to their agricultural pursuits they can maintain them much more cheaply than the people in the town, and consequently their cost of production per seer of milk is much lower.
- (b) The lack of purchasing power among the villagers. This makes them look up to the middleman for advances to buy milch cattle and depresses still more the price they can ask for their milk. It should be remembered that the middleman buys much the larger part of his daily supply of milk from such needy villagers who, instead of paying interest on the money received from him, offer to sell their milk at a rate cheaper than they would otherwise have charged.
- (c) The high rate at which they must discount their individual convenience, time, and expense in marketing their milk at a great distance also pulls down the price of milk.
- (d) Their ignorance of the prevailing prices in the town market also works against them to the corresponding advantage of the better informed middleman. This ignorance is, however, getting less as the inter-communication between the town and the villages is increasing. But still for the average villager the good or bad seasons and their effect upon his crops are a far more reliable barometer for the regulation of his prices of milk than the comparatively more scientific market prices of the town. But more of this later.

The total number of middlemen bringing milk to Lahore was 191, which gives an average of about two maunds of milk for each of them. They may be divided into two classes :—

Classes of middlemen.

- (i) Those for whom the purchase and sale of milk is the principal occupation.
- (ii) Those for whom the purchase and sale of milk is a subsidiary occupation.

The former class is the more numerous. It consists mostly of Muhammadan *Gujars* to whom dealing in milk in some way or other is a traditional occupation. Again, quite a number of the class belong to castes such as *Telis* (oilmen), *Julahas* (weavers), *Sainis* and *Khatriis* who have adopted the profession of milk-selling only within the last one or two generations.

To the latter class belong such agriculturists as have some spare time and money and above all the enterprise to do the job. There are also other persons such as *Jogis* and *Fakirs* (beggars), the nature of whose callings placing some funds at their disposal, permits them sufficient time to deal in milk.

A few remarks on the economic situation of these people may not be out of place here. In the last table we have brought out the wide margins that these people secure between their purchase and selling prices. To this we must add the profits accruing to them on account of adulteration.

The profits of the middleman.

The amount of such adulteration varies almost directly with the unsatisfied demand for milk—being highest in summer and lowest in winter. The following results taken from the milk analysis records of the Lahore Municipal laboratory clearly bear this out :—

Names of months.		Total number of specimens examined.	Average percentage adulteration with water.	Number of samples found adulterated with more than 8 per cent. water.	Percentage of the adulterated samples out of the total number examined	Remarks on adulterations.
WINTER.	October 1918 ...	94	11 per cent.	72	78 per cent.	A few cases of extraction of fat.
	" 1919 ...	159	12 do.	105	66 do.	
	" 1920 ...	219	14 do.	108	51 do.	
	November 1918 ...	77	10 do.	35	46 do.	
	" 1919 ...	102	10 do.	53	52 do.	
	" 1920 ...	154	12 do.	73	47 do.	
WINTER.	December 1918 ...	Not available.	Not available.	Not available.	Not available.	
	" 1919 ...	40	12 per cent.	17	42 per cent.	
	" 1920 ...	70	13 do.	32	46 do.	
	January 1918 ...	Not available.	Not available.	Not available.	Not available.	
	" 1919 ...	49	10 per cent.	24	49 per cent.	
	" 1920 ...	42	8 do.	19	42 do.	
WINTER.	" 1921 ...	113	8 do.	50	42 do.	
	February 1918 ...	Not available.	Not available.	Not available.	Not available.	
	" 1919 ...	62	9 per cent.	28	45 per cent.	
	" 1920 ...	55	10 do.	24	44 do.	
	" 1921 ...	69	9 do.	31	45 do.	
	March 1918 ...	...	...	...	...
SUMMER.	" 1919 ...	Not available.	Not available.	Not available.	Not available.	
	" 1920 ...	77	14 per cent.	34	44 per cent.	
	" 1921 ...	32	15 do.	15	48 do.	
	April 1918 ...	Not available.	Not available.	Not available.	Not available.	
	" 1919 ...	Ditto.	Ditto.	Ditto.	Ditto.	
	" 1920 ...	29	16 per cent.	20	69 per cent.	
SUMMER.	" 1921 ...	57	18 do.	41	72 do.	
	May 1918 ...	47	20 do.	39	83 do.	
	" 1919 ...	81	16 do.	56	70 do.	
	" 1920 ...	77	16 do.	58	75 do.	
	June 1918 ...	54	21 do.	34	63 do.	
	" 1919 ...	54	22 do.	37	68 do.	
SUMMER.	" 1920 ...	174	19 do.	112	65 do.	
	July 1918 ...	54	20 do.	36	67 do.	
	" 1919 ...	86	22 do.	56	65 do.	
	" 1920 ...	150	20 do.	104	67 do.	
	August 1918 ...	48	18 do.	34	70 do.	
	" 1919 ...	41	17 do.	24	59 do.	
RAINY SEASON.	" 1920 ...	81	16 do.	45	56 do.	
	September 1918 ...	71	14 do.	44	62 do.	
	" 1919 ...	60	12 do.	28	47 do.	
	" 1920 ...	156	18 do.	73	47 do.	

In order to bring out the conclusions more precisely, we have on the previous page represented the variations in the two more important sets of figures by graphs.

It will be noticed that as a whole the adulterations are the highest as well as the most common in the summer months, *e.g.*, April—July; and the lowest and the least frequent in the winter months, *e.g.*, November—February. The months of August, September and a part of October and again the months of March and a part of April occupy an intervening position—the former period preceding a fall and the latter a rise in the adulterations.

As we said above the adulterations follow the unsatisfied demand of milk pretty faithfully—varying almost directly with it.

But before proceeding to discuss this proposition any further let us pass in a brief review the respective intensities of the forces of demand and supply in the different months of a year. The demand for milk depends on—

- (i) the consuming public. We find that it is very great between October and June when the population of Lahore is at its maximum and is very low during the rest of the year, *viz.*, June—October, when owing to the closing of Colleges, Schools, Government Offices, Courts and other institutions, a large part of the more important section of the milk-consuming public is absent;
- (ii) the different seasons of the year. Thus all other things being equal, the demand for milk is greater in summer than in winter and is the least during the rainy season. It is the greatest in summer because even those people who do not use milk in winter use curd and *lassi* in summer to quench their thirst. It is least in the rainy season because in those days the necessity for taking milk in any form exists only to a small extent.

The supply of milk depends on —

(i) The calving periods of milch cattle. From the statement given below it is clear that the largest number of buffaloes calve in September—December, and the smallest number in February, March, April and May. Correspondingly the buffalo milk is plentiful for three or four months following October and is scarce during the rest of the period particularly in the hot months of May, June and July:—

Statement* showing the percentage of calvings in different months.

Kind of animals.	Locality.	No.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Buffaloes ...	College Dairy, Poona ...	428	6.7	5.2	3.0	2.0	1.4	6.3	13.5	11.4	15.0	20.0	9.0	6.5
Ditto ...	Poona Military Dairy.	851	6.7	7.8	4.2	4.3	5.0	5.4	10.8	13.3	14.4	11.3	10.3	7.0
+ {	Murrab buffaloes	Ferozepore Military Dairy.	60	5	3	3	1	5	5	7	7	5	7	3
	Sahiwal cows ...	Ditto ditto *	87	14	13	9	6	3	3	3	1	1	3	5

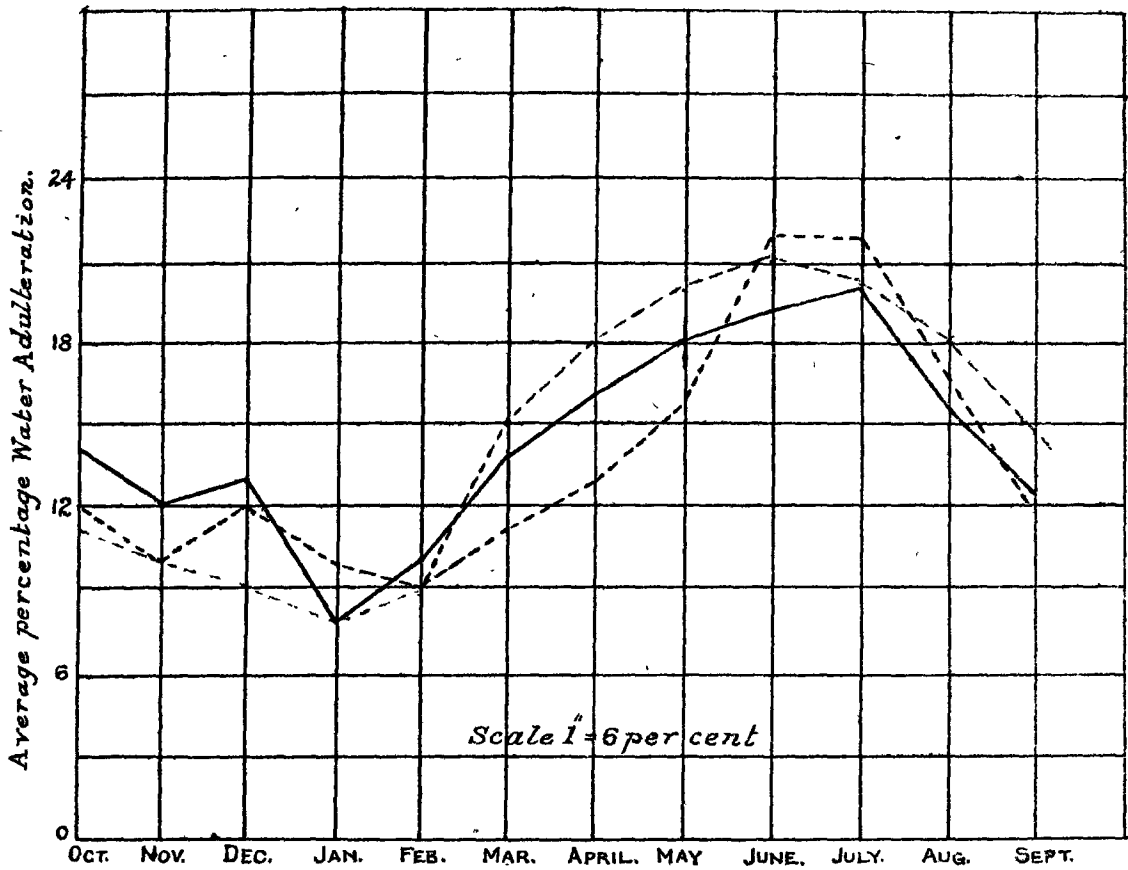
*Notes on Dairying by Bhai Kartar Singh, page 3 bottom.

†The figures are for 1920-21 and have been compiled by the writer.

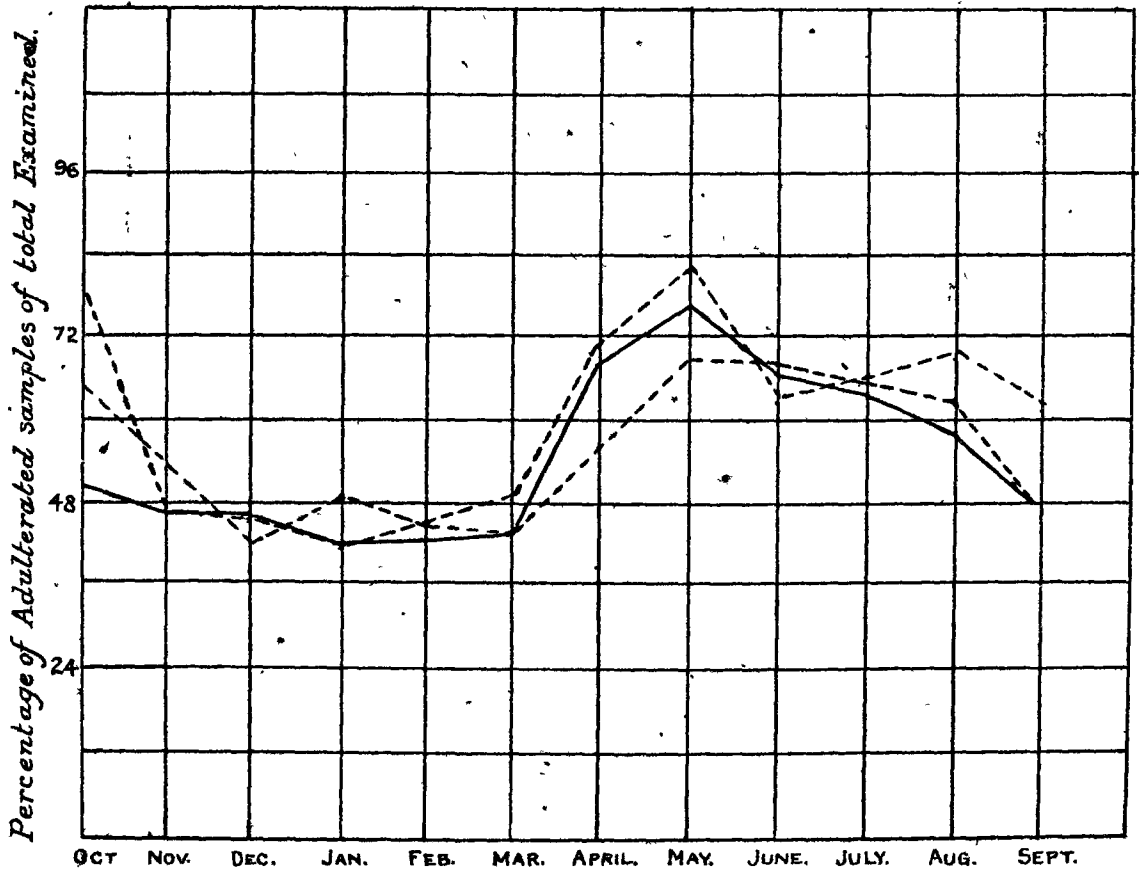
Again most of the cows calve in January, February, March and April and a few of them in September—December.

Accordingly the cows' milk is comparatively abundant during the two or three months succeeding January and is comparatively scarce during the rest of the year. Thus the respective calving periods of cows and buffaloes serve to relieve each other's scarcity of milk. But as is clear from a previous set of figures (*vide* page 1, paragraph 2) the cows' milk forms only a small percentage of the total town supply of milk, therefore the scarcity or abundance of buffaloes' milk exercises the dominant influence.

Graphs representing variations in the adulterations of milk.



Note { 1918 shown in Red -----
 1919 " " Black -----
 1920 " " Black -----



Scale 1 = 24 per cent.

(ii) The sufficiency of fodder for milch cattle. It is a familiar maxim of dairying that other things being equal the yield of milk varies with sufficiency of food. Apart from periodic fodder famines there is every year a general scarcity of fodder in the months of December and January and again in April and May, the latter being the more acute of the two. The supplies of milk are therefore appreciably depressed during those months.

The intensities of demand and supply of milk in the various months of a year may at a given price of milk be very roughly expressed as follows :—

Months.	Demand.	Supply.	REMARKS.
October	Great	Sufficient ...	Low unsatisfied demand,
November	Do.	Do.	Ditto.
December	Do.	Do.	Ditto.
January	Do.	A little depressed	Higher unsatisfied demand.
February	Do.	Do. do.	Ditto.
March	Do.	Insufficient ...	Ditto.
April	Do.	Do.	Ditto.
May	Very great ...	Do.	Very high unsatisfied demand.
June	Do.	Do.	Ditto.
July	Do.	Do.	Ditto.
August	Comparatively small	Do.	Low unsatisfied demand.
September	Do. do.	Do.	Ditto.

It will be seen therefore that the unsatisfied demand is at its highest in the three months of May, June and July, quite high in January, February, March and April and low in August, September, October, November and December.

On a reference to the adulteration graphs it will be found that with a few exceptions in September and October, both of them trace a course similar to that of the unsatisfied demand described above.

Among the various adulterations of milk, that of water is by far the most important. Not only do the suppliers add it for the sake of profit but they have also a sentiment, perhaps the result of a long continued practice, that without it the milk gets sour and spoiled. To crown all, some of the wretches do not add fresh well water but that of canals, tanks and pools. On closer inquiry it was found out that on account of the suspended impurities contained in those waters the adulteration did not much lower the specific gravity of the milk though it changed its colour to a reddish yellow, and the product easily passed off in the market as rich buffalo milk.

We may note here in passing that the *Halwais* retail such adulterated milk for drinking purposes, but they are more careful about the milk they get for making sweetmeats and for setting to curd. The middlemen respond to the demand by keeping separate vessels for milks of different qualities.

Adulteration by the addition of skimmed milk is very common in summer when in relation to the supply the demand for milk for drinking purposes is very great. At that time the suppliers get part of their milk separated in one of the local dairies, make over the cream to a dairy, and mix the separated with the milk still lying with them.

Thus do these people add a considerable sum (especially in summer) to their otherwise honest profits. On account of the variable nature of these profits it is not possible to measure them exactly. But taking the minimum average adulteration of

*The author's explanation of the slightly altered specific gravity is incorrect. The milk is first skimmed, a process which raises the specific gravity, and then watered, a process which reduces the specific gravity to normal or below normal according to the relative volume of water added.—W. C. H. F.

water to be about four seers in the maund, or 10 per cent.,* they clear about 12 annas on every maund of milk. This added to their average margin of profit of Rs. 3-4-0, got otherwise, gives a total profit of about Rs. 4 per maund.

Against this we have to put their expenses of collection and haulage.

Their expenses of collection and haulage.

Very frequently the middleman collects the milk himself. But sometimes he employs certain extra hands whom he pays at an average rate of Rs. 10 per mensem for the daily collection of a maund of milk, which comes to a little over Re. 0-5-0 per maund every day. Turning to his haulage expenses, we find that he can carry about 5 maunds of milk in his *ekka* or bamboo cart,

In ordinary times the feeding expenses of the horse and the wear and tear of the cart, and, if you like, the interest on the money invested in the whole outfit, does not come to more than Rs. 2-8-0 per day. This item therefore adds another Re. 0-8-0 per day to the bill. Very often, however, as these people bring milk by some of the most frequented of roads they easily secure some passengers, whose payment brings the haulage expenses down by a fair amount. Thus the most optimistic estimate of their total collection and haulage expenses does not exceed a rupee per maund.

As a rule these middlemen in their turn obtain advances from the town

The advances received by these middlemen.

No interest is paid. An understanding to supply a fixed quantity being considered a sufficient consideration.

Halvais (milk-sellers) in return for which they undertake to supply them with a certain quantity, usually prescribed as a maximum or minimum. This undertaking alone is considered a sufficient compensation to cover the charge of interest on these advances.

There is no fixed rule about the security in the supply of milk demanded by the *Halvais*. The rates of advances vary from Rs. 350 to Rs. 500 per maund (of 50 seers). There were cases in which Rs. 1,000 per maund had been given, but such latitude is allowed only when the *Halvais* feel that their urgency of demand coupled with the ability of the debtor to pay it back in milk is a sufficient justification for the risk involved. These advances are paid back by a daily deduction made by the *Halvais* from the total price of the milk daily brought by the middlemen.

Thus taking their income and expenditure into consideration we find that

The average net profit of the middleman.

the middlemen make an average net profit of Rs. 3 per maund every day and taking the average daily amount of milk carried by a middleman equal to about 2 maunds a day (*vide* page 2) they have a balance on the average of about Rs. 6 a day per man.

The likelihood of his losses is much lessened by virtue of the position

The losses of the middleman are, by virtue of his position, not much.

the middleman enjoys. For instance there are only two ways in which he can lose:—

- (i) By failing to supply the quantity of milk stipulated in his contract with the *Halvai*. In such a case he becomes liable to the damages mentioned in the terms of the contract. The middleman, however, meets this contingency either by increasing the adulterations in his milk or by pushing the burden of the damages he may be called on to pay on to the shoulders of the person who sells him the milk. But these damages are very seldom claimed by the *Halvais* who, being always hard pressed for milk, generally try to placate these people and overlook temporary breaches of contract.
- (ii) By losing his hold over the original supplier, either through some treachery of the latter or through the early drying up or death of the milch cattle, and the inability of the owner to pay. This is the more important of the two sources of loss to the middleman. But such cases are not very frequent.

The lucrateness of their jobs is well reflected in the comparatively flourishing condition in which a large number of these middlemen live. Almost all of them possess houses of their own, some of them built of pucca

The middlemen live in better circumstances than their co-villagers.

* My laboratory results show that the average adulteration is much nearer 25 per cent.—W. C. H. F.

bricks and covering a good area. Inside their houses you find a standard of living much superior to that of their co-villagers. Their vessels, furniture, clothes and the women's ornaments all speak of better taste and still better pecuniary conditions. Some of these people are bankers, doing business in thousands.

But the milk brought in from outside forms after all only a portion of the total consumption in the town. The total amount of milk daily consumed in the town may be computed as follows*—

	Maunds.	Seers.
(i) From 2,997 cows and 982 buffaloes kept specifically for the sale of their milk	228	or 9,120
(ii) From 905 cows and 569 buffaloes owned for private consumption of their milk at the rate of 2 seers for a cow and 3 seers for a buffalo	1,810 + 1,707	3,517
(iii) From outside	350	14,000
Total		26,687

Thus 47 per cent. of the total supply of milk is produced inside the city and civil station and 53 per cent. is received from outside. Since we are at present concerned with milch cattle alone the part of the total supply of milk contributed by goats has not been included.

The cattle-keeping population may be divided into four classes. We may divide the keepers of milch cattle within Lahore into four different classes :—

(i) Persons whose sole or principal occupation is the keeping of milch cattle and selling their milk. The total number of workers of this class above the age of ten years in 1921 was 779, distributed among the different castes or tribes as follows :—

Gujars	..	..	..	..	..	505
Gowalas	..	..	..	..	..	96
Jats	..	..	..	..	..	55
Telis	..	..	..	..	..	33
Changars	..	..	..	..	..	14
Arains	..	..	..	..	..	13
Khatris	..	..	..	..	..	14
Brahmans	..	..	..	..	..	6
Mashkis	..	..	..	..	..	7
Sayyads	..	..	..	..	..	5
Bhatras	..	..	..	..	..	2
Lalaris	..	..	..	..	..	2
Tarkhans	..	..	..	..	..	1
Bharwals	..	..	..	..	..	2
Persons belonging to criminal tribes and jails	..	..	..	..	..	24

These may further be considered under two heads :—

(a) Those who keep milch cattle and sell their milk as a hereditary occupation. Most of the Muhammadan Gujars and the Hindu Gowalas belong to this class. From the figures given above it is clear that they form about three-fourths of the whole cattle-keeping population.

*These and other subsequent figures relating to Lahore were obtained by a special inquiry conducted with the help of the local Municipal Health Department in April and May 1921.

†The average yield of cows and buffaloes have been determined with proper regard to the number of dry animals (of which there were a good many) in the total number.

- (b) The remainder, about one-fourth, include those whose traditional occupation is something else but who have taken to the occupation of keeping-milch cattle within the last few generations. Such are, for instance, the Telis, Changars and sweepers, Arains, Mashkis, Sayyads, Lalaris, Tarkhans, from amongst the Muhammadans, and Brahmans, Khattris, Jats, Bhatras and some sweepers out of the Hindus.

We might still further consider this section under two sub-heads, viz., the non-agriculturists and agriculturists. Under the former category come castes such as carpenters, watermen, oilmen, dyers, Changars and sweepers and others. There are two principal reasons why they have changed their hereditary occupation for that of selling milk, namely—

(a) that some one of their ancestors found that the keeping of milch cattle and the selling of their milk was more profitable to him than his hereditary occupation. He, accordingly took up the work on a small scale and put some member or members of his family exclusively to look after it, and in course of time it became the principal means of livelihood of the next generations; and (b) Some persons who had originally only kept a few milch cattle for their own use subsequently took a sort of fancy for keeping a larger number of milch cattle and came therefore in course of time to make it their chief occupation. As a matter of fact, many persons of these castes attributed their beginning as well as their further continuance in the profession to simple fancy. In some two or three cases it was found out that they had pledged valuable landed property only to purchase some fine buffaloes or cows.

The second class consists of persons who keep milch cattle for private use.

(ii) Who keep milch cattle for private use.

As a rule such persons belong to the well-to-do classes. The number of such persons was approximately 1,100.

The third class consists of persons who keep milch cattle for their private use as well as for supplementing their income

(iii) Who keep milch cattle as a subsidiary source of income.

from other sources. For them the keeping of milch cattle and selling their milk is a subsidiary occupation. The number of such persons could not be definitely ascertained but there must be a few hundreds of them. Most of them belong to the menial classes such as Fakirs, Bhats or Bhatras, Chamars Jolahas, watermen, oilmen, dyers and others. But there is quite a fair number of persons of the middle class who although they think it necessary to keep milch cattle for their private use, yet find it too expensive to maintain them without some income from the milk. As a rule they sell a portion of their milk in secrecy so as to avoid public scandal.

The fourth class consists of persons who deal in the purchase and sale

(iv) Persons dealing in the purchase and sale of milch cattle.

of milch cattle. They may be further subdivided into two sections:—

- (a) Persons carrying on the purchase and sale of cattle side by side with their principal occupation of milk-selling. To this section belong a good many from the first class. These persons include almost all the Chowdhris of the milk-sellers.
- (b) Persons devoted almost exclusively to the purchase and sale of milch cattle. There are about 4 or 5 such places (called Addas) in the town engaging about 40 persons. They generally charge a brokerage of Rs. 3 per buffalo and Re. 1-8-0 per cow on their sales.

The fifth class consists of the graziers and milkmen who are mostly Gujars and Gowalas. These may also be divided under two heads:—

(v) Graziers and milkmen.

- (a) Those who graze and milk the cattle of other people in addition to their own. But at best it remains merely a subsidiary occupation for them. Such persons belong to class (i) but their herds are so small that they find some spare time to milk the cattle of

a number of other persons in the town as well as to graze their milch cattle along with their own. Very often when they find enough work they set one of themselves apart exclusively for the purpose of milking and grazing milch cattle of other persons.

- (b) Those who devote themselves exclusively to the grazing and milking of milch cattle belonging to other people. They generally possess no cattle of their own and live on the grazing and milking fees.

The grazing fees are Re. 1 per mensem for a cow and Rs. 2 per mensem for a buffalo. If they graze as well as milk cattle, they charge Rs. 2 per mensem for a cow and Rs. 3 for a buffalo.

We may, however, note here that these people do not provide the cattle with any sort of grazing. As a matter of fact the term grazing in this case is a misnomer. What they do is simply to hire certain big plots of clean land near the city, take the cattle there about 10 o'clock in the morning, keep them sitting or standing there for the next 6 hours and then drive them back to their homes at about 4 o'clock. The case is, however, different with graziers of section (i). Since these people have the interests of their own cattle also to look to, they generally take them to plots under some fodder crop or else to a place where there is actually something to graze the cattle upon. Consequently they charge higher grazing fees.

In addition to these fees the graziers also charge bulling fees. A very admirable custom prevailing amongst these people especially among persons of section (ii) is that they have at least one good bull with their respective herds. These bulls grazing with the herds are generally cow bulls, the buffalo bulls being kept tethered at one place generally in their own private premises. These bulls have all been selected with care, but unfortunately the general appearance of the animal seems to have carried greater weight than other points bearing on the milking qualities of their progeny. Except in the herds of some of the Gujar graziers, the bulls generally belonged to the Haryana or desi breed. The bulling fees are Re. 1 for a cow and Rs. 2 for a buffalo.

As a class the economic condition of the graziers is much better than that of any other section of the cattle-keeping population. This is specially true of section (ii) who unlike persons of section (i) have nothing to fear from the shifts of fortune visiting the milch cattle keepers. Obviously the reason is that they have everything to gain from their work and nothing to lose. They are all in good circumstances, very few of them being found in debt or otherwise in want.

We may now refer briefly to the economic condition of Gujars who are by far the most numerous as well as the most important of the milch cattle keeping population. From the figures given already we find that they form about 65 per cent. of the total number of milch cattle keepers living inside the city proper. Again as pointed out in the table given below they own 70 per cent. of the total number of milch cattle in the city :—

TOTAL NUMBER OF MILCH CATTLE IN THE ARRA = 3,699.		TOTAL NUMBER OF MILCH CATTLE OWNED BY GUJARS ONLY = 2,578.		PERCENTAGE OWNED BY GUJARS OF		
Cows.	Buffaloes.	Cows.	Buffaloes.	The total number of milch cattle.	The total owned.	
					Cows only.	Buffaloes only.
2,778	921	1,971	602	70	77	23

Except in about 25 cases out of the whole lot of them about 505 in number, all others were found in a state of chronic indebtedness;

Some idea of the state of affairs may be formed from the following two* sets of figures.

There were in Section A † Lahore City 33 family groups ‡ of Gujars consisting of 90 persons above the age of 10 years. These groups could, in order of their indebtedness, be further divided as follows :—

Section A—

20 groups consisting of 35 persons owing between Rs. 500 and Rs. 2,000 (average actually found being Rs. 1,575) per group.

(a) They owned 217 cows and 20 buffaloes in all, *i.e.*, 11 cows and 1 buffalo per group.

10 groups consisting of 35 persons owing between Rs. 2,000 and Rs. 5,000 (actual average Rs. 3,150) per group.

(b) They owned 233 cows and 60 buffaloes, *i.e.*, 23 cows and 6 buffaloes per group.

3 groups consisting of 16 persons who owed between Rs. 5,000 and Rs. 10,000 (actual average Rs. 5,666) per group.

(c) They owned 46 cows and 22 buffaloes, *i.e.*, 15 cows and 7 buffaloes per group.

2 groups consisting of 6 persons who owed nothing.

In Section C, Lahore City, there were 27 family groups of Gujars consisting of 94 persons above the age of 10 years. These groups could in order of their indebtedness be further divided as follows :—

Section C—

10 groups consisting of 25 persons owing between Rs. 500 and Rs. 2,000 (actual average Rs. 721) per group.

(a) They owned 58 cows and 21 buffaloes, *i.e.*, 6 cows and 2 buffaloes per group.

10 groups consisting of 33 persons owing between Rs. 2,000 and Rs. 5,000 (actual average Rs. 3,320) per group.

(b) They owned 167 cows and 22 buffaloes, *i.e.*, 17 cows and 2 buffaloes per group.

5 groups consisting of 25 persons owing between Rs. 5,000 and Rs. 10,000 (actual average Rs. 6,120) per group.

(c) They owned 81 cows and 21 buffaloes, *i.e.*, 16 cows and 4 buffaloes per group.

2 groups consisting of 3 persons who owed nothing.

Briefly stated—

(A.) *In Section A—*

Group of two persons owing Rs. 500—Rs. 2,000 possessed 11 cows and 1 buffalo per group.

In Section C—

Group of two persons owing Rs. 500—Rs. 2,000 possessed 6 cows and 2 buffaloes per group.

In Section A—

Group of three persons owing Rs. 2,000—Rs. 5,000 possessed 23 cows and 6 buffaloes per group.

*As the class of figures for most of the rest of the area were scanty and frequently understated and at other times exaggerated they had to be rejected as unreliable. The figures for these two sections were compiled with the best possible care and they may be taken as fairly representative of the actual conditions prevailing in the whole of the area.

†Section A and Section C relate to the division of the Municipal area by the Health Department.

‡The unit of society among Gujars is the family group and not an individual. We have accordingly adopted † as the basis of all our subsequent calculations.

In Section C—

Group of three persons owing Rs. 2,000—Rs. 5,000 possessed 17 cows and 2 buffaloes per group.

In Section A—

Group of five persons owing Rs. 5,000—Rs. 10,000 possessed 15 cows and 7 buffaloes per group.

In Section C—

Group of five persons owing Rs. 5,000—Rs. 10,000 possessed 16 cows and 4 buffaloes per group.

Altogether four groups, consisting of nine persons, owed nothing.

Again—

(B.) In Section A—

57 per cent. of the groups owed Rs. 2,000 or less.

In Section C—

37 per cent. of the groups owed Rs. 2,000 or less.

In Section A—

28 per cent. of the groups owed Rs. 2,000 to Rs. 5,000.

In Section C—

37 per cent. of the groups owed Rs. 2,000 to Rs. 5,000.

In Section A—

9 per cent. of the groups owed Rs. 5,000 to Rs. 10,000.

In Section C—

19 per cent. of the groups owed Rs. 5,000 to Rs. 10,000.

In Section A—

6 per cent. owed nothing.

In Section C—

7 per cent. owed nothing.

From the (B) set of figures it is clear that most of these Gujars consist of a group of two persons and owe Rs. 2,000 or less and only a very insignificant fraction of them is without any debts.

It may here be objected that a state of indebtedness does not necessarily involve a backward pecuniary condition. On the other hand, it may reveal a state of sufficiency that justifies the debts. In a way this is true about the class of persons we are speaking of. For instance, from (A) set of figures above we find that an increase in their liabilities finds a corresponding increase in the strength of their securities, viz., the number of persons forming a group and the number of milch cattle, notably the number of she-buffaloes composing their herds.

But owing to various reasons the limit of safety in these loans is often overstepped. The principal cause of this is that owing to the supply of milk falling far short of the demand the market price of milk is high nearly all the year round; and therefore every milk-vendor is anxious to secure his share of the supply under as favourable conditions as possible.

Thus he is keen that his supplies —

- (i) be obtained as cheaply as possible;
- (ii) be very regular;
- (iii) be continued even longer than the period stipulated for, preferably at the previous contract rates.

The milk-vendor or the *Halvai* is almost always the creditor of the milkman. Owing to keen competition within his own profession he has even for the simple act of securing the supply got to offer a sum of money in advance

that well-nigh covers all his chattels and other property* of the milk supplier. To secure, however, the other benefits particularly in order to keep his hold over the supplier even longer than agreed upon in the terms of the current contract, the creditor offers an additional sum of money which the milkman, ignorant and needy as he is, readily accepts: But that is not all. In periods of scarcity

of fodder the milkman not only is unable to make any payments in return but has actually to borrow some more money to meet his requirements. Even in ordinary times the *Halvai*, both for fear of losing his client and for making his hold over the supplier more fast, does not insist on the supplier for making regular daily deductions from the value of the milk brought to him. Thus a good deal of debt that is quite uncovered goes on increasing. The Gujars as a class are therefore held fast in the clutches of the milk-vendor or the *Halvai*. Theirs is a state of indebtedness that in view of the repeated fodder famines and the general high level of prices knows no prospect of early redemption. Is there any remedy for it? We shall look at the problem later on.

*It being supposed for the sake of convenience that the milkman offers all his milk to one man only.

CHAPTER II.

MILCH CATTLE.

There are in the city and civil station 5,692 head of milch cattle, out of which 3,995 are cows and 1,697 buffaloes. Corresponding to our division of the cattle-keeping population of the area in three principal classes, e.g., (i) those who keep milch cattle for the sale of their milk to the public, (ii) those who keep them for private use, and (iii) those who keep milch cattle for their own use as well as for making some money out of the sale of a part of their milk, we may sub-divide the numbers of milch cattle as follows:—

	Total No.	(A) kept for public use.	*(B) kept both for private and public use.
Cows	3,995	2,997	†998
Buffaloes...	1,697	982	†715

It will be seen that 75 per cent. of the cows and 58 per cent. of the buffaloes are kept for public use. Again 70 per cent. of the total number of milch cattle inside the city are cows and 30 per cent. are buffaloes.

In strict contrast to this the milk imported into the city from outside is principally that of the buffaloes. On looking more closely into the matter we find that while the greater part of the inside source of supply is used for drinking purposes, the greater part of the outside milk goes to provide the *Halvais* for sweets and other requirements. We shall revert to this point later on.

The animals of class A are generally kept in herds, while those of class B are kept and looked after individually.

Milch Cows.—The prevailing breed of milch cows is the mixed Sahiwal or Montgomery. Of all the cattle-keeping population the Gujars possess the largest number of them. Other castes, especially the Gowalas as also private persons, are indifferent about the breed so long as the cows give good milk. The Hansi breed is very seldom to be seen.

Milch Buffaloes.—The Delhi or Murrah breed is the most common. Here and there one comes across buffaloes that look like the Surti breed, but in most cases these animals are found to be a hybrid embodying the effects of a mixture of the Surti blood in the veins of their Murrah parents.

Milch Cows.—Most of the milch cattle are purchased after they have come in milk. Thus out of 2,997 cows kept by the professional milk-sellers, 2,594, i.e., 86 per cent., had been bought when in milk while only 14 per cent. had been reared out of the herds.

Again from out of 982 buffaloes, 930, i.e., 95 per cent. had been bought and the rest reared locally.

The professionals buy their milch cattle either from the cattle-traders who are constantly pouring into the city or more frequently direct from the cattle-breeders. The cow-breeders inhabit the Ravi bets and the part of the country known as the Ganji Bar; while the buffalo-breeders abound along the banks of Nili (Sutlej) and Ravi. By thus going to the breeder himself, the milk-seller not only gets a more reliable animal but gets it much cheaper.

*Since separate figures for milch cattle kept for both private and public use,—(vide class III of cattle-keepers)—could not be had for some of the quarters of city, the figures for cattle kept for private use only have been added on to them under one and the same column. We may, however, point out that the number belonging to the former class is much less (roughly about 20 per cent.) than the number of the latter class.

†Owing to inclusion of the figures of a statement of a quarter which arrived too late to be considered in a previous estimate, the figures exceed that estimate by 93 under cows and 126 under buffaloes.

Amateur milk-sellers and other persons select their animals out of the herds of the professional milk-sellers who in seasons of sufficiency of fodder are as a rule willing to sell their animals at a remunerative price and in periods of drought are always anxious to dispose of all animals except the minimum strength required to satisfy their creditors.

But although for reasons to be explained later on they are unable to breed many good animals for their own use, yet their breeding arrangements are by no means so unsatisfactory. Of all others the Gujars are the most careful about selecting and breeding good animals. Thus almost all owners of fairly big herds of cows possess bulls of their own. The number of such private cow bulls was 59, *i.e.*, one for every 77 cows kept by the professional milk-sellers, while the number of buffalo-bulls was 15, *i.e.*, one for every 65 buffaloes. They keep all these bulls tethered at their own premises and allow their use either to their own relatives or to a limited few of the public on payment of fees. In almost all cases the cow bulls were high bred Sahiwal and the buffalo-bulls were good Murrah. Almost all of them had been selected with judicious regard to the milking qualities of their parents and other relatives. A few of the offsprings of these bulls could be readily marked out in the herds as being superior to the purchased number. Unfortunately owing to the absence of any milk records and of any material other than mere oral evidence, no figures could be collected.

How strange then that with satisfactory breeding arrangements these people have reared by themselves only a very small percentage of their herds. But let us trace the evil from its beginnings.

✓ (i) *Sucking calves.*—At the outset it should be understood that according to the prevailing custom in this Province every milch animal is as a rule suckled by its calf during the greater part of its lactation period. In the natural course of events therefore we should find at least one sucking calf corresponding to every milch animal. From the figures relating to the professional milk-sellers, however, we find that corresponding to 2,025 cows in milk there were only 1,306 sucking calves while corresponding to 630 buffaloes in milk there were only 261 calves. This means that 56 per cent. of the cows in milk and 73 per cent. of the buffaloes in milk were without any sucking calves. The question naturally arises: what happened to such a large number of calves? The answer is that most of them died of starvation and want of care. The general practice among the Gujars is to allow to the calf only one teat, roughly $\frac{1}{4}$ th of the total milk yield of the mother, for the first forty days, $\frac{1}{2}$ a teat, *i.e.*, $\frac{1}{2}$ th of the total milk for the next month or so, and then to use it simply as an instrument to excite the udder of the mother for sometime more and to do away with it altogether when the mother has gone dry. Taking the average daily milk yield of a cow and a buffalo for two months after coming in calf to be 6 and 8 seers respectively, we see that the Gujars allow to the Cow calves $1\frac{1}{2}$ seers of milk daily for the first 40 days, $\frac{2}{3}$ seer daily during the next 30 days, *i.e.*, for 70 days they allow them only $82\frac{1}{2}$ seers of milk: to Buffalo calves they allow 2 seers of milk daily for the first 40 days 1 seer daily for the next 30 days *i.e.*, for 70 days they allow them 110 seers in all.

The standard of feeding Cow calves in some of the military dairies is:—

	Whole milk.	Separated milk.	Total whole milk.	Total separated milk.
For the 1st week ...	9 lbs. daily ...	...	31½ seers ...	...
" " 2nd " ...	8 " " ...	2 lbs. ...	28 " ...	7 seers.
" " 3rd " ...	7 " " ...	4 " ...	24½ " ...	14 "
" " 4th " ...	6 " " ...	6 " ...	21 " ...	21 "

and so on till they are $2\frac{1}{2}$ months old and consume daily 18 lbs. of separated milk only. By this time they have consumed $136\frac{1}{2}$ seers of whole milk and 315 seers of separated milk.

In the Government dairies.

Even after $2\frac{1}{2}$ months, separated milk is served to them for another 17 weeks at the rate of —

	Daily.	Total separated.
11th week	... 17 lbs. separated milk ...	59½ seers
12th "	... 16 " " " ...	56 "
13th "	... 15 " " " ...	52½ "

and so on till they are a little over 6 months old and have consumed an additional $435\frac{1}{2}$ seers of separated milk.

The total quantities of milk served to the calf during the first 6 months thus are —

Whole milk = $136\frac{1}{2}$ seers. Separated milk = $750\frac{1}{2}$ seers.

We see, therefore, that not only do the Gujars feed their calves for a much shorter period than is necessary, but that they also give them much less than is required to promote their proper development. The result is that their calves remain constantly under-fed and most of them die before they are two months old.

The mortality among buffalo-calves is, as we have already pointed out above, much greater (*viz.*, more than $1\frac{1}{2}$ times as much) than among the cow-calves. It is said that the buffalo-calves are much more susceptible to disease than are the cow-calves. But the fact of the matter is that to starve the buffalo-calves to death is found much less risky than to kill the cow-calves in the same manner. The reason is that the buffalo can much sooner and with much less difficulty than the cow, be induced to yield her full flow of milk without the calf and therefore her calf can be dispensed with sooner than that of the cow.

But the milk-seller does not destroy all the calves, even if he will. For he finds that —

- Some calves that are reared by them.
- (i) a certain number of milch animals would, without the calf, either not yield any milk or tangibly fall off in their yield. He is therefore under the painful necessity of retaining all such calves. The tendency, however, is not to keep such obstinate animals, and to trick some of the remaining by mummies.*
 - (ii) There are some calves that survive in spite of the studied inattention of the milk-sellers.

The calves of these two classes are as a rule disposed of before they are 9 months old.

There is, however, a certain number of calves that the milk-sellers have from the very beginning designed to rear up with more than usual care. They are meant either for sale or for meeting their own requirements. The males are generally reared for sale and the females for meeting their own requirements. But poor and reckless as they are, they do not mind selling even the females. As a matter of fact the difference in the disposal of males and females is only one of degree. As a rule they keep the males only so long as they do not find any purchasers while they retain the females at least till they come in calf. It should, however, be noted that they keep only the better sort of the female calves with themselves while they give out the rest of them on what is known as *Adhyara* system. Under this system the female calf, after it has left sucking its mother and is otherwise fit enough to graze about freely, is removed by a person other than the owner on condition of returning it to the owner at the commencement of her first lactation. An arbitration then settles the price of the animal, of which half is claimed by the owner and the other half by the rearer. The first choice of purchasing is given to the owner, who if he accepts the animal at the price can get it after paying only the remaining half of the price.

The stuffed skins of dead calves.

But as we said, the best class of young calves is looked after by them personally at their own premises. The number of such non-sucking calves below the age of 8 years in the area, was as follows :—

Cows.		Buffaloes.	
Males.	Females.	Males.	Females.
163	253	36	57

We know that the number of milch cattle possessed by the professional milk-sellers in the area was 2,997 cows and 982 buffaloes. The above young calves were therefore proportioned as follows :—

Cows.		Buffaloes.	
Total No. of calves.	Total No. of cows.	Total No. of calves.	Total No. of buffaloes.
	1 : 7		1 : 11
Total No. of female calves.		Total No. of female calves.	
	1 : 12		1 : 17

The salient features of the rearing of calves by Gujars may be summarised as follows :—

- (i) That most of the calves of their milch animals die of starvation before they are two months old, the mortality among the buffalo-calves being higher than among the cow-calves.
- (ii) Most of the living sucking calves are kept out of sheer necessity or helplessness. They are almost always kept underfed and are disposed of before they are 9 months old. Most of these calves are males in the case of cows and females in the case of buffaloes.
- (iii) Only a very small proportion of calves is reared up with some care. The male calves are generally sold out while the females are retained till they have come in calf and their milking qualities can in some measure be ascertained.

We have already referred to the arrangements of breeding among Gujars and other professional cattle-keepers in the area. **Breeding arrangements in general.** The breeding arrangements of other cattle-keepers are much less satisfactory. Intent solely upon seeing their animals in milk they are not very particular as to the breed of their calves. The bulls are selected at random, the main criterion being their handiness. For cows, bulls belonging to the professional cattle-keepers and those that have been let loose by charitably disposed individuals or public bodies are indifferently used. But of these the latter class of bulls is the more important. The number of such bulls in the town was 14, out of which 8 were serviceable and the rest useless. They can be seen patrolling the streets day in and day out, and it is only when any of these bulls cannot be found that the ordinary person seeks the bull of the professional cattle-keeper.

Like so many other things originating in charity in these days most of the young and serviceable bulls are of a poor quality. Only two out of the whole lot of them showed any resemblance to the Sahiwal breed, the rest of them having

been let loose regardless of any breeding virtues. Again, since the guest of everybody is generally neglected, most of these bulls showed poor health and in some cases were actually suffering from some disease.

For buffaloes, the arrangements of breeding are more satisfactory. All the buffalo bulls are in the first place selected with good care and then all of them are kept tethered at a certain place and looked after with more than usual care. The person who requires their services is therefore in a position to exercise a choice among them which he cannot do in the case of the stray cow bulls. Again after any of the buffalo bulls begins to show any signs of emaciation or bad disease, it is either castrated and used for draught purposes or sold to the butcher.

How different to this is the case of the cow bull. The Hindu sentiment tolerates it, nay, worships it to the end of its life, however useless it may be for breeding purposes. We may not quarrel with the Hindu so long as this act of his reflects a sentiment of gratitude for past services. But we cannot refrain from pointing out that much of the deterioration of the cow both in breed and in numbers is due to this sentiment, while the buffalo has attained much of its present superiority in breed and numbers to the absence of it. The interests of good breeding required, and humanity would have approved of the weak and diseased cow bulls being segregated say in some suitable asylums or even rendered totally unfit for breeding purposes.

FOOD SUPPLY.

The question of food for milch cattle in Lahore may well be considered under the following two heads:—

A—Food given by the professional cattle-keepers, and

B—Food given by persons keeping milch cattle for private use only.

✓ The distinction arises mainly owing to two reasons, *viz.*, that while the house-holder does not keep his milch cattle for profit, it is the principal concern of the milkman. Again while the house-holder cares more for the quality, the milkman cares mainly for the quantity of milk.

Accordingly we find that the food given by the milkman is generally deficient in nutrition and actually debilitating. The principal ingredients of the food given by Gujars for instance are—rice husk, gram husk, *Tukkar* (*i.e.*, dried up crumbs of wheaten bread) and some gram. Again the Gowalas are said to feed their cattle upon horse litter after washing the animal refuse out of it.

Persons keeping milch cattle for private use, however, feed them on more nutritive concentrates. Grains such as gram, *moth*, *mash*, barley and oilcakes such as sesamum and cocoanut are all given in suitable proportions along with gram or other husks.

The fodder are practically the same in both the cases. The distribution of fodders over a whole year is as follows:—

Distribution of fodder crops.

Middle of October to middle of January—
Maize and Senji of.

Middle of January to middle of March—Oats, Wheat and Senji.

Middle of March to middle of June—Chari and Bhusa.

Middle of June to middle of October— Grass.

The above sequence, however, holds only if the the rains come in proper season.

Compared with this the distribution of fodders in Government Military Dairy Farms especially in those that possess lands under canal irrigation is :—

*“ October—December	.. Shaftal, lucerne, turnips, oats, French oats, senji, raya and Japan rape.
January	.. Turnips, raya and oats.
February	.. Oats, Japan sarson, raya and senji.
March	.. Wheat, oats, shaftal, senji and lucerne.
April	.. Lucerne, shaftal and oats.
May	.. Shaftal, lucerne, chari, moth and maize.
June to August	.. Grass and maize.
September to October	.. Lucerne, chari, gowara, maize and guinea grass.”

We may, however, add that sufficient green fodder is not available throughout the year. Even ordinarily green fodder is scarce during the later months of winter and during the months of May, June and July. If, however, the rains fail, the scarcity of fodder extends over many months and causes havoc among the cattle. In these periods of scarcity the dry fodder known as Bhoosa alone is served to the milch cattle, with the consequence that their milk yield is lessened. In dairies run on European lines, however, it is supplemented by silages of chari and other green fodders. By doing so these dairies keep up to a great extent the milk yield of their cattle even in periods of scarcity and drought.

With regard to the quantities served to the milch cattle, the professional cattle-keeper follows no particular feeding standard. In serving the concentrates to his wet, in calf, dry and young stocks, he observes a distinction both in the ingredients and quantities given to them. Between his wet stock, however, the discrimination exercised is very small and is based on no scientific principle. The concentrates are doled out of a tub, just before milking, into another vessel containing Bhoosa, and mixed together. But the quantities given to each of the animals except in case of some animals of outstanding merits are almost the same.

But the worst of the matter is that they have no idea of the nutrition required by a wet animal to keep her in full flow of milk. In the first place the foods given by them obey the law of cheapness rather than of utility in nutrition and in the second place the quantities given are much too little to supply the necessary nutrition. Owing to the absence of any uniform practice among them, these quantities cannot be given.

In regard to fodders, however, they are more generous. They feed all their cattle with as much of roughness as is available. As a matter of general practice besides *Botawa* (concentrates mixed with Bhoosa) they serve nothing else at their stalls. After the milking time in the morning they drive their cattle outside to some lands where they have already provided some green fodder for them. Such fodder is generally cut and spread before them all to eat together. But from the time that they drive them back to the stalls in the evening till about the time of driving out in the morning practically no fodder is served to them. Even in periods of scarcity when Bhoosa alone is available, they observe the same practice, spreading Bhoosa instead of the green fodder in some lands outside. By this device the milkman is able to afford some exercise to his milch cattle as well as to give them at least the shadow of an impression of what grazing is like.

From the above we find that the milkman keeps his cattle in the first place underfed and in the second place maintains them on green and succulent fodders and on concentrates some of which, rice husk and

As a whole the food increases the quantity of milk-yield but decreases its quality.

horse litter for instance, are deleterious and most of them are very poor in proteids and fats. Now it has been observed* that the quantity of milk under such conditions is appreciably increased while its quality as judged by the presence of fat and total solids is very low. Such stuff is easily tolerated in a town like Lahore where the demand of milk for drinking purposes within the town limits is much greater than the supply and the quality, even if desired, can seldom be brought in question. The Gujar therefore finds the present method of feeding his milch cattle quite in keeping with his interests to obtain as large a quantity of milk at as low a cost as possible. Effective in its own way the system is open to the serious objection of doing a permanent injury to the cattle as it proves prejudicial to their health. Again in so far as some foods are intended to stimulate

the flow of milk, the milkman by following this system helps to a great extent the forces of decay to set in the animal at a much earlier age. It makes the animal unremunerative sooner than usual.

Accordingly we find him disposing of his animals for their unremunerativeness after they have been with him only for a few lactations.

Owing to the disposal of their milch cattle being due to so many causes other than their unremunerativeness, e.g., sales to *Beoparies* (traders) and other persons for the sake of profit, gifts in marriage and otherwise, rejection owing to disease or an inordinate length of the dry period, etc., etc., even a rough estimate of the average length of time that a milch cattle remained with a Gujar or a Gowala on grounds of its remunerativeness alone could not be made. From general inquiries however it transpired that the average duration was two lactations in the case of cows and four in the case of buffaloes. They generally buy their cows in their first or second lactations and dispose them of after the third or fourth. With respect to cows there is a popular saying amongst them, which goes:—

کڑو چر نیہ کھار اونیہ

meaning that after reaching the fourth lactation the cow is only worth its hide. The buffaloes generally hold longer, from the second or third lactation to the sixth or seventh lactation. From special enquiries instituted it was found that the average ages of the oldest milch cattle in the herds of professional milkman varied as follows:—

Cows	...	...	...	...	...	6 to 10 years.
Buffaloes	...	...	...	...	...	8 to 12 years.

The conduct of the Gujar and other cattle-keepers is not, however, without its justification.

There is after all some justification of the Gujars' conduct.

The question of supplying adequate quantities of food to the milch cattle particularly in Lahore, has gradually assumed the proportions of a vexed problem. Not that there is no food available for them, although in periods of drought when no fodder can be had for love or money even that is true, but that the rise in its prices has been more than proportionate to the rise in the price of milk. The situation has arisen mainly owing to the fact that most of the milkmen in or near about Lahore do not possess lands of their own and therefore have to depend for their fodder supply upon others. To add to the difficulties, most of the lands are *Barani* and even a slight irregularity in rains sets up a scarcity of green fodder. The milkman has therefore to depend for his fodders, firstly, on the choice and means of another person, and secondly, on the caprice of rains. The competition for securing green fodder in the precincts of the city being very keen, prices are generally very high. These prices are generally for only one fodder crop and for one season only and are calculated per kanal of the area.

Add to this the presumption that the milk-yield of the average milch cattle has tangibly gone down and then we can to some extent understand why the professional milkman keeps his milch cattle almost always underfed and

* "The Milk Problem in Indian Cities" by L. L. Joshi, page 30.

without adequate nutrition. Taking Bhoosa to be the staple cattle food, the following figures for the last 7 years may fairly represent the situation :—

* *Statement showing the ruling market wholesale prices of Milk and Bhoosa in Lahore for 1914—1920.*
Incompatibility of the rise in the price of food and the rise in the price of milk.

The prices are all stated in rupees per maund of 40 seers.

	MILK.				BHOOSA.			
	Cows.		Buffaloes.		Price.	Index No.		
	Rs.	A. P.	Index No.	Rs.	A. A.	Index No.		
1914	4	8 0	100	5	8 0	100	0 9 9	100
1915	5	8 0	122	6	12 0	123	0 11 9	121
1916	5	8 0	122	6	12 0	123	1 1 9	132
1917	5	8 0	122	6	12 0	123	1 5 3	218
1918	6	0 0	133	7	8 0	136	1 8 3	249
1919	8	0 0	178	9	8 0	173	1 13 3	300
1920	10	8 0	233	12	8 0	227	2 0 0	323

We see accordingly that the index number of the prices of milk rose during the period by 133 per cent., while the index number for Bhoosa rose by 228 per cent., *i.e.*, by roughly twice as much.

The great disparity between the rise in the price of milk and the rise in the cost of cattle food is, however, only one of the important reasons explaining the present conduct of the town milkman. There are some others which can be appreciated only after we have examined at a later stage his complete cost of production of milk and other matters.

*The prices of milk as well as those of *Bhoosa* have been compiled from the rate tables of the Lahore Tahsil office. The prices of milk, however, have been further compared with the rates entered in the contract papers for the various years of a number of town milk-sellers (*Halevis*), and corrected accordingly.

CHAPTER III.

PRODUCTION AND DISTRIBUTION OF MILK IN LAHORE.

As in most other Indian cities milk is produced and distributed in Lahore under the most insanitary conditions. These conditions were ably described by Lieutenant-Colonel Wilkinson in the course of a paper.* He said "Most of us are familiar *ad nauseam* with examples of much cattle crowded into low, unventilated huts, fed upon garbage and milked in urine-sodden byres. We also know the dirty hovels in which milk is stored, the battered milk vessels cleaned with mud from byres and have seen milk carried long distances in open cans with a wisp of dirty straw floating in it to prevent spillage. We have also had experience of milk obtained from unhealthy animals or shamelessly adulterated with skimmed or churned milk or diluted with water from any filthy source."

The result of such conditions is that milk is often contaminated with various injurious germs such as those of typhoid, cholera, tuberculosis and other diseases. Dr. L. L. Joshi in Chapter IV of his book "The Milk Problem in Indian Cities" has given some interesting results of the bacteriological examination of a number of specimens of milk taken from some of the Indian cities. He then proceeds to locate the causes of the contamination of milk and says, "Ordinarily the real contamination occurs after the milk has left the udder. From the act of milking to the final distribution and consumption of milk, numerous and varied are the possibilities of contamination."† He then describes 18 possible sources of contamination which are:—

(A) During the process of milking—

- (1) Through the mouth of the sucking calf.
- (2) The dirty udders and flanks of the unwashed animal.
- (3) The unwashed hands of the milker.
- (4) The filthy clothing of the milkman.
- (5) The insanitary habits of the milkman, *e.g.*, coughing, sneezing, nose blowing with the fingers, etc.
- (6) Any communicable disease of the milkman, *e.g.*, tuberculosis.
- (7) The filth from the walls, ceiling and the dust-and-dirt-laden air of the cattle stables.
- (8) The dirty milk vessels.
- (9) The faulty water supply.

(B) During transit and distribution through—

- (1) The dust and dirt from the vitiated air of a crowded city street getting into the open or partially covered milk vessels,
- (2) The dirty grass or rags serving as covers of the milk vessels.
- (3) The manner of conveying milk.
- (4) Further adulteration of milk in transit by filthy water,
- (5) The insanitary conditions of the milk shops where milk is exposed for sale in open vessels.
- (6) The frequent handling of milk.
- (7) The filthy habits and customs of the hawker or retailer of milk.
- (8) Careless handling of milk by consumer.
- (9) The house-fly.

He concludes thus:‡ "The presence of *B. coli* and allied organisms in large numbers indicate manurial and other undesirable pollution of milk."

These deplorable conditions are due to a number of causes, chief of them being ignorance and poverty. It is both because the people do not know how harmful it is to produce and distribute the milk in the way they do, and because they, even if aware of the danger, cannot at present find money to introduce the necessary improvements, that these conditions have prevailed.

* Published in *Tribune*, dated 26th April 1912.

† *Ibid* page 50.

‡ *Ibid* page 66.

To dispel ignorance on such matters is obviously the work of educationalists and sanitary authorities. Not much, however, seems to have been achieved by them so far. The sanitary authorities, it is true, have been doing their utmost to ensure a pure supply of milk by carrying out some public improvements in the housing conditions of milch cattle, but so many of the other conditions described above that pertain to the person of the cattle-keepers and of their charge could not be attended to. The chief reason is contained in a characteristic reply that a Gujar once gave to a sanitary inspector. On being asked to make better housing arrangements and provide better food for his milch cattle and cleaner utensils and dress for himself the Gujar said: "Well, sir, we have no objection if the Municipality can afford it for us." Exaggerated though the remark is, in so far as it belittles his own ignorance and emphasises his indigence, it is true in essence. The problem of the improvement of the sanitary and other conditions of the supply of milk is primarily an economic one. It is 'whether production of milk pays or does not pay' that will decide it for better or worse. Dr. Harold Mann in his paper on "The Milk Supply of Poona City,"* after describing the insanitary conditions of the production and distribution of milk, asks "Such being the miserable state the question is what can be done?" and then answers "The question of price is vital. Any attempt to improve sanitary measures which will result in a rise in price of pure milk will be a mistake and the *problem* is, so economising in the production of milk and in the method of its conveyance to the market that it will be possible to impose restrictions in the interests of sanitation without raising the price." The importance of the economic factor underlying these conditions is well brought out by the fact that the extent of adulteration of water which serves as a fruitful source of contamination in milk is up to a great extent dependent upon the price fetched by the milk. The following table compiled from results obtained after examination of a number of samples of milk in the city of Lahore may clearly bear this out:—

Table showing that the amount of adulteration generally varies inversely with the price paid for milk.†

Source of milk.	Rate per seer.	Percentage of adulterated sampls.	Average amount of water added to 100 parts of milk.	REMARKS.
	Rs. A. P.			
Buffaloes	0 3 0	20	5	
	0 2 9	100	7	
	0 2 6	100	13	
Cows	0 3 0	17	5	
	0 2 6	75	9	
	0 2 3	86	10	
	0 2 0	93	20	

The case is similar with other adulterations of milk such as those of separated milk, wheat and maize flour and other starches.

If, however, we go to the very root of the matter and consider why people adulterate, the importance of the economic factor becomes still more evident. A little while ago (see page 20) we had an occasion to point out the great disparity between the change in the prices of milk and of cattle food. We shall presently see that that disparity is even greater if the complete costs of production of milk and its present price are considered. Well, then, ordinarily milk is adulterated up to such an extent as will cover that part of the complete cost of production and distribution which will, at the market rate, have been left

* Dr. Harold Mann's paper—Journal of Dairying for October 1913, page 12.

† Notes on Dairying by Bh. Kartar Singh, L. Ag., page 4 (1914-15).

unrealized. We do not mean, however, that if price and cost of production were to come up close together there would be no adulteration. 'No adulteration' even at the balancing of the forces of demand and supply of milk is a condition of an ideal society or more precisely of a society, hedged in by well-planned and still better administered laws against adulteration, which the milkmen are not. The desire for additional gains on the side of the supplier, coupled with the indifference, poverty and ignorance of the milk-buyers will always, except, perhaps, when the consumer is either well enlightened or is vigilantly looked after by a strong authority, permit of some adulteration. Yet it is certain that the adulteration will be the least under such conditions. But, as it is, the supply falls far short of the demand, *i.e.*, the unsatisfied demand is still great, and so long as that continues, together with the ignorance and poverty of the consumer and absence of any adulteration laws, there must be some way or the other room for plenty of adulterations of milk.

THE PRICE OF MILK IN RELATION TO ITS COST OF PRODUCTION.

The two primary agents of the production of milk are the milch animals and their keepers. And the cost of production of milk is the total price that is paid to them for their services.

General considerations—

In respect of milch animals, we have to consider the prices at which they can be purchased, the cost of their food, housing, treatment, etc. In respect of labour, we have to consider the price payable for the tending and general management of the milch cattle and for the enterprise of the keepers themselves.

We have so far dealt with the cow and the buffalo as being the premier milch animals of this country. No doubt in big cities like Lahore some quantity of milk is obtained from goats also, but in proportion to the total quantity of milk obtained from milch cattle this quantity is almost negligible. Our conclusions, therefore, apply to cows and buffaloes only.

Milch animals

The prices paid for cows and buffaloes are affected by a number of considerations such as their age, breed, general appearance and other attributes, into the details of which it will serve no useful purpose for us here to enter. They are no less affected by conditions of the supply of food for them. Thus all other things being equal, milch cattle are cheaper in periods of drought than under ordinary conditions. Taking all these points into consideration, we find that the prices of these milch animals have changed considerably during the last twenty years. As in so many other matters concerning milch cattle no reliable records of their prices are available. The information furnished by the District Cattle Fair records does not help us much, as the majority of milch cattle sold on these occasions consist of the rejected sort, and their prices are therefore not representative of the prices of good milch animals. The prices paid by the military department for their milch cattle even although a bit too high to be representative can yet afford us an index as to the change that has occurred for the last few years.

Price of cows and buffaloes.

Colonel Matson, the Controller of Military Dairy Farms, Northern Circle, gave the following approximate figures for the prices of milch cattle—

(a) a Montgomery cow with an average yield of 2,800 lbs. per annum could be purchased—

- in 1903 for less than Rs. 70 ;
- in 1905 for about Rs. 85 ;
- in 1908 for about Rs. 100 ;
- in 1911 for about Rs. 98 (a year of famine) ;
- in 1914 for about Rs. 120 ;
- in 1919 for about Rs. 200 ;
- in 1921 for about Rs. 220 ;

(b) a Murrah buffalo with an average yield of 3,500 lbs. per annum—

- in 1903 for about Rs. 80 ;
- in 1908 for about Rs. 110 ;
- in 1911 for about Rs. 100 (a year of famine) ;
- in 1914 for about Rs. 140 ;
- in 1919 for about Rs. 250 ;
- in 1921 for about Rs. 325 ;

and he added that even for these enhanced prices he is at present unable to obtain animals, cows in particular, even half so reliable as those he could get in 1903.

From the above estimate it follows that a cow yielding an average of 8 lbs. daily (2,800 lbs. per annum) costs Rs. 220 and a buffalo yielding 10 lbs. daily (3,500 lbs. per annum) costs Rs. 325. Even allowing for the fact that the prices quoted for the military department may be a bit higher than those ruling in the market, we may say that a first class cow with daily average of 8 lbs. milk costs Rs. 200 and a first class buffalo with an average daily yield of 10 lbs. costs Rs. 300 in Lahore.*

We have already said that the milkman follows no particular feeding standard and feeds his milch cattle on the principle of getting the maximum quantity of milk out of a minimum cost of food. Again, he generally underfeeds his milch cattle. Thus we find according to an experiment conducted in the Lyallpur Agricultural College dairy farm that a cow yielding 12 lbs. of milk every day ate about 15 seers of bhoosa and about 25 seers of green fodder besides grazing during the day time, to continue in full flow of milk. At Lahore, however, it was found that an equally good animal was given about 5 seers of bhoosa besides grazing on green fodder (if available) during the day time. As pointed out in a previous Chapter, the milkman generally tries to give as much green fodder to his animals as is compatible with his resources. Since all his animals are at one and the same time let loose in a field to graze upon the fodder, it is difficult to ascertain the quantity eaten by each of them individually. Yet considering that a kanal of green maize crop which costs them about Rs. 25 in these days (May 1921) is grazed out by 50 cows and by 30 she-buffaloes in a day, we may say that under ordinary conditions they serve Re. 0-8-0 worth of green fodder to a cow and Re. 0-13-0 worth of it to a buffalo per day.

Adding cost of dry fodder (bhoosa) to it at 4 seers to a cow and 8 seers to a buffalo, we find that at the market rate in April 1921 (14 seers per rupee) he serves Re. 0-4-0 worth to a cow and Re. 0-9-0 worth to a buffalo. The total rough cost of fodder (dry and green) served to a cow yielding at the average 4 seers of milk daily and to a buffalo yielding a daily average of 6 seers of milk, therefore, comes to Re. 0-12-0 and Re. 1-6-0, respectively.

We have already said that the principal ingredients of foods served by the professional milkman in the city are rice husk, gram husk, dry crumbs of wheaten bread (*Tukkar*), and barley husk and a little quantity of ground gram. Generally they are fed mixed with bhoosa in different combinations called *Botwa*, the cheapest ingredients, e.g., the husks being common, being served a little previous to and at the time of milking. The quantity served per head, as we already pointed out, follows no particular feeding standard—they vary according to the milk yield of the animal, the resources of the milkman and the price of the ingredients and lastly of the milk itself. The most common average amount served—

(a) to a cow with an average daily yield of 4 seers was—

	Seers.
Phak (rice husk) and gram husk	4
<i>Tukkar</i>	2
Ground gram	$\frac{1}{2}$

which at the market rates of these different commodities could be valued at not more than Re. 0-7-0 a day ;

* We have deliberately confined our estimates to the cases of a Montgomery cow and a Murrah buffalo as they are the prevailing breeds (which is not quite pure) of milch cattle in Lahore.

† The market rates (retail) of these commodities in the week ending 30th June 1921 were per rupee :—

	Seers.
Phak (rice husk)	18
<i>Tukkar</i> (dry crumbs of wheaten bread)	12
Gram husk	9
Ground gram	$5\frac{1}{2}$

(b) to a buffalo with an average yield of 6 seers they give better food—

						Seers.
						8
Phak ..	::	::	::	::	::	4
Tukkar	::	::	::	::	::	2
Ground gram	::	::	::	::	::	

which at the market rate of the different commodities would be valued at no more than Re. 1 a day.

In addition to this the milkman who had contracted with the *Halvais* for valuation of their milk according to the *Khoa* yielded gave oilcake of sesamum,

Thus we find that the total cost of feeding a cow in milk yielding 4 seers a day is—

Rupee 0-12-0 for fodder plus Re. 0-6-0 for concentrates = Re. 1-2-0; and for feeding a buffalo in milk with an average daily yield of 6 seers it is—

Rupee 1-6-0 for fodder plus Re. 0-12-0 for concentrates = Rs. 2-2-0 a day.

We have yet to add to this (i) the cost of labour, (ii) the interest on and depreciation in the value of the animals, and lastly, (iii) the rent of the premises, if hired, or depreciation on the capitalized value of the premises, if owned, where the animals and their keepers live.

As pointed out already the professional milch cattle-keepers employ no extra labour—their herds being limited generally according to their own capacities of management. All the members of the family work. The elderly men milk the cattle, sell their milk and keep their accounts and do the more responsible part of the herd management. Their boys are put on to the actual feeding and tending of the cattle both at the stalls and out in the open. The women are generally in charge of the stores, and collect the cattle dung which is pressed into cakes, and, after drying, is either used as fuel in the household, or sold out in the market.

We find according to an estimate given previously that 2,997 milch cattle are attended to by 779 persons above the age of ten years, which means that 4 milch animals plus their calves are in Lahore looked after by one person. That gives a fair idea of the work that an average professional cattle-keeper has to put in every day.

Even if we consider the cattle-keepers as deserving the wages of unskilled labour, we find that at Lahore they should be allowed at Re. 1-4-0 a day. This means that one milch cattle requires tending at annas 5 a day.

On the whole the professional's milch cattle are very imperfectly housed in the city of Lahore. All round the main city, between the main sewage drain and the old city walls, one finds hosts of milch cattle—cows and buffaloes—all tied and jumbled up together in the open. The cattle-keepers pay a ground rent for the use of these lands to the local municipality. Roughly this rent comes to Re. 0-4-0 per mensem per milch animal. It is only in the months of extreme cold, December and January, and in the rainy season, July and August, that the cattle-keepers hire some premises to protect their cattle from exposure. This adds roughly a charge of Re. 0-2-0 per mensem per animal. The herds inside the city are much more neglected. Almost all the compounds are hired by the cattle-keepers, and in respect of the space allowed per animal suffice it to say that one cannot pass through the herds from one side to the other. In a compound of about 100 feet by 100 feet as many as one hundred and fifty animals were found tethered.

A few cattle-keepers possess premises of their own. In almost all such cases, however, they were found mortgaged with a money-lender, so that the question of computing rent by allowing for depreciation of the value of the premises does not arise at all.

As stated already the price of a first class Montgomery cow with an average daily yield of 8 lbs. would be Rs. 200 and that of a first class Murrah buffalo with a daily average yield of 10 lbs. would be Rs. 300. For a twelve-pound buffalo we may by interpolation say that it would cost Rs. 325 at present,

Interest and depreciation in the value of animals.

Following the system of the military dairies in charging interest on the values of milch cattle at Rs. 10 per cent. per annum we may allow Re. 0-0-9 as interest accruing on the value of a cow yielding eight pounds and Re. 0-1-1 as interest accruing on the value of a buffalo yielding twelve pounds.

Again, according to the military dairies' practice of charging depreciation at 12 per cent. per annum we may allow Re. 0-1-0 on the value of an eight-pound cow and Re. 0-1-8 on the value of a twelve-pound buffalo.

Thus the aggregate interest and depreciation charges in respect of a cow yielding eight pounds, and a buffalo yielding twelve pounds, amount to Re. 0-1-9 and Re. 0-2-9, respectively.

Complete cost of production of milk per day per seer in Lahore, 1921.

Adding all the foregoing cost items we have—

(a) For a cow with an average daily yield of 4 seers (8 lbs)—

	Rs.	A.	P.
Cost of fodder plus feed per day	1	2	0
Cost of labour per day	0	5	0
Cost of interest and depreciation on value of animals per day	0	1	9
Housing per day	0	0	3
Total	1	9	0

Therefore cost of production per seer of cow's milk is about Re. 0-6-3.

(b) For a buffalo with an average daily yield of 6 seers (12 lbs)—

	Rs.	A.	P.
Cost of fodder plus feed per day	2	2	0
Cost of labour per day	0	5	0
Interest and depreciation on the value of animals per day	0	2	9
Housing per day	0	0	3
Total	2	10	0

Therefore cost of production per seer of buffalo's milk is about Re. 0-7-0.

Compared with these the average cost of production of milk per gallon in Great Britain in 1916-17 was 10d. per gallon (*Report on Milk Production in Great Britain*, page 211) or Re. 0-2-0 per seer and in 1919-20 it was about Re. 0-5-0 a seer.

We have not as yet added to these items the cost of maintaining calves and bulls, which for the time being at least are maintained out of the proceeds of the sales of milk of milch cattle. Since the considerations affecting their upkeep are generally other than those of getting milk, we may safely omit them.

The foregoing estimate of the cost of production is for obvious reasons strictly rough. In view of the fact that it was made at a time in the year (February to April 1921) when the forces of demand and supply are comparatively more regular and more representative in their action it may at best be taken as representing the short period supply price of milk in the first half of 1921.

The cost of production of milk is subject to many fluctuations. There are first the seasonal variations. Thus, all other things being equal, it is lowest in the rainy season, July to September, when there is plenty of grass and green fodder, and highest during the dry months of May to July. Then there are the more violent fluctuations due to fodder famine and cattle disease when the cost of maintaining milch cattle gets almost prohibitive.

Last, but not the least, the cost of production of milk is sympathetically affected by the rise in the general level of prices. This change is gradual, but more comprehensive and permanent. Thus, while the seasonal variations and the more violent fluctuations due to famine affect the cost of fodder mainly and pass off in course of time, the rise in the general level of prices may influence all the several items of cost and raise them permanently.

COST OF DISTRIBUTION OF MILK.

Before we pass on to the consideration of the price of milk it seems necessary to consider the costs of distribution of milk and some other relevant matters.

As pointed out at the very beginning, milk in Lahore is supplied through two different sources—the outside and the inside sources. We have already dealt with the outside sources at length.

Inside the city the various agencies for distribution of milk are—

(i) The milch cattle owners. They may be further sub-divided into the following classes :—

- (a) those who distribute the milk at the stalls. To this class belong the Gujars and Gowalas who retail their milk to the individual citizens either for ready cash or on account of contracts called *Bahn*, entered into with them previously ;
- (b) those who deliver the milk at the consumer's door or shop in accordance with previous contracts ;

(c) those who take their animals to be milked in the presence of the consumer.

(ii) The middlemen who are generally called *Halvais* or milk-sellers. Some of them go to the individual stalls to receive the milk every day, while others stay at their shops to receive the milk there. It is all a question of previous arrangements. Generally those who lend money to the cattle-keepers and enter into regular contracts go to the stalls, while others who have to pay ready cash or pay for the milk at short intervals receive the milk at their shops.

From the above it is clear that no costs in particular are incurred for the carriage and distribution of milk inside the city of Lahore. It was found, however, that the remuneration for any trouble taken by the cattle-owner in particular and the *Halvai* in general figured in the prices of milk charged. Thus it was found that milk could be obtained cheaper by half an anna per seer at least if you took delivery of it at the stalls than if you got it through the milkman (generally the milch cattle-owner) or if you got the milch cattle to be milked in your presence. By the way, the milch cattle carried to the doors of the consumers are always cows, never buffaloes. We may say the same about the milk obtained from the *Halvai's* shop.

It must be added, however, that the difference in prices of milk due to costs of distribution is not always so obvious, or we should say seldom so obvious. Very often it appears in the shape of water or adulteration of cheaper milk. Thus the milk received through any middleman at your own house or at the *Halvai's* shop is almost always so adulterated.

To these costs of distribution we have yet to add the amount of milk spilt and spoiled in transit from the milch animal to the consumer. Everybody is familiar with the utensils and receptacles used for the storage, carriage and distribution of milk. They are generally made of brass with narrow mouths and without any protective covering. Accordingly there is first some amount of spillage in the act of milking and then in the act of storage and then in the act of carriage when they use only wisps of straw which permit some trickling down of milk, and finally in the act of distribution with open jars and without any funnels. Cases of spoilage or souring of milk occur frequently in summer, but very seldom in winter. They are generally due to the bad scouring of the storage utensils and the retention of milk in them for long hours.

After all, it is extremely difficult to make even a rough estimate of the total costs of distribution. They seldom figure as a separate item. We have already seen that in the case of milk supplied from outside they are mixed up with the middlemen's profit while in the case of the inside source of supply we find them mixed up either with the middleman's (milk-seller's) profit or with the cost of production of the milch cattle owner,

CHAPTER IV.

DEMAND FOR MILK IN LAHORE.

Although it lies beyond the scope of this paper to consider the forces of demand, yet in so far as in the determination of the price of milk they are as important as the forces of supply, a brief reference to them seems to be called for.

The demand for milk in Lahore is mainly for two purposes—

- (a) *For drinking.*—Milk is one of the most important item of the dietary of the Punjabis, particularly of the Hindus most of whom are vegetarians. But it is *the diet par excellence* of children, invalids, and other sick persons.
- (b) *For making sweets.*—Milk and its various preparations such as curd, butter, ghee and khoa are used in almost all sweets that the Punjabis use.

From enquiries made it was found that more than half of the total daily supply of milk was used for drinking purposes. The greater part of the population of Lahore consists of brain-workers and middle class people and therefore the above conclusion is not improbable.

The following tables* give the available supply of milk per day per head of population in—

(a) Some of the Indian cities :—

Town.	Population in 1921.	Average total daily milk supply.	Available supply per head per day in lbs.
Lahore	257,295 (210,787)	54,796 lbs. (60,114)	0·21 (0·285)
Bombay	1,175,914 (979,445)	6,775 maunds or 1,897,000 lbs. (285,000) lbs.	0·16 (0·27)
Poona	133,165 (117,256)	235 maunds or 6,580 lbs. (25,820)	·05† (0·22)
Calcutta	(596,067)	(240,000) lbs.	(0·26)
Delhi	246,987 (225,471)	Not available. (52,000) lbs.	Not available. (0·23)

(b) In some of the principal towns in foreign countries †—

Town.	Average consumption per day per head of population.
London	0·31 pints or 0·38 lbs.
Glasgow	0·25 pints „ 0·32 lbs.
Edinburgh	0·22 pints „ 0·27 lbs.
Great Britain	0·25 pints „ 0·32 lbs.
New York (U. S. A.)	0·50 pints „ 0·68 lbs.

N.B.—In the above two tables, the standards of weight adopted are—

1 Bombay maund = 28 lbs. (Avoir.)
1 maund (Punjab) = 40 seers.
35 seers = 72 lbs.
8 pints = 10 lbs. = 1 gallon.

* (a) Figures for 1921 for cities other than Lahore were collected by correspondence with the Health Officers of the respective municipalities.

(b) For the sake of comparison figures for 1913-14 (as given by Dr. L. L. Joshi on page 30 of his 'Milk Problems in Indian Cities') are stated within brackets. For the figures for Lahore in 1913-14, I am indebted to Bhai

Kartar Singh's—'Notes on Dairying, page 2.'

† Evidently there is some huge mistake in the estimates about Poona.

‡ The figures are taken from Report on the Production of Milk in Great Britain, 1918.

From these figures it appears that the consumption of liquid milk in Lahore is fairly high as compared with that of most other Indian cities and is considerably low as compared with some of the principal towns in foreign countries.

As we said just now, in the dietary of the Punjabis milk occupies on the whole a very important place. For children, invalids and sick persons it is a necessity of life, while for the rest of the population, vegetarian as most of it is, it may be considered as a most important necessity for efficiency.

Owing, however, to wide differences in the purchasing power of the various classes of society, all persons cannot use as much milk as they will. Thus although the rich and the upper half of the middle classes will perhaps continue using milk according to their requirements even if it became dearer, the working class and the lower half of the middle class can hardly even at present day prices purchase as much milk as they require. For the latter classes, milk is fast becoming an article of comfort which they will very much like to have but the cost is getting almost prohibitive.

But then the working and middle classes form the largest part of the population of Lahore and as such even in their humble way consume the larger part of the total supply of milk. In other words the demand for milk in Lahore is largely dependent upon people who can ill-afford to buy sufficient milk even at the present day prices. Evidently among such people a given fall in the price of milk will correspondingly elicit a larger demand for milk, and conversely a rise in price would restrict the demand still more. We may express it by saying that the demand of milk in Lahore is highly elastic.

On the whole the demand for milk is for a larger and a cheaper supply of milk. The purity of milk, the unhygienic conditions attending its production and distribution, and last but not the least, the lowering of the food value of milk by adulterations are matters of no great concern. And in this particular the problem of milk in India differs from that of the West. For while the importance of the economic factor is not ignored, the principal care of the Western countries has been to improve the hygienic conditions of the production and distribution of milk with a view to safeguard the public health and to fight against the adulterations of milk in so far as they lowered its nutrient value.

A good many causes are responsible for the two different state of affairs but, their discussion will carry us further than the scope of this inquiry. Suffice it to say that in India owing to the richness of buffalo's milk and the comparative ignorance of the people respecting the value of hygiene, the adulterations and dirty conditions have not so far been considered so serious a matter. It is true that the people are now awakening to the benefits of sanitation and purity in the supply of milk, but their helplessness in the matter owing to their increasing backward economic conditions is getting still worse. Truly did somebody say "Pure milk! Yes, we will think of it when we have enough of it."

CHAPTER V. PRICE OF MILK.

In the foregoing pages we have at some length discussed the forces of supply and demand of milk in Lahore. It now remains for us to see their interaction.

To begin with, even although the market of milk has no such organization and regularity about it as we find for instance in the case of staple commodities such as wheat and cotton, yet on the whole the price of milk in the city tends to be competitive. The differences in the selling and purchase rates are very few and are traceable to well defined causes such as ignorance, desire for cleanliness, and superiority of milk obtained in the case of retail, and indebtedness or previous contracts in the case of wholesale prices.

But the period for which competition is operative is much too brief to enable it to work out its full effects. This is due to the various fluctuations to which the price of milk is frequently subject.

There are first the annual variations. They are temporary and may further be sub-divided into—

- (i) regular seasonal fluctuations due to variations in the supply and demand of milk. Thus, all other things being equal, the prices are higher from November to June, and lower from July to October. For instance, while the average market price of cow's milk was Re. 0-4-6 per seer from November 1920 to June 1921, it was Re. 0-4-0 from July to October 1921,
- (ii) the more frequent and irregular variations due to particular occasions such as festivals, particular ceremonies and outbreaks of epidemic diseases like malaria, influenza, etc.

Then there are the more permanent variations whose effect is spread over a long period. They are due to—

- (i) changes in the general standard of living, involving changes in tastes and customs. Thus while tea and coffee have to a considerable extent restricted the demand for milk, a general belief in the nutrient value of milk and other factors have popularised the use of milk.
- (ii) changes in the general level of prices. They affect the price of milk not only directly but also much more indirectly by raising cost of production all over. The change in price due to this factor is slow, but as we shall see presently more certain and permanent than that of any other factor.

On the whole the price of milk in Lahore has been steadily rising for the last twenty years. The change has, however, been particularly marked ever since the beginning of the Great War.

The following table gives the annual average prices (both retail and wholesale) of unboiled milk in Lahore since 1904 :—

Year.	* RETAIL PER SEER.				† WHOLESALE PER MAUND.			
	Cow's.		Buffalo's.		Cow's.		Buffalo's.	
	Rs.	Index No.	Rs.	Index No.	Rs.	Index No.	Rs.	Index No.
1904 ...	0 1 6	100	0 2 0	100	2 8 0	100	3 0 0	100
1914 ...	0 2 3	150	0 2 9	138	4 8 0	180	5 8 0	183
1915 ...	0 2 6	167	0 3 0	150	5 8 0	220	6 13 0	225
1916 ...	0 2 6	167	0 3 0	150	5 8 0	220	6 12 0	225
1917 ...	0 2 9	183	0 3 3	163	5 8 0	220	6 12 0	225
1918 ...	0 3 0	200	0 3 8	175	6 0 0	240	7 8 0	260
1919 ...	0 3 6	233	0 4 0	200	8 0 0	320	9 8 0	316
1920 ...	0 4 0	267	0 4 6	225	10 8 0	420	12 8 0	417
1921 ...	0 5 0	333	0 6 0	300	12 0 0	480	14 0 0	466

These figures have been obtained from the Lahore Tahsil records. (°) and (†). The figures for retail prices are taken from the local Tahsil records while the wholesale prices have been obtained after comparing a number of records of the ...

Thus while the index number for retail prices of milk of cows and buffaloes rose during 1904—1914 by 50 and 38, respectively, it rose by 183 and 162, respectively, between 1914 to 1921 and by 233 and 200, respectively, during the whole period (1904—1921). Again, the index number for wholesale prices of cow's and buffalo's milk rose by 80 and 83 during 1904—1914, while it rose by 300 and 283, respectively, during 1914—1921 and by 380 and 366, respectively, over the whole period (1904—1921).

And now let us pass in a brief review the various causes that have affected the rise in the price of milk. We may divide these causes under the following three heads :—

- (i) Those affecting the cost of production or supply,
- (ii) Those affecting demand, and
- (iii) General causes affecting both supply and demand of milk.

Although no figures for the complete cost of production of milk are available, yet if we refer to the several items of cost we find that there has been a considerable rise in their prices—

*Table showing rise in the cost of production of milk.**

Year.	Bhoosa.	Index No.	Gram.	Index No.	Daily labour on masonry.	Index No.	Average price of a cow yielding 8 lbs. a day.	Index No.
	Rs. A. P.		Rs. A. P.		Rs. A. P.		Rs.	
1904 ..	0 4 3	100	1 6 3	100	0 4 0	100	60	100
1914 ..	0 9 9	229	3 13 0	202	0 10 0	250	120	200
1920 ..	2 0 0	753	5 5 0	382	1 2 0	450	230	367

N.B.—(i) Prices are all retail and are stated in rupees per maund of 40 seers at Lahore.

(ii) For the sake of brevity, we take bhoosa and gram to be the staple cattle foods.

(iii) For the sake of brevity, we take the price of a cow yielding 8 lbs. as representative of the changes that have occurred in the prices of both cows and buffaloes since 1904.

If we compare this table with the foregoing table of prices, we find that the cost of cattle food which is the principal part of the cost of production has risen almost twice as much as the price of milk, while the other items have risen considerably above the retail price of milk.

It must be noted, however, that the rise in the several items of cost is material only if it shows a rise in the cost of production of milk per unit of output. For, supposing in 1904, 100 seers of milk could be obtained from a herd of 20 milch cattle, at a total cost of Re. 0-1-0 per seer. Now, if all other things had continued equal, the present cost of production of milk owing to the rise in prices would have been, say, Re. 0-3-0 a seer. But supposing in the meantime they have increased the strength of their herd to 100 animals, thereby achieving on account of economies of large scale production a saving of Re. 0-1-0 in the cost per seer of milk produced. Nay they go further and through a better selection of their animals and an improvement in their milk strains, increase the average milk yield of their animals from 5 seers in 1904 to 10 seers in 1921 thereby securing a saving of another Re. 0-2-0 of cost per seer. And thus a rise of Re. 0-3-0 per seer in the cost owing to rise in prices has vanished owing to a simultaneous improvement in the organisation and management of the herd.

Not till, therefore, we have recognized that 'other things' such as the organisation of the milk industry as exemplified by increase in the numbers of milch cattle, their management and their improvement, have during the period continued the same, shall we be in a position to appreciate the real value of the rise in the cost of production of milk in Lahore. Before 1914 no effort seems to have been made to investigate into these two important matters about the city of Lahore.

* These figures have been obtained from the Lahore Tahsil records.

According to a milch cattle census carried out by Bhai Kartar Singh, L. Ag.,* there were in 1914 within the municipal limits of Lahore 3,077 milch cows and 1,083 milch buffaloes compared with 2,778 milch cows and 921 milch buffaloes in 1921. This shows a decrease of 299 under milch cows, and 162 under milch buffaloes. The difference is, however, not very material as it is possible that either the numbers in 1921 were through an oversight a bit under-estimated or those in 1914 were a little over-estimated.

And if during 1914—1921 when the rise in the various items of cost of production and in the market price of milk has been so much more than in the previous years, the change in numbers of milch cattle has been so small, it seems safe to conclude that so far as the numbers at least are considered there has not been much change in Lahore since 1904.

More significant than the change in numbers is, however, the variation in the yield of milch cattle. Thus we find that according to Bhai Kartar Singh the average yield of a cow kept at 'sheds for sale' in 1914 was 6.3 lbs., while according to our estimate the yield of a cow similarly kept in 1921 was 3.8 lbs.

Again, according to Bhai Kartar Singh, the average daily yield of a buffalo kept at 'sheds for sale' in 1914 was 7.9 lbs., while according to our estimate the yield of a buffalo kept similarly in 1921 was 7.2 lbs.

Accordingly we find that the average yield of both cows and buffaloes has fallen since 1914, but that of cows has fallen considerably.

It will thus be seen that the effect of these two important changes has been, at least since 1914, to emphasise rather than to wipe off the considerable rise in the various items of cost of production and therefore the conclusion that the supply price of milk, i.e., the cost of production per unit of output has risen considerably during 1914—1921 stands uncontradicted.

And now for the causes of this rise in the supply price. Apart from the rise due to a higher general level of prices which we shall deal with presently, the supply price has been a good deal affected by:—

- (A) Causes which are peculiar to big cities like Lahore. These are—
- (a) an almost exclusive dependence of the cattle-keeping population on purchase of cattle food at extremely dear prices. We have already pointed out that in and about Lahore people purchase fields of fodder crops for the use of their cattle at very dear prices and there is no possibility for them to secure any cheap grazing for their animals.
 - (b) Again, they have to pay much higher prices for housing, labour, money, and for general management of their cattle than the people in the country outside have to.
- (B) Causes that have affected both towns and villages alike. Principal among such causes are—
- (a) Increase in prices of milch cattle due both to shortage in their supply and to the increased cost of rearing them up.
 - (b) Absence of cheap grazing.

We have already referred to the rise in prices of milch cattle in Lahore. Owing, however, to a rise in demand prices of milk accommodating a corresponding increase in the supply price the number of cattle has, as we pointed out just a while ago, not been tangibly affected.

But the increased cost of rearing up milch cattle is perhaps nowhere more patent than in big cities like Lahore. We have in a previous Chapter calculated that in Lahore 56 per cent. of the cows in milk and 73 per cent. of the she-buffaloes in milk are without any sucking calves, and pointed out that the calves are neglected principally because it is found much more expensive and

* Notes on Dairying by Bhai Kartar Singh, page 2.

troublesome to rear calves up to maturity than to find equally good, perhaps better, grown-up animals at a much less price and trouble from the country outside.

We may add, however, that for obvious reasons the cost of rearing up calves in a city supplies no reliable standard on which to judge the rise of prices—and for this matter also we must wait till a later stage.

We mentioned in the section on 'Food supply' in Lahore that there are no lands in or about Lahore that can provide cheap grazing for the town milch cattle. The main reasons obviously are that the lands in question are in much greater demand for building and for the intensive cultivation of food crops.

If we, in accordance with our estimate, substitute 4 lbs. and 6 lbs. for 8 lbs. and 14 lbs. as the respective average daily yields of a cow and a buffalo kept at private stalls, in the calculations made by Bhai Kartar Singh in 1914,* we have—

in 1914 at the average market price of Re. 0-2-6 the total quantity of milk demanded = 27,533 seers, and

in 1921 at the average market price of Re. 0-4-6 the total quantity of milk demanded = 26,637 seers.

Considering that the population of the town of Lahore was 210,271† in 1914 and 257,295 in 1921‡ we have—

in 1914 the average quantity of milk demanded per head of population = .27 lbs. ; and

in 1921 the average quantity of milk demanded per head of population = .21 lbs ;

i.e., a decrease of .06 lbs. per head or 22 per cent. Correspondingly we find an increase of 80 per cent. in the average market price of milk during the same period.

By the way, we may refer to the interesting coincidence of the average demand of milk per head of population having fallen by nearly the same figure as the increase in population during the same period, *i.e.*, by 22 per cent. in both cases.

The principal causes of the decrease in the demand for milk in Lahore have been—

- (i) the decrease in the real wages of the working population and of the lower half of the middle classes who, as we said, are the largest consumers of milk in Lahore.

According to the wages surveys taken in 1912 and 1917 we find that the urban wages rose in 1917 as follows †:—

Class of labourers.	Percentage of increase or decrease at Lahore.
Workers in iron and hardware ..	+ 25
Brass, copper and bell metal workers ..	+ 25
Carpenters ..	+ 13
Masons and builders ..	+ 25
Unskilled labourers ..	+ 29
Average increase ..	+ 23.4

Corresponding to this we find that for the whole of the Punjab (and Lahore should have been almost equally affected) the average price of food-grains in June 1919 as compared with that of December 1912 rose by 154 per cent.§ Thus even although we are unable to give any definite figures for increase in the

* 'Notes on Dairying,' pages 2 and 6.

† *Vide* census figures for 1911 and 1921, respectively.

‡ *Essays on Indian Economic Problems*, by Professor Brij Narain, page 147.

§ *Inquiry into the Rise of Prices*, parag

prices of food-grains in 1917, yet considering that they have risen steadily but continuously, it seems safe to presume that the differences between them and the wages of the labourers, *i.e.*, the decrease in their real wages must have been a good deal.

The effect of this coupled with the corresponding increase in the market price of milk has been to narrow the margin permissible for the purchase of milk.

(ii) The increasing popularity of tea among all classes has still more depressed the demand for milk in Lahore.

The real significance of the general rise of prices is that it has affected any and every commodity not because there has been any corresponding scarcity, not even because of any improvement in their popularity, but simply because certain general but fundamental causes such as rise in the general level of prices all over the world, inflation of prices inside India and a comparative scarcity made the changes inevitable. In actual practice the change worked out first by raising the prices of some commodities owing to some special reasons such as their comparative scarcity or offer of higher prices and by degrees the change spread over the commodities or uses which were closely connected with them.

Such has been the case with the rapid rise in both the retail and wholesale prices of milk.

According to Mr. Datta* in the quinquennium 1895—1899, the rupee prices of milk and ghee rose as compared with the basic period 1890—1894 by 3 per cent.; in the quinquennium 1900—1904 by 12 per cent.; in the quinquennium 1905—1909 by 28 per cent. and in the triennium 1910—1912 by 46 per cent.

We have no official figures on which to base our estimates of rise in the prices of milk and ghee in India after 1912, but in accordance with our estimates (given in previous table) both the retail and wholesale prices of milk rose during 1912—1921 by more than 150 per cent.

Principal among the general causes affecting the cost of production of milk are—

(i) The rise in the price of food-grains.

We find, for instance, that according to the index number of the Commercial Intelligence Department the special index number for food-grains† rose from 100 in 1873 to 189 in 1912, while the general index number rose from 100 to 137 during the same period :—

“ Since 1905, however, the prices of food-grains have risen almost continuously . . . ” The Fiscal Commission appointed in 1910 admitted in its report that “ ‘ up to 1905 the fluctuation in the prices of food-grains and pulses depended largely on the agricultural conditions in India.’ But a sharp and rapid rise of prices began in 1905 which was not always wholly due to unfavourable agricultural conditions . . . (and) the predominant characteristic of which,” according to the Commissioners, “ was the existence of famine prices without famine.”‡

Even since the beginning of the Great War the rise in prices, particularly of food-grains, has been still more marked. Thus we find that the special index number for food-grains rose from 100 in 1912 to 143 in 1917 and to 254 in 1919.§ Compared with the prices in 1894 the special index number rose from 100 to 509.

In the Punjab also there has been a considerable rise in the prices of food.

* *Vide his* “Inquiry into The Rise of Prices.”

† The production and demand of milk and ghee being much more closely connected with the supply and demand of what are technically known as ‘ food-grains,’ we have deliberately emphasised the changes in the prices of food-grains. The food-grains considered were rice, wheat, jawar, bajra, gram, barley and rafi. The index numbers are based on their retail prices.

‡ *Essays on Indian Economic Problems* by Professor Brij Narain, page 91.

§ *Essays on Indian Economic Problems* by Professor Brij Narain, page 145.

grains. We have the following figures* for the rise of prices in food-grains at Hissar for the years 1863 and 1906 :—

Prices are all given in seers per rupee.

	Wheat.	Bailey.	Jowar.	Bajra.	Gram:
1863	28	46	54	54	43
1906	14½	20	18	16	19

In December 1904 and December 1920 the market prices ruling at Lahore were as follows † :—

Prices are given in seers and chhataks per rupee.

	Wheat.		Bajra.		Maize.		Jawar.		Gram.	
	Srs.	Chs.	Srs.	Chs.	Srs.	Chs.	Srs.	Chs.	Srs.	Chs.
1904	20	2	25	10	37	15	32	0	29	0
1920	6	12	6	8	8	0	8	8	7	0

Stating the prices (approximately) in rupees per maund we have :—

Year.	Wheat.		Bajra.		Maize.		Jawar.		Gram.	
	Rs. A. P.	Index No.	Rs. A. P.	Index No.	Rs. A. P.	Index No.	Rs. A. P.	Index No.	Rs. A. P.	Index No.
1868	1 7 0	...	0 12 0	...	...	...	0 12 0	100	0 15 0	...
1904	1 15 3	100	1 9 0	100	1 1 0	100	1 4 0	...	1 6 0	100
1914	...	...	...	...	...	...	...	375	...	...
1920	6 0 0	310 (417) †	6 2 0	392 (517) †	5 0 0	471	4 11 0	(625) †	5 11 0	414 640 †

If the average index number for 1904 is 100,
the " " " " 1920 is 392.
If the " " " " 1868 is 100,
the " " " " 1920 is 625.

This means that Lahore in particular and the Punjab in general have been no less affected by the rise in the prices of food-grains than the other parts of India.

The general cause next in importance is the rise in both the rural and urban wages. Statistics compiled by Mr. Datta in 1912 show " that the wages of every class of wage-earners have risen in rural and urban areas and in the cities much more rapidly than retail prices . . . and that among different classes of wage-earners the unskilled labourers in urban areas have obtained the largest increase."§ Since 1912, wages have risen considerably both in rural and urban areas.

Among the general causes affecting the demand for milk, the principal are the increase in population and the general improvement in the standard of living and the level of prices itself.

Mr. K. L. Datta in his Report of an Inquiry into the Rise of Prices|| points out that "owing to the increase in population and to the general improvement,

* Season and Crop Report, 1906-07.

† Figures from the fortnightly statement of prices ending 15th December in the respective years.

‡ Index number as compared with prices in 1868 is stated within brackets.

§ Essays on Indian Economic Problems by Professor Braj Naran, page 146, and Surveys of Wages in the Punjab, 1912 and 1917.

|| Ibid page 126, paragraph 301.

in the standard of living among all classes, the demand for milk and ghee has on the other hand considerably increased. Most villages can now boast of at least one sweetmeat shop if not more and one has merely to visit one of the village railway stations to be convinced of the increased consumption of ghee and other preparations of milk."

We are unable to deny that there is some truth in Mr. Datta's conclusions when we apply them to the province as a whole and to Lahore in particular. For corresponding to an increase of 80 per cent. in the price of milk in Lahore during 1914—1921 and a phenomenal fall of real wages, the decrease of only 22 per cent. in the demand seems to be rather small. While therefore not admitting that the operation of the two forces has increased the demand for milk, we may recognise that it has been instrumental in arresting the fall in demand up to an appreciable extent.

To summarise our conclusions regarding the rise in prices of milk, particularly since 1904, we find that it is traceable to the following set of causes :—

(A) Causes affecting supply. They may be sub-divided in the following classes :—

(a) Causes affecting rise in the cost of production. They are briefly (i) rise in the prices of milch cattle ; (ii) rise in the cost of feeding them ; (iii) rise in the price of cattle management.

(b) Causes such as the adulterations of water, and of cheap liquids like skimmed and churned milk and of starches that relieve cost of production by obtaining a price for milk higher than it is worth.

(B) Causes affecting the rise in the cost of distribution of milk. They are briefly (i) increased price of distribution ; (ii) wasteful methods of distribution resulting in a considerable loss of milk through spillage and souring ; (iii) profiteering.

(C) Causes affecting demand may be sub-divided into two classes—

(a) those affecting a fall in the demand. They are briefly—

(i) The fall in the real wages of the largest part of the consuming population resulting in the narrowing of the margin of incomes available for consumption of milk.

(ii) The great elasticity of the demand for milk emphasised by the large increase in the price of milk specially during 1914—1921.

(iii) Substitution of tea for milk among all classes of population.

(b) those arresting up to an appreciable extent the fall in demand. They are briefly—

(i) increase in population,

(ii) general improvement in the standard of living of all classes.

But underlying and affecting both the supply and demand of milk more permanently is the rise in the general level of prices, particularly since 1905.

CHAPTER VI.

REMEDIAL MEASURES.

Considering that milk and its various products are a very necessary article of diet for the poor vegetarian Punjabis and that its consumption per head (at least in Lahore) has decreased a good deal since 1914, and that in view of the progressive rise in the price of milk this consumption may be expected to fall still more, it seems important for us to consider how best we can meet the situation.*

There are two alternatives for us (i) either we must so increase the income *per capita* as to make a sufficient consumption of milk at the current prices possible, or (ii) the price of milk should be lowered so as to enable the people with their present means to consume a sufficient quantity of milk.

Evidently it would be most desirable if we could succeed both ways at the same time. But whether or not we will succeed in obtaining an increase in our incomes, a depression in the present price of milk will always be welcome and is urgently and immediately needed. At any rate it is necessary to check the tendency of the price of milk to rise still more and thereby to increase the average consumption.

HOW THE PRICE OF MILK CAN BE LOWERED AND ITS TENDENCY TO RISE STILL FURTHER CHECKED.

Obviously the first and the most important step in the direction is to reduce the cost of production of milk. We have already seen that in Lahore the present cost of production, even according to the crude methods of the Gujars and other cattle-keepers exceeds the market price of milk.

We have therefore to see what economies can and should be affected in the cost of production of milk so as to lower it.

The first suggestion in the direction is that to achieve the largest possible saving in cost, the production of milk should be treated as an industry and carried on the system of large scale production.

Our use of the term 'large scale' is, however, qualified in so far as it refers to enlarged production not only under single management but under co-operative organisation also. What we desire to point out is that the present practice of producing milk from a number of small, but separate, individually owned and mutually repellant groups of milch cattle cannot in the first place admit of all the various economies that can be affected, and in the second place cannot admit them in a measure that can be ascribed to large production under single management or under co-operative organization. We will try to bring out this point as we go on.

In respect of the supply of milk in Lahore, we have to consider two sources.

We have already seen that milk inside the city of Lahore is supplied—

Inside sources.

- (a) mostly by the professional milch cattle-keepers, such as the Gujars, Gowalas and other people ;
- (b) partly by dairies (i) who keep their own milch cattle such as 'The Danapur and Mozang Dairies' and (ii) who take milk from the professional cattle-keepers on contract such as the 'Dal-housie' and 'Lahore Dairies' ;
- (c) partly, by the professional milk-sellers known as *Halvais* (i) who keep their own milch cattle ; (ii) who take milk on contract from the professional cattle-keepers.

Outside sources.

The large part of the daily supply is, however, received from villages lying about Lahore.

Both inside and outside Lahore, however, the typical producer of milk is the Gujar or the Gowala of whose methods we have said so much in the previous pages, and will now say something more.

* Improvement of the sanitary conditions under which milk is being produced also requires solution. But the question of price is vital. No measures that will improve cleanliness but raise price can possibly succeed, and therefore in view of the economic nature of this inquiry considerations relating to price of milk will occupy our attention almost exclusively in the subsequent pages.

Food.—By far the heaviest item in the cost of production of milk is food. The following points characterize the food supplied to milch cattle in Lahore—

Economies in the cost of production of milk.

- (i) Being a dairy man pure and simple and not a farmer the town milkman has to purchase all the fodders and concentrated foods for his cattle at the enhanced prices obtaining in the city, and is unable to secure any decent grazing, free or otherwise, for his cattle.
- (ii) With a view to affect some saving the town milkman generally underfeeds his animals, specially the dry stock. Very often, to stimulate production of milk, he actually administers deleterious foods to his wet animals. On the whole he employs no particular feeding standard for his milch cattle.

Milch cattle.—The selection of the dairy stock is not happy: at least it is not suited to the requirements of a profitable dairy business in the town. Thus the average yield of milch cattle in Lahore is very low. According to our estimates a good average for a cow in Lahore was 6 lbs. a day or 950 lbs. per lactation with an interval between the two succeeding calving periods varying from 12 to 16 months. Correspondingly a good average for a buffalo was 10 lbs. a day or 2,000 lbs. per lactation with an interval between the two succeeding periods varying from 16 to 20 months.

On inquiry from a number of milch cattle-keepers, however, it was found that the yield of the milch cattle purchased from the country outside was sufficiently high in the beginning, but deteriorated during subsequent lactations,* and considering that the milch cattle in Lahore are almost always insufficiently fed or fed on deleterious foods and above all are kept in unnatural conditions and under a faulty management we think the conclusion that in Lahore there is a progressive decrease in the yield of milch cattle seems a very likely one.†

The price of labour, rents and interest are all very high in Lahore, and raise the cost of production of milk still further.

To realise, however, the full significance of the high cost of production of milk in Lahore, we must find it in relation to a unit of milk. For the sake of convenience, we will find out the cost of production per pound of milk in Lahore.

Taking ten annas to be the lowest average cost per day of feeding a milch cow at Lahore, we find that during 14 months, *i.e.*, till she calves again, she will consume about Rs. 315 worth, and produce a total quantity of 950 lbs. only. This means that a good cow in Lahore produces 1 lb. of milk at a cost of about annas 5, while the market price of cows' milk is Re. 0-2-3 a lb.

Again, taking Re. 1 to be the average cost per day of feeding a buffalo, we find that during 18 months a buffalo will consume Rs. 540 worth but produce a total quantity of 2,000 lbs. This means that a good buffalo in Lahore produces 1 lb. of milk at a cost of about Re. 0-4-0, while the market price of buffaloes' milk is Re. 0-2-6 a lb.

Compared with these figures the average cost of production per pound of cow's milk ($\frac{1}{2}$ in America is taken at a dollar per 100 lbs. or roughly an anna a seer (about 2 lbs.). For one herd of 34 cows of which extraordinarily detailed figures were kept, the average cost taken over a year was 2.26 cents per quart, or rather less than an anna a seer, in spite of the fact that 56.3 per cent. of the feed was purchased and only 43.7 per cent. grown on the farm. This cost includes labour, interest and depreciation. In another case in which a careful record of a herd varying from 23 to 31 cows was kept for 7 years, the average cost calculated in the same manner was 2.37 cents per quart or about an anna a seer and in this case, too, more than half of the feed was purchased. In the former case the average yield per cow per day was about $9\frac{1}{2}$ seers and it was slightly under 9 seers in the second. The ordinary wholesale price of milk in America is taken $3\frac{1}{2}$ cents a quart or slightly less than $1\frac{1}{2}$ annas a seer and this is said to yield a good profit.

* Owing to absence of any milk records I was unable to find any figures to substantiate this conclusion but as the matter was very important, it was inquired into verbally.

† Also compare conclusions *re.* demand of milk on page 23.

' In the Argentine the wholesale price is stated as 2½d. a gallon or about an anna a seer.....' * Even after allowing for the rise in cost of production of milk during the years that have elapsed, since the figures were taken we find that the Western countries are able to produce milk much cheaper than ourselves.

The worst feature of our present day production is, however, that we are producing milk at a loss.

How then can the situation be helped? It goes without saying that feed and labour, the principal items of the cost of production of milk, are both cheaper in the Punjab than in other countries that produce cheap milk. How then can we account for the great difference in the cost of production of milk per pound?

The difference primarily lies in the low milking capacities of our milch cattle. From the foregoing calculations it is evident that if the average yield per lactation of our cows could be increased, say five times as much, and the yield of the buffaloes four times as much, the cost per pound of milk would be reduced to an anna.

The next question is whether it can be done. The experience of the military dairies is that with careful selection and regularity of feeding, our best breeds both of cows and buffaloes are capable of great improvement.

The following table, which we owe to the courtesy of the Manager, Ferozepore Military Dairy, shows what can be done to improve the milk yield of Montgomery cows and the Murrah she-buffaloes:—

Years.	NUMBER OF COWS CONSIDERED.		DAILY AVERAGE YIELD PER COW, IN LBS.		NUMBER OF BUFFALOES CONSIDERED.		DAILY AVERAGE YIELD PER BUFFALO, IN LBS.	
	In milk.	Herd.	In milk.	Over all.	In milk.	Herd.	In milk.	Over all.
1912-13	47	94	10.4	5.3	39	63	10.5	6.2
1913-14	30	72	11.2	5.5	49	75	9.0	6.5
1914-15	35	69	11.5	5.8	30	59	14.1	7.2
1915-16	42	61	12.9	6.2	32	46	12.5	8.7
1916-17	30	42	12.9	9.2	21	33	13.3	8.7
1917-18	40	52	12.6	9.8	40	50	13.8	10.9
1918-19	39	55	14.8	10.6	43	67	14.0	8.9
1919-20	51	67	14.7	11.5	58	85	13.4	9.4
1920-21	51	69	15.0	11.5	54	80	15.1	10.0

These figures show that the average yield over all the herd increased from 5.3 lbs. in 1912-13 to 11.5 lbs. in 1920-21 in the case of cows, and from 6.2 lbs. to 10.0 lbs. in the case of buffaloes.

Incidentally the figures also show two more important results, that (a) as a dairy animal, the cow is capable of greater improvement than the buffalo; and, (b) that for evident differences in the costs of feeding and tending a cow and a buffalo, the cow can be a much cheaper dairy animal than the buffalo.

But after all we must admit that there is a limit beyond which improvement in the milk yield of a particular breed cannot be carried. We have it on the authority of Colonel Matson, that inter-breeding of the indigenous breeds with imported bulls, particularly of the Ayrshire breed, is even at present showing good results and it is expected that in course of time it is likely to produce animals that will be much superior milkers than any of the native breeds are. In the

* Paper on Milk-supply by C. F. Payne, Chairman, Calcutta Corporation, December 1917.

following statement taken from the Karnal Military Dairy Farm, the yields of pure-bred cows are compared with those of the cross-bred :—

Statement comparing the yields of Milk of cross-bred daughters with those of their pure-breed dams.

Breed.	Name of daughter.	Yield.	Dam.	Breed.	Yield.
Har x Fr = $\frac{1}{2}$ Eurp.	Dick ...	lbs.	Dakni ..	Hariana	lbs.
		5,591			4,285 $\frac{1}{2}$
		6,074			2,577
					2,548 $\frac{1}{2}$
					2,726 $\frac{1}{2}$
Har x Sah x Ayr = $\frac{1}{2}$ Eurp.	Seadale ...	3,794	Dularia ...	Har x Sah ...	2,255
		4,386			2,682
		4,986 $\frac{1}{2}$			1,429 $\frac{1}{2}$
		5,654			
		3,997 $\frac{1}{2}$			
Sah x Fr = $\frac{1}{2}$ Eurp.	Piebald ...	4,944	Piebald ...	Sahiwal ...	298
		4,546			1,492
		7,554			25
Har x Fr = $\frac{1}{2}$ Eurp.	Snow ..	8,152	Snowdrop ...	Hariana ..	148
		7,420 $\frac{1}{2}$			2,420
					4,069 $\frac{1}{2}$
					2,565
Har x Fr = $\frac{1}{2}$ Eurp.	Shamrock ...	8,221 $\frac{1}{2}$	Phylis ...	Hariana ...	3,826
					3,446
					3,902
					4,085 $\frac{1}{2}$
					2,766

Whatever we may say of these experiments, it is quite clear that improvement in the average milk yield of our milch cattle is absolutely necessary before we can imagine even an iota of decrease in the present cost of production of milk.

Besides the inherited qualities of a breed the average daily yield of milk depends on—

- (a) the length of the lactation period ;
- (b) the length of the dry period—obviously the most profitable dairy animals have the longest wet period with the shortest dry period. And we may here point out that our milch cattle must be made to have a much shorter dry period than they at present have, while the wet period should also be lengthened ;
- (c) the regulation of the calving period. It was found in Lahore that the calving periods of milch cattle were as a rule irregular. It is quite evident that till they are regularised, it is very difficult to make the dairy business pay ;
- (d) selection of the dairy bulls. We have in a previous chapter referred at length to the case of breeding bulls in Lahore. As has been said ' the bull is half the herd ' and therefore a better selection of dairy bulls is one of the most important conditions of an improved average yield of milk of our milch cattle ;
- (e) rearing the calves, particularly the rearing of what is called the dairy heifer. In a previous chapter we have referred to the conditions under which calves and heifers are reared up in Lahore. Needless to say, the conditions and methods are both crude and inefficient. As a matter of fact, it is idle to expect people attending to the heifers while they are unable to attend properly even to their more immediately remunerative milch cattle ;
- (f) herd management. This includes consideration of their housing and tending arrangements. As has been pointed out already,

the animals in the city are very often neglected and are kept in unnatural conditions with very insufficient accommodation. This reacts unfavourably on their production of milk.

Last, but not the least, it depends on a sufficiency of suitable food. The importance of food in the production of milk cannot be too much emphasised. We have just said that in Lahore the yield of milch cattle decreases during successive lactations. The principal reasons are improper and insufficient food. We may safely ignore the want of definite figures in this case, because once we admit that the milch cattle are insufficiently and improperly fed, their subsequent deterioration becomes a matter of course.

It is a problem whether the sufficiency of food should come first or the improvement in the breeds of milch cattle. We may, at first sight, say that sufficiency of food is of primary importance, for how can even the better breeds continue if there is not sufficient food for them. But no, the sufficiency of food is almost wholly dependent upon the question of price. There is seldom any famine of cattle food but frequently the prices of cattle food are much too dear to permit of enough food being purchased for the low-yielding milch cattle. It is not too much to say that for animals of high yields, in so far as the return from the sale of their milk will be large enough, food even at the present-day high prices can be found and will be found.

The question is, however, different, if we were to think of the gradual transition of the present low-yielding animals to milch cattle of a superior yield. For here 'food' comes first. It is evident that sufficient and proper food would in all probability prevent any further deterioration of the present breed of milch cattle, and therefore as a condition of their subsequent improvement, a sufficient supply of food is necessary just now to preserve them.

Unfortunately, however, all economic motives are against this theory. For, to preserve the present low-yielding animals, we must continue suffering a loss of money till a breed with improved yield is forthcoming. Public bodies and charitable institutions may undertake such a venture, but the average man in the street would not.

On the whole, the questions of sufficiency of food and of the improvement of the breed of cattle act and react upon each other. Thus the improvement in the breed of milch cattle cannot be permanently affected if there is not sufficient food, while sufficient food cannot be had if the yield is too low to afford it and unless therefore there is an improvement in the breed of milch cattle.

To conclude, in order to make our production of milk remunerative, we must make efforts so to develop our milch cattle as to produce the maximum quantity of milk at a minimum cost. We stand in urgent need of a 'dairy animal' and not of a mere cow or a buffalo. It should be remembered that this 'dairy animal' is largely a creature of our own making. Nature made milk for the calf, but human effort increased it by various means so that now milk from the animal is to be had far in excess of the requirements of the calf.

The milch cattle in India have, unlike the Western countries, not been treated owing to certain prejudices, as regular milk-producing machines. It is high time that they should be considered as such.

Better utilisation of manure is another economy to be secured. According to Eckles* 'generally 16·5 per cent. of the fertilizing value of food is taken up by milk and the rest finds its way back to the soil. If skimmed milk were retained, no manurial value is lost. . . . Again 'urine of animals contains by far the most valuable fertilizing constituents of the excreta. It is about 63 per cent. of the manurial value of the excreta.

On the other hand, we find that in Lahore a considerable portion of the dung is made into cakes and sold as fuel. Only a comparatively small part of the animal dung mixed with straw is stored up for fertilizing purposes. But almost the whole of the animal urine is either allowed to be soaked up in the kacha floors of the stalls or drained out or is otherwise wasted.

Further economies relate more to the distribution than to the production side of milk. Thus, for instance, an introduction of better protected, tinned

* In his "Dairy Cattle and Milk Production."

and scoured utensils is needed to avoid wastage of milk through spillage and souring.

A few general remarks may be offered on the question of milch cattle mortality. There are two aspects of this question—the economic and the religious. We are here concerned mainly with the economic side of milk supply, and will therefore treat the religious aspect only incidentally.

Mortality of cattle may be considered under two heads (a) mortality through slaughter, and (b) mortality through diseases. We have no figures for mortality through diseases and will therefore treat only mortality through slaughter.

The following figures are available about the slaughter of milch cattle within the Municipal limits of Lahore* :—

Year.	Cows.	Buffaloes.	Total.
1915	6,935	3,833	10,768
1916	8,022	3,026	11,048
1917	5,591	5,754	11,345
1918	6,465	5,543	12,008
1919	9,505	4,306	13,811
1920	7,952	4,654	12,606

According to Resolution No. 262 of the Lahore Municipality meeting, dated 9th October 1920, the following paragraph was added to the bye-law regulating the slaughter of milch cattle within the Municipal limits :—

‘ That no cow which gives milk nor any calf up to the age of 3 years shall be slaughtered in any of the slaughter-houses within the Municipal limits of Lahore.’

Accordingly ever since 1920-21 no milch cow or calf is slaughtered in Lahore. Among the animals now offered for slaughter were found—cows and she-buffaloes suffering from diseases, particularly those of the udder, buffalo calves, oxen and male buffaloes. Again on the whole it was found that more animals were slaughtered in winter than in summer.

The principal causes affecting slaughter of cattle in Lahore are the following :—

- (i) Prices of hides. This is said to be the principal reason—the slaughter increasing with the rise in prices of hides. In the following table the wholesale prices of cow-hides are compared with the slaughter of cows (figures already stated) :—

Year.	Wholesale price of cow-hides at Lahore.	Slaughter of cows and calves.		
		Rs.	A. P.	
1915	...	37	8 0	6,935
1916	...	40	8 0	8,022
1917	...	Not available.		...
1918	...	36	0 0	6,465
1919	...	34	0 0	9,505
1920	...	30	0 0	7,952

From these figures it appears that there is a direct relation of the prices of cow-hides to the slaughter of cows. The slaughter increased in 1919 because of the higher prices of cow-hides available in America and of the acute scarcity of fodder felt in 1918-19 owing to failure of rains, which made the cattle very cheap.

- (ii) Prices of dried meat, bones, blood and fat. There is from Lahore a good export of dried meat, specially of buffalo, to Burma and foreign countries. Bones and fats are also largely exported. Their prices naturally affect the slaughter of cattle.

- (iii) In respect of consumption of beef, the principal factors are (1) the demand of Europeans, Anglo-Indians, Muhammadans and other

* Lahore Municipality Slaughter-House Returns.

meat-eating classes. The second factor is the price of goat meat and mutton—the beef increasing in demand when the goat meat is scarce and *vice versa*. This is because the poor Muhammadans form the largest portion of the meat-eating public in Lahore and for them cheapness is the main consideration. Thus, for instance when the retail price of goat meat rose from Re. 0-5-0 per seer in 1915 to Re. 0-12-0 per seer in 1920-21 and good beef could be had at Re. 0-6-0 per seer, the poor sort were inclined evidently to substitute beef for goat's meat in their meat requirements. The effect of this factor is comparatively minor to that of the prices of hides, dried meat and bones, but is appreciable enough to be noticed here.

Underlying and governing all these various causes is, however, the one economic, namely, that in respect of certain animals it pays better to slaughter them than to keep them living. No animal is slaughtered that will, while living, be a source of greater profit. The only exception to this rule occurs in times of scarcity when even useful animals, for want of fodder, have to be sold to the butchers. In its application to Lahore, this rule stands on a much safer footing than the same obtaining in other big cities like Bombay and Calcutta. For, the Gujars, and Gowalas in Lahore very seldom sell their dry milch cattle to the butcher, not at least so soon as the cattle-keepers of Bombay and Calcutta do.* Instead they send their dry stock either for grazing in the country outside or sell them to the *Beoparies* (cattle-dealers). As a matter of fact, most of the animals slaughtered are imported from the country outside.

To proceed with the principal cause underlying slaughter. It is estimated that an average cow with the butcher yields about 1½ maund of beef valuing Rs. 20 or so, a hide weighing at the average about 4 seers, valuing Rs. 3-8-0 and bones, blood, gut and fat valuing about Rs. 6 or so. Thus the butcher obtains about Rs. 30 from an average cow of the slaughter-house which he can purchase for about Rs. 25 or so.

Except, therefore, in times of scarcity there is generally no indiscriminate slaughter of milch cattle in Lahore. Instead the slaughter is based on economic reasons that actuate an average sensible man in the street. Our conclusion, with respect to slaughter of milch cattle in Lahore, therefore, is that it has no effect on the milk supply.

In its bearing on the cost of production of milk, however, the slaughter of milch cattle in so far as it is confined in Lahore mainly to the comparatively useless ones has a healthy effect, for it makes so many useless cattle less to feed upon the earnings of the useful ones.

The case of mortality through disease in so far as it affects the useful and the useless equally stands on a better footing. There is a clear case for preventing it as fully as we can.

We may also in passing refer to another important matter, *viz.*, the export of milch cattle from Lahore. In the months of Sawan, Bhadon, Asuj and Katik and again in Baisakh, *i.e.*, August, September, October, November and April-May, cattle-dealers pour in in large numbers and buy dairy stock, mainly cows in calf, for sending them to the other chief towns of India and principally to Calcutta and Bombay. No figures of the number thus exported are available, yet these sales are acknowledged by the cattle-keepers. After all, the sales for export at Lahore constitute only a portion of the greater export of milch cattle made annually from the Punjab on the occasions of principal cattle fairs like the *Baisakhi* fair at Amritsar and others.

In view of the facts that most of the animals exported are of the very fine type and that there exist at present no provision for filling their places suitably, the effect of exports on the cost of production is naturally injurious.

Various remedies have been from time to time suggested and tried in Lahore to ensure a cheaper and purer supply of milk.

Remedies already tried.

*It is authoritatively stated that most of the cattle-keepers in Bombay and Calcutta sell their dairy stock to the butcher as soon as they are dry.

*In March 1909 five gentlemen under the lead of a European dairy expert applied for a plot of land measuring from two to three thousand acres situated within easy reach of Lahore for (a) grazing milch cattle, (b) raising fodder for them and housing them. They offered to form a limited dairy concern for supplying pure milk and butter to Lahore especially to the European population.

In response to this and for the benefit of any further applicants the Government decided to set apart for this purpose a plot of 1,846 acres called 'Rakh Chandrai' about 12 miles away from Lahore. For irrigating this land, a *rajbaha* passed across its whole length.

Owing, however, to the early demise of the European gentleman, the scheme fell through.

In 1913, the Lahore Municipality resolved to raise a loan of a lac of rupees for the purpose of starting a model dairy farm near Lahore. They recognised, however, that it would be much better to leave such an enterprise to be made by some private agency and further appealed to Government for the provision of grazing at nominal or concession rates.

In supersession of this, but following close in the spirit of the resolution, a Syndicate called the 'Lahore Dairy Syndicate' consisting of four well-to-do citizens of Lahore was formed in 1913 and after considerable correspondence Rakh Chandrai was leased out to them on certain conditions and they began their work in 1915. The objects of this Syndicate were in substance the same as those of the applicants of 1909. To make a long story short, the Syndicate failed to fulfil the conditions of lease prescribed by the Government principally because they got practically no canal water for irrigating their lands.

Accordingly in 1919 the Government resumed possession of the lands. On the termination of this lease in 1920, the land was again asked for purposes of dairying. The following were the chief proposals :—

- (i) Certain individuals offering to run a dairy on a large scale.
- (ii) Certain individuals offering to run a dairy on a co-operative basis.
- (iii) A proposal to open a joint dairy farm for Schools and Colleges under supervision of a Committee of their heads.
- (iv) A proposal to start a dairy under the general charge of the Principal, Veterinary College, and under the direct supervision of a European to serve as a model for veterinary students and to supply good milk and butter for College and School boarders. In this connection a rough estimate of a dairy consisting of 200 cows in full flow of milk was added by Colonel Walker, Principal, Punjab Veterinary College, Lahore.

The lease of Rakh Chandrai was, however, given to two individuals of considerable experience in dairying.† They have at present (March 1921) 89 cows and 85 buffaloes of their own and 24 cows and 111 buffaloes purchased by them, but made over to the Gujars who look after them and return the value in milk. The milk is brought to Lahore for operation by machinery.

The Lahore Municipality has also been zealously trying to organise means for supply of milk in Lahore at cheap rates and in pure condition.

We have already referred to their Resolution in 1913. Again in accordance with their resolution of 9th October 1920, they (a) prohibited the slaughter of milch cows and calves within the municipal limits and (b) requested local Government for sanction of 100 squares of land near Lahore 'for rearing and grazing of milch cattle and for establishment of a municipal dairy to meet the growing demand of Lahore people for the supply of milk at cheaper rates than is obtainable at present'. Unfortunately the demand for 100 squares of land was not acceded to by the Government.

In addition to this, the Health Department has by a system of licenses to milk vendors and other measures considerably improved the sanitary conditions attending the production and distribution of milk in Lahore:

* The material for this section was gathered from the records of Darogha, Nazul lands, Lahore, with the permission of the Deputy Commissioner.

† I understand that the scheme has since fallen through.

Although not carried out to a successful end, yet these schemes give us a clue to what is required at Lahore. Thus the repeated demand for land for dairying purposes, on the outskirts of the city proper, shows the widespread belief that cheap milk can be produced only outside the city and not inside. This fact has been recognised by persons like Colonel Matson, Dr. L. L. Joshi, Dr. Harold Mann and others who have closely inquired into the conditions governing the supply of milk in Indian towns.

The advantages claimed for supplies of milk from outside are—

- (i) a sure reduction in the various items of cost specially in the food cost ;
- (ii) better housing and other conditions of cattle-management.

The only objections urged against it are : that the cost of transit may be prohibitive and the delay in bringing the supplies of milk to the city may involve, particularly in summer, a good deal of waste. Evidently these objections can be met by shortening distance and pasteurization of milk.

As a matter of fact, milk in almost all the densely populated countries of Europe and America is brought to the towns from the country outside. Not long ago, in Europe, milkmen used to keep their cows in towns and the main reason why they moved outside was because it was profitable to do so.

We, therefore, reach the conclusion that in order to cheapen milk we must arrange to get the supply of milk, at least the largest part of it, from the country outside.

The various schemes suggested in this connection are—

- (i) the wholesale removal of the Gujars or the town milkmen outside the city precincts.

The experiment has been tried at various places in India, e.g., at Nagpur Benares, Allahabad, Lucknow and other cities, where the Gowalas have been formed into co-operative dairy societies. In the Punjab the experiment has been tried at Gurdaspur where the Gujars have been organised into a co-operative dairy society known as the ' Behrampur Co-operative Milk Society, Limited.'

On the whole, the results have not so far been very encouraging. The principal difficulties in the way have been—

- (i) The inertia of the town milkman in leaving his traditional home in the city with a doubtful hope of finding better conditions outside.
- (ii) Their huge liabilities, that must be discharged before they can move out. Obviously to enable good numbers of them to go out of the city, money for meeting this enormous initial expenditure must be found.
- (iii) Difficulty of finding enough land just near about the city to accommodate them and their cattle and to permit of cheap grazing.
- (iv) The cost of carriage of milk in their primitive fashion comes to a good deal and will have to be reduced.
- (v) The absence of a real co-operative spirit amongst them.

Perhaps the greatest difficulty of the town milkman is his habit of believing things after their value has been tested by a practical demonstration. And therefore as a condition precedent to the Gujars either changing their methods or profiting by their removal outside, the comparative advantage of producing milk outside must be practically demonstrated to them.

There are two ways of doing this. One is by the opening of a Municipal dairy farm on a large scale somewhere near in the country outside, and the other is by carrying out the same object by private enterprise, say, by the floatation of a dairy company. The idea of a Municipal dairy farm is open to many objections, the principal among them being the one common to all State enterprises

namely, the absence of the driving force of individual interest and competition. The floating of dairy companies like those already contemplated in Lahore is to be strongly advocated. But as the experience in Lahore has shown, no such enterprise can succeed without the active and encouraging help of the State. As a matter of fact, the dairying industry in this country is at present at a stage where financing by the State on the system of guaranteeing a minimum percentage of return on the total outlay is urgently needed.

In helping to oust the town milkman, care will have to be taken that the change does not merely increase his opportunities of carrying on his business in the objectionable ways that he is at present doing inside the city. For this, some legislation such as the introduction of some necessary precautions to be observed in the production and sale of milk, may be quite necessary.

Even if all the various material difficulties were overcome, and the town milkmen were persuaded to migrate outside the city, it is in our opinion still very problematical whether the change would be justified by the results. In fact, to induce them to go out of the city as they are—uneducated, disunited and without any grounding in the higher organization of the dairy business—will either put a premium on their inefficiency and malpractices, or what is more certain make their indebtedness still more chronic and their fate more pitiable.

From the experience of the Western countries, particularly of Denmark, it appears that dairying in order to be a profitable business should not only be carried on in the country outside but should have besides the following facilities :—

(i) A highly improved breed of dairy animal. We have in previous pages said much about the low yield of our milch animals. To run the dairy business we must have an animal whose yield will make it worth while to incur its cost of keeping. For this purpose as we have said proper selection and breeding with high class indigenous or foreign bulls and the introduction of proper milk records would be quite necessary.

The selection and improvement of the dairy animal.

As it is, we have to consider the relative merits of the cow and the buffalo as a dairy animal. As has been ably brought out by Bhai Kartar Singh* the cow is a more economical producer of milk, while the buffalo can produce butter-fat more cheaply than the cow. If the present régime of indiscriminate breeding and neglect of the cow and the comparatively more careful handling of the buffalo cannot but continue, the chances are clearly in favour of the buffalo being in the future our dairy animal *par excellence*. If, however, people were to realise early that the cow, as we pointed out in connection with the Ferozepore dairy figures, is capable of much greater improvement than the buffalo, there may yet be chances for the cow.

(ii) *State help*.—In this connection a brief mention may be made of the interest taken by the Government in improving the quality of milch cattle in the Punjab.

In his note on 'Cattle-breeding in the Punjab in 1920-21' Mr. T. F. Quirke, Chief Superintendent of the Civil Veterinary Department, lays down 'the fixed and definite policy' of the department with regard to cattle-breeding in the Punjab to be "the preservation and improvement of the indigenous breeds of the Province by a process of selection from among the best specimens procurable." But so far the main concern of the breeding operations such as those carried on in the Hissar Cattle Farm, the grantee farms in the Lower Bari Doab Colony and elsewhere has been the production of a high class plough bullock. Mr. Quirke admits that the improvement of the milking breeds has not so far had the attention that it deserved. Montgomery breeding has been encouraged by the establishment of a number of grantee farms—principal among them being the one at Jahangirabad. There are at present in the farm at Jahangirabad about 500 high-bred Montgomery cows, 150 male calves, 150 female calves and 250 sucking calves. The Chief Superintendent has very recently issued a circular inviting various municipalities in the Punjab to purchase some of the Montgomery bulls that were available for distribution at this and

Activities of the Civil Veterinary Department.

*Vide his "Notes on Dairying," pages 8 and 9.

some other farms. As a matter of fact the distribution of Montgomery bulls and an increase in the number of approved buffalo bulls throughout the province forms part of the breeding programme of the department. If the response of the public be encouraging enough and the extension of the activities of the department thus continues on a still larger scale, it may be expected that the Montgomery breeding of cows and the Murrah breeding of buffaloes may receive a stimulus that has hitherto been almost entirely wanting.

(iii) But evidently in the matter of breeding all that is required to be done cannot be accomplished by a Government department without at the same time enlisting the living interest of the public. As a matter of fact, we should,

Necessity of public support.

in the matter of breeding, look up to Government just for so much of assistance, advice and control as is necessary for leading the way. This, for instance, has been the procedure in most countries where stock have required improvement. "Thus in Argentine Republic 30 years ago it was decided to improve the stock of the country, including cattle, horses, pigs and poultry. Experts were sent in other countries to buy the best of each class obtainable and fabulous prices were paid to get them. At the same time they were instructed to study the methods of dairying business practised in those countries. The State is now reaping the benefits of this outlay. Their horses, mules and dairy produce are all in great demand. They boast the largest creamery in the world and they are the largest producers of dairy bye-products."* It may also have been added here that the success was not in a small measure due to the people very rapidly taking up and assimilating the ideas and aid thus rendered. In India, the Government has been, partly through the agencies of the civil veterinary department and the dairy section of the military department, and partly by the appointment of dairy experts and opening of agricultural dairy farms along with agricultural colleges, doing a good deal to improve the knowledge of dairying. But

Necessity of educating public opinion.

it cannot be denied that the people, the professional cattle-keepers in particular, have so far practically derived no benefit from these measures. The reasons are well put by Mr. Reeves:—† "The primary reasons for this state of affairs (*e.g.*, the failure of dairying business in India) are the lack of interest in breeding taken by cattle-owners and the poor producing quality of the milch cattle." He then significantly adds that 'the ryot who is the sole breeder of milch cattle for public purposes has not the capital nor the ambition (we should say the 'motive') to increase or improve the milking qualities of the animal. In many cases his financial condition does not allow of his feeding them properly. They are subjected to a surfeit of fodder in the rains and a starvation diet in the hot season.'

(iv) Improvement in the knowledge, morale and last, but not the least, in the economic condition of the cattle-keeping population is accordingly the next point of importance.

In regard to a regular system of education in dairying there exist at present in the Punjab practically no facilities. The examples of a few dairy farms of the military department and of some others seem to have been considered enough. The necessity of introducing literacy among these people as a condition primary to their ability to assimilate advanced and scientific notions about the business of dairying according to Western methods and thereby to improve their present methods, seems to have been scarcely realised, or, if realised, nowhere put in practice. In this matter therefore a course of universal primary education suited to the needs of the cattle-keeping population seems to be urgently needed. Help in this direction may well be expected from the State or local administrative public bodies.

Improvement of the economic condition of the cattle-keeping population

The necessity of improvement in the economic condition of the cattle-keeping population.

is a matter of the greatest difficulty. We have already in previous pages dealt at some length with the pitiable economic condition of the milch cattle-keepers in Lahore.‡ They are heavily indebted to the town milk-sellers (the *Halvais*) and other creditors and the great problem requiring solution before anything can be done to improve their lot is the liquidation of their ever-accumulating debts.

*Article on the Dairy Industry in India by W. Reeves in the Journal of Dairying, July 1918.

†Journal of Dairying, July 1918.

‡*I*vide section dealing with the Economic condition of Gujars, page 2.

To find the enormous sum required for meeting these liabilities is a feat that may perhaps be performed by the State. But no measures that will merely ease the situation by clearing off these standing debts will solve the difficulty. A guarantee that such debts will not be contracted in future, or will at least be very much restricted, is a much more important consideration. But this requires a change in the morale—a deliberate rousing in the cattle-keeping population of a mental attitude assisted by suitable monetary facilities—that no measures except an enlightened co-operation among these people suitably encouraged by the State can affect.

It may here be objected, why should so much expense and trouble be undertaken for a rotten community like the present Gujars and Gowalas of Lahore and why should not instead a start with equal facilities be given to dairy enterprise under expert or joint stock management? Apart from considerations of humanity and public peace, there are some very strong reasons for leaving the dairy enterprise in the towns mainly in the hands of the Gujars or other professional cattle-keeping tribes. Thus, in the first place, they possess an experience in the native methods of dairying which no other community can claim. Most of them have been following this profession now for several generations. Even European dairy experts admit that the Gujars display a familiarity with the management of the indigenous types of milch cattle and local conditions which frequently excite their admiration, and very often it has been found difficult to go on with dairy management in this country without enlisting the help of Gujars or other professional cattle-keepers.

In the second place, their familiarity with the milch cattle and the local conditions enable them, even at present, to produce milk much more cheaply than anybody else in like conditions could do, and therefore it is highly probable that with improved facilities and better knowledge they may be able to produce milk at a much cheaper cost than if the management were entrusted to less experienced and less skilful hands.*

Moreover, the problem of increasing the supplies of milk at a reduced cost should be solved primarily with a view to utilize more completely and render more efficient the sources that at present exist. And obviously the improvement of the conditions of production and distribution of milk that at present obtain among professional cattle-keepers requires our first consideration.

In passing we may here point out that a wholesale removal of the professional cattle-keepers cannot be effected all of a sudden and is therefore not advocated here. Facilities of land, transport, accommodation and other things required for their removal will take a very long time to be provided. What we therefore refer to here is their progressive removal and a gradual disappearance of the professional cattle-keeping in the city.

Economy and sufficiency in feeding are the next important points. We have in previous pages pointed out that at present the professional cattle-keeper follows no feeding standard on scientific lines and keeps his cattle generally in a state of semi-starvation. No doubt the low yield of his milch cattle and the corresponding high prices of cattle food-stuffs are largely responsible for this state of affairs. But while, as we have said, the yield of our milch cattle may be much improved by suitable selection and breeding, the situation arising out of the high prices of cattle food-stuffs calls for consideration of a different kind of measures.

Necessity of economy and sufficiency in feeding milch cattle.

We may consider these measures under the following heads :—

A.—Under ordinary conditions—

(i) The necessity of replacing purchased fodder stuffs by grazing.

(ii) The necessity of introducing more economical and nutritious fodder crops and of changing their rotation so as to ensure a more regular supply of fodder throughout the year. This would require proper storage of fodder, green and dry.

*This has been, in fact admitted by a number of persons writing on the subject,—*vide* Mr. H. R. C. Hailey's paper on 'Improved milk-supply for large towns in the United Provinces', and Notes on Dairying by Bhai Kartar Singh, page 14.

(iii) And lastly, for achieving all these results the necessity of giving to the dairyman a permanent interest in the land so as to enable him to get the advantages of mixed farming.

B.—Under conditions of scarcity—

The provision by State of—

- (a) lowering of railway freights to admit of cheap transmission of fodder from one part of the country to another,
- (b) storage by the State of grass or other dry fodders and making them available to the people in periods of scarcity at reduced rates.

The necessity for the provision of some grazing for milch cattle is admitted by all dairy experts. But the measure in which it should be available is a point of some discussion. The public opinion here seems to be inclined to the view that the main part of fodder for our milch cattle (*i.e.*, excepting *Botaua*) should be provided by grazing at cheap rates. This is a large subject, and we will confine our attention here to the feasibility of such demand in towns like Lahore.

The main objections to such a demand near towns being complied with are the high price of suburban lands and the highly intensive cultivation to which such lands are subject. To divert such lands to the use of grazing cattle will therefore in the first place be very expensive and in the second place will involve comparison between the use of such lands for supplying food-crops to a dense population and their use for grazing a few milch cattle.

Last, but not the least, the popular demand for grazing is highly exaggerated at least in so far as it relates to the wet stock. In almost all the other densely populated countries of the world like the United States of America, England, Argentine Republic, Denmark and others, the milch cattle are not provided with so much of grazing as is demanded in this country. In Denmark, for instance, "cows are practically kept indoors for eight months of the year. During the rest of the 4 months, in May and June, they are kept in the fields; in July again in the stalls and in August and September again in the open."* Even during the period that they are kept in the open their use of grazing is highly economical. Thus 'In the open they are tethered in a small pen of grazing land always set apart on the farm for this purpose. By doing this they economise grass and the rest of the field is not spoiled.'

What we therefore require to understand is—

- (a) that an extensive and indiscriminate grazing of milch cattle all the year round may well be afforded in a pastoral country which ours is not;
- (b) that stall-feeding of milch cattle for the most part of the year is now the rule rather than the exception in almost all the agricultural and densely populated countries of the world. And, what is more important it is the rule in nearly all the countries like Denmark and United States that are noted for cheap milk production and for their profits in dairying;
- (c) that grazing should be permitted on strictly economical lines so as to secure all the advantages to the cattle without involving any waste.

After all the question of grazing depends largely upon availability. Availability in its turn depends upon the two main considerations of cost and climate, including rainfall. Thus, in the first place, grazing, both when it is taken as a substitute for stall-feeding or as an addition to it, depends upon whether the cattle thus treated will yield sufficient value in milk to compensate for the cost incurred in providing it. In this connection it may be of interest to add that pasturage for milch cattle in countries like America and Denmark is on highly arable and therefore precious lands and vast sums are spent on their preparation

*"Agricultural Co-operation in Denmark" by Chandika Parshad, page 274.

before milch cattle are allowed to graze in them. This is done because the milch cows yield more value than the cost incurred in preparing these lands.

In the next place good grazing to be worth the name requires a rather humid climate with either a regular and well-distributed rainfall or good irrigation. Now how many places in the plains of the Punjab will answer to this test.

What we therefore should expect by way of grazing in this country, especially in the large towns is an area sufficient to afford the cattle a little exercise and an indifferent grazing.

The case of the dry stock stands on a different footing. They may during the dry period be transported to such areas as can afford sufficient grazing to keep them up. An area in the new canal colonies may, for instance, be suitably suggested for the dry milch cattle of Lahore. Till the production of superior dairy cattle in this country, the provision for such an area will have to be made by the State.

The questions of introducing more economical and nutritious fodder crops and of suitably varying the rotation of fodder crops are matters requiring the attention of agricultural and dairy experts. Fruitful researches in this direction have been carried out at the Agricultural Colleges at Pusa and at Lyallpur, and it is hoped that it will be possible to popularise the results of these researches and the present high cost of cattle food reduced in course of time.

The problem of reducing cost of fodder in periods of scarcity has been engaging the attention both of the Government and of the public for a long time past. Owing to a highly irregular rainfall, the Punjab in general has been in the past subject to a series of fodder famines, with the consequence that a large number of cattle have been lost for want of food during these periods. The measures devised by the Government to cope with these conditions may be broadly divided under two heads: (1) lowering of railway freights to facilitate transmission of fodder from one part to another; (2) accommodation in the form of money advances and opening of forests for grazing are also sometimes granted. In this connection an excerpt from the Season and Crop Report of 1918-19 may be interesting:—

“The scarcity was acute in parts of the south-west. To meet it the following measures were adopted:—

- (i) Concession rates for the carriage of fodder (*e.g.*, Bhoosa) were sanctioned for many of the districts and much was imported from the canal colonies.
- (ii) In Rawalpindi a portion of the Margalla Forest and in Attock reserved *rakhs* were thrown open to grazing.
- (iii) Advances for the purchase of fodder were made by the District Board of Jullundur.
- (iv) In Rohtak the District Board permitted the use of the leaves of the roadside trees as fodder and similar permission was granted by the canal department in respect of canal bank trees.”

It was found, however, that in spite of these measures, the relief rendered was quite insufficient and cattle in large numbers either perished for want of food or were sold to the butcher at low prices.

It has now been admitted by nearly all the provincial Governments that, in order to meet such periods, a provision in the form of a regular storage of fodder—of Bhoosa for instance—should be made, even under ordinary conditions, over and above the facilities that already exist. A great advantage of any such schemes will be to keep down the competitive prices of fodder which at present run very high in periods of scarcity. Such schemes may be run either by private agency, *i.e.*, by individuals storing for themselves, or by Government. In the Punjab it has been found that what with their limited resources and what with their improvident habits people left to themselves do not store enough to meet their requirements, both in periods of temporary but recurrent annual scarcity, and in the more severe periodic scarcity of fodder famines.

Storage by State agency is therefore not only necessary, but will be desirable also. The existing fodder supplies may be classed under two major heads—

- (a) Natural grown grass such as in the forests.
- (b) The results of cultivation.

With regard to (a), the cutting, storage and sale of grass from forests forms at present a regular part of the provincial famine programme of Bombay. In the Punjab this has not as yet been done, transport being the main difficulty.

With regard to (b), the State may annually earmark some portion of the total expenditure in the Agricultural Department for purchase of green as well as dry fodder—to form ensilages of green fodder and suitable heaps of dry fodder. At the same time some stimulus for conserving supplies of fodder may be given to the people in the form of demonstrations for economising their use of fodders and making of ensilages, etc.

But apart from the difficulties directly connected with the milch cattle and their keepers, a question of no small moment is the finding of enough land for them in the near vicinity of Lahore. As referred to in a previous connection, to find enough suitable land even for meeting the requirements of an ordinary joint stock dairy enterprise has been so far a problem in Lahore. The migration of the professional city cattle-keepers in good numbers and the prospect of their ultimate wholesale removal would obviously require lands much greater in extent.

The more important questions will, however, be—

- (i) Whether in view of the high price of land near the town, it will not be much too expensive to acquire even the minimum area required for dairy purposes.
- (ii) Whether it will be desirable to convert highly cropped land probably supporting a dense population into an area maintaining a comparatively few milch cattle. A comparison of gains arising out of the two different uses will also be necessary.
- (iii) Whether it will do merely to hire the land temporarily or give these people some permanency of lease, to enable them to use it to the best advantage. As we find in the case of Western countries, particularly Denmark, best results are obtained where persons own the land they work. Thus Mr. (now Sir) H. Rider Haggard points out in his 'Rural Denmark and its Lessons' * that co-operative dairying in Denmark could have scarcely flourished if the land had been hired and not owned. Thus over 90 per cent. of the Danish farmers own the land they work.†

A description of the difficulties to be encountered in this connection in the Punjab will lead us into the discussion of systems of land settlement, which is difficult to attempt within the small compass of this paper. Suffice it to say that this country is a land of small holdings and of temporary tenancies. A scheme for the consolidation of small holdings has been already set on foot under the auspices of the Registrar, Co-operative Credit Societies (*vide* page 26 of the Report on the Co-operative Credit Societies in the Punjab, 1919-20). Another measure specially suited to the requirements of dairying in large towns is the acquiring of lands by the Government, under the Land Acquisition Act and letting them out to the people on a lease, temporary or permanent. But there are a good many difficulties even in the way of the Government taking such a step.

In short, the question of the removal of the professional cattle-keepers outside presents a number of difficulties. Yet the way to obtain cheap milk lies in successfully surmounting them at an early date.

THE SUBURBAN VILLAGE MILK-SUPPLY.

As we pointed out in the beginning much the greater part of the total supply of milk in Lahore (about 64 per cent.) is received from outside, principally from villages lying within a radius of 12 miles. We also referred to the fact that milk in these villages was much cheaper than inside the city.

* *Ibid.*, pages 181-82.

† *Ibid.*, page 177.

Here is then a source from which cheap milk is already obtainable. And the question may be pertinently asked as to why, instead of facing so many difficulties in the case of the city professional cattle-keeper, should not this source be further developed and better organised?

As we alluded to in the beginning, the main reason why milk could be had so much cheaper in the country outside was that the producers were generally agriculturists who kept milch cattle and sold milk generally as a side line to their primary pursuit of agricultural farming. In all the different countries of the West, particularly those well-known for their dairying pursuits, it has been found that cheapest milk is obtained under conditions of mixed farming. Thus in Denmark, besides keeping milch cattle, the farmers rear up poultry and pigs, and devote a portion of their farms to the growing of food crops such as oats, barley, wheat, rye and potatoes. Therefore in suitably extending the production of milk in the country outside under conditions of mixed farming lies our surety for cheapening the cost of milk.

We have now to consider the ways in which we can develop this source.

For obtaining pure and cheap milk there is within the history of dairy industry no more effective organization than that of enlightened co-operation among village cultivators. As Mr. James Gardner put it*—‘For small holders and farmers co-operation is a necessity to get the most out of their lands.’ The best proof of what co-operation can do in dairying is afforded by Denmark where the prosperity of the farmers is almost entirely due to the successful working of this idea. With their organization of co-operative agricultural associations and unions they have successfully solved almost all the various difficulties that at present stand in our way of cheapening the cost of milk.†

Our main obstacles to the adoption of a similar programme are mainly :—

- (i) the character of the agriculturists. As Mr. (now Sir) H. Rider Haggard points out‡ ‘Danish agriculture owes the greater part of its prosperity to co-operation or, what perhaps is more correct to say, to the character of the people which renders co-operation popular among them.’ On the other hand, from the history of the co-operative societies in the Punjab, we find that nothing has retarded their growth so much as the character of the people not assimilating ideas of true co-operation.
- (ii) Local conditions. This includes many things such as the influences of climate, rainfall, nature of the soil and above all conditions of land settlement. As referred to already, the Punjab is a country with dry climate and irregular rainfall and therefore even with good soils the results of agricultural operations are spasmodic and unreliable. For a successful dairy enterprise, however, nothing is more important than a regular supply of food and water, which our local conditions obviously do not permit. Denmark, on the other hand, possesses all the advantages of a well-distributed and regular rainfall, damp climate and good soil which are utilized by the enterprising and industrious people to the full extent.
- (iii) Conditions of land settlement have already been noticed in previous pages. We are reminded of them here mainly because of the advantage possessed by the Danish farmers of owning the lands they work, which counts considerably in the development of co-operative dairying in Denmark.
- (iv) The alternative of other and for the time being at least, more paying agricultural pursuits than the dairy industry. From the history of co-operative enterprise in Denmark, we find that dairying was adopted by them when they had absolutely failed in making their living out of the growing of grain crops. It is otherwise in this country. Dairying is in keen competition with

* *Vide* his evidence before the Royal Commission on Agricultural Operations in England (1919).

† These have already been noticed by us in previous pages.

‡ *Vide* his ‘Rural Denmark and its Lessons,’ pages 187-88.

farming of food and commercial crops. And in so far as, for the last twenty years, the growing of food-grains and cotton have yielded much larger profits than dairying could give, the agriculturists have naturally preferred to keep to farming as their primary pursuit and to treat dairying or, what is ordinarily understood, the keeping of milch cattle merely as a subsidiary occupation—adopted mainly because the cows would give them plough bullocks and buffaloes would yield *lassi* that they would use for energising themselves and *ghee* that they would sell in the market to supplement their incomes. Under these conditions dairying cannot be treated so seriously as in a place where it is *the* means of the livelihood of the people.

(iv) *Last, but not the least, the success of co-operative dairying in Denmark is in a large measure due to State encouragement and help. As a matter of fact, the present tree of co-operative dairying enterprise in Denmark is the result of the very careful nurturing of it by the State. Thus in the beginning the State rendered help—

(i) by granting subsidies to farmers ;

(ii) by introducing legislation to adapt settlements of lands to the needs of the dairy farmers with the result, as we said, that at present 90 per cent. of farmers own the lands they work ;

(iii) by granting them suitable monetary accommodation. Thus most of the lands at present owned by the farmers have been permitted to be mortgaged with the State in lieu of advances made to them, and the liquidation of such debts is expected by instalments ;

(iv) by providing expert opinion and efficient control over their operations.

Even now when the dairying industry is in a flourishing condition the Denmark Government maintains an efficient Agricultural Department consisting of persons with technical knowledge about dairying and milch cattle and subsidises what are called the 'control societies and associations for the improvement of livestock.'

We have in this country practically nothing corresponding to these State measures, except perhaps the presence of some expert opinion.†

Under the circumstances the promotion of co-operative dairy enterprise will take very long to be satisfactorily established. Yet as we said at the beginning of this section, no scheme is more useful for the small holder who wishes to engage in dairying. Some of the advantages that he will derive may be summarised—

(i) Equipment. Writing of the remarkable progress made by co-operative dairying Mr. Henry H. Wolff in his book 'Co-operation in Agriculture' says‡—'It is in the main, the centrifugal cream separator, of course, which has conjured up this remarkable transformation—the separator coupled with technical education with cheap ice and refrigerators
As a matter of fact, the cost of production will decrease only if up-to-date modern appliances are used and the work is carried on on a large scale. We must, therefore, need under the scheme of co-operation machinery, implements, buildings, etc., etc., the cost of which would be prohibitive for an individual farmer, but could be borne by many persons working conjointly.

*This section is based on the authorities of the following two books :—

(a) Rural Denmark and its Lessons, by H. Rider Haggard.

(b) Agricultural Co-operation in Denmark, by Chandika Parshad.

† The principal State measures in this province have already been referred to

‡ *Ibid.*, page 65.

- (ii) Saving of time on the farm. After the milk is sent to the co-operative dairy, the farmer and his family are free to work on the farm.
- (iii) Better product. Obviously with superior management and appliances better product will be the result.
- (iv) Lessened cost of production and transit and better market prices. Lessened cost of production will obviously follow the production of milk on a large scale. Again as the quantity to be marketed will be great, the cost of transit per pound will be very small. A society would further be better able to market its product and secure better prices for it than an individual should be able to do.
- (v) Lessened cost of distribution and total elimination of the middleman's profits. As we pointed out in the beginning, the middleman and his profits figure very largely in the distribution of milk—particularly of the part received from the suburban villages. Co-operative dairying by organizing delivery of milk direct to the consumer will be able to eliminate the middleman up to a very great extent.
- (vi) With better advice and facilities, breeding and maintenance of stock will be more satisfactorily done.
- (vii) Cheaper money and freedom from the money-lender's yoke will be an immense advantage gained.
- (viii) Lastly, the superiority of co-operation in dairying is chiefly owing to the advantageous circumstances under which the above factors operate and may principally be ascribed to the responsible relation in which the dairy and its purveyors stand towards each other—it being the interest of the shareholder to deliver as good milk as possible to the dairy of which he previously derived no advantage or regarding which he took no pains when delivering the milk to private dairy. Again the producer of milk is aware that if he improves the quality of milk he delivers to the co-operative dairy his profit increases. The fact of his being personally interested in the dairy enables him to control his neighbours and co-partners.

A start in the direction may with considerable advantage be immediately made by an organisation of *collecting agencies* among the milk-producers of the principal villages all round Lahore. At present, the work of this agency is being performed by the individual middlemen.

A suitable encouragement in this direction may be given by the Co-operative Societies' Banks, electing all such producers as their members, and granting them monetary facilities sufficient in due course to supplant the infernal village middleman. The founding and organisation of the Behrampur Co-operative Milk Society is a case in point. This society * is represented to have sold during 1919-20 "1,360 maunds of milk and secured for its members a saving estimated at Rs. 2,200." The society was started on 22nd February 1919 with 14 members, but through misconduct of some of the members and a temporary break in the operations of the society, members in August 1921 counted only 12. The objects of the society are—

- (i) To take milk from members and sell it on commission (*viz.*, Re. 1-8-0 per hundred rupees worth) to outsiders.
- (ii) To improve stock of cattle by grant of loans for joint purchase of milch cattle.
- (iii) To provide facilities for purchasing, housing and feeding milch cattle.
- (iv) To promote other interests.

* *Vide* Report on Co-operative Credit Societies in the Punjab, 1919-20, page 24. The description of the Society is the result of personal investigation on the spot.

The capital of the society consists of—

- (a) realisations from its members on account of shares of Rs. 50 each ;
- (b) deposits of members ;
- (c) realised profits.

The liability of members is joint as well as several, but is limited to a maximum of Rs. 150 each.

The conditions of membership are almost the same as those of the members of any other co-operative societies.

Apart from the realisation of some profits almost regularly ever since the inception of the society, some of the other benefits gained by members have been—

- (i) the shaking off of the money-lender's yoke. Thus at the very start, *i.e.*, in February 1919, Rs. 1,550 were advanced to the society for liquidating the outstanding debts of the members, Rs. 460 for meeting some other liabilities and Rs. 115 for purchase of fodder for their cattle.

In the next May, *i.e.*, 3 months afterwards, loans began to be repaid and by June 1920 they were all cleared.

- (ii) the securing of better prices. Just before the society was started the members, all of whom are Gujars, sold milk to the town *Halwai* at 12 seers for the rupee, but just afterwards, *i.e.*, when their liabilities were cleared, they could sell it at 7 seers for the rupee.

The Khalsa College* Co-operative dairy is a much humbler show. In fact, it is not a dairy but merely an agency for supplying unadulterated milk to students and staff of the School and College, with a finance somewhat resembling that of the Co-operative Credit Societies. A few Gujars with their milch cattle have been invited from the city to live near the College and to supply, in lieu of some advances made to them, milk at a fixed minimum rate under the close supervision of the students and staff of the College. For the Gujars themselves the change means mainly a change of the money-lending agency, *e.g.*, the Managing Committee of the College and the dairy committee funds for the town *Halwai* and money-lenders, with the additional convenience of being able to get quarters outside the city and a saving in transport charges. Their condition, therefore, under the auspices of the College Society practically remains the same as it was in the city. It ensures, however, for the College a more regular, purer and cheaper supply of milk. To secure these benefits for the College seems to be the primary object of the Society. If, however, we were to consider the interest accruing on the money invested in advances and buildings provided for the Gujars, there seems very little to have been gained economically. The finance of the society, as we said, is modelled on co-operative lines. Thus all students of the College and the staff and Gujars are members of the society. To conclude, in its practical working, the society fails to secure equal benefits for all its members and can therefore hardly be called a co-operative society.

The society is, however, yet in its beginnings, having been formed in the autumn of 1916. With longer experience and better facilities, it may secure the benefits that it at present is unable to.

CHARITABLE INSTITUTIONS—GOWSHALAS.

Our treatment of the subject of milk supplies in Lahore will perhaps be incomplete without a reference, even though very brief, to the activities of charitable institutions in the large towns of this country called Gowshalas.

As the name denotes (*gow*—meaning a cow and *shála* meaning quarters for preservation), the primary object of these institutions is the preservation of the cows and their offspring—male and female. They are exclusively managed by the Hindus for whom the cow is an object of worship. Accordingly they are at present run chiefly on humanitarian principles, the main source of their

* The description is based on the results of personal enquiries.

APPENDIX A.

PROSPECTUS OF THE CATTLE PRESERVING COMPANY, LIMITED.

CAPITAL Rs. 1,00,000.

WITH THE POWER TO INCREASE OR DECREASE.

Divided into 10,000 shares of Rs. 10 each, of which 9,650 shares are now offered at par to the public for subscription.

This Company is started with the view of enabling the inhabitants of Calcutta to procure good pure milk by selling them milch cattle at a much cheaper price than now prevailing in Calcutta, and also of saving good dry cattle from being slaughtered.

The scarcity of pure milk in Bengal is chiefly due to two causes, first, the Bengal cows have deteriorated to such an extent as to make it almost impossible for an enterprise to become commercially a success by keeping them, and second, the cattle that are imported from up-country generally milk for only one season and for want of pasture ground and price of fodder being so prohibitive, they are, as a rule, sold to butchers when run dry at a nominal price.

If the dry cattle could be saved from butchers and made to breed again the price of cattle would considerably come down and would also preserve the milking quality of cattle. The best milch cattle are purchased by dairy people and no sooner they come down to about two and a half seers a day they find their way to the slaughter-house, and this is responsible for the dearth of deep milkers.

Objects of promotion of the Company. To overcome these difficulties the promoters of this Company have started this concern to purchase dry cattle and breed them again and import good milch cattle from up-country and thus will enable not only the rich but also gentlemen of the middle class who can afford a little space in their own houses to keep cattle and thus ensure to themselves a supply of pure and wholesome milk.

Pasture grounds. This Company will acquire and maintain a large plot of ground within easy access of Calcutta, to breed these dry cattle and also to keep dry cattle of other gentlemen at a small fee till they breed again. For breeding the cattle the Company will keep high-class and strong stud-bulls of different breeds. The Company will derive a good revenue from the fee of stud-bulls. Good stud-bulls are also a rare object in Bengal.

Reclamation of dry cattle. The Company will make all endeavours to reclaim all dry cattle that may be purchased by them, but if any may be found to become permanently unfit for breeding, it will be kept at the farm till it dies. The percentage of such cattle is expected not to be more than five per cent. The upkeep of such animals will not cost the Company more than Rs. 8 per head, per year, which expenditure will hardly be perceptible.

Profit from calves. The Company will also purchase calves of both sexes and rear them up at their farm—the cow calves turning into good milch cattle and bull calves into good, strong and able-bodied bulls suitable for stud purposes, plough or as beasts of burden. Bulls for the aforesaid purposes fetch a good value in the market and the Company hopes to derive about 100 per cent. of profit from this source. As at present the calves find their way to the slaughter-house, this is unfortunately one of the reasons of the dearth of good milking cattle and bulls for stud purposes and cultivation in Bengal. The difficulty in procuring good strong bullocks for agricultural purposes is well-known and the Company hopes to help the cultivators materially in this respect.

Helping the cultivators. The Company will endeavour to help the cultivators by purchasing their cattle when they dispose of them for want of money at a reasonable price with the condition to sell them back the very same cattle, if they so like, within a given period at the same price which the Company may pay for them, plus a small feeding and keeping charge. This will save the cultivators a considerable amount of money and they will be able to get money when in need, at the same time this will also yield a small revenue to the Company, as at present the cultivators often sell their cattle for a mere song to meet the demand for ground rents and other charges from Zamindars, &c.

Improving Bengal cows. The Company also intends to improve Bengal cows by breeding them with high-class up-country bulls.

Hospital. The Company will also have a good hospital equipped with good drugs and surgical instruments, in charge of a qualified veterinary surgeon which will provide medical aid to its own cattle, also take in other cattle for treatment at a reasonable fee. This hospital, in time, will become self-supporting and may also yield some revenue to the share-holders.

APPENDIX B.

THE MEMORANDUM OF ASSOCIATION OF THE CATTLE PRESERVING COMPANY, LIMITED.

- 1st. The name of the Company is "The Cattle Preserving Coy., Ltd."
- 2nd. The registered office of the Company will be situated in Calcutta.
- 3rd. The objects for which the Company is established are as follows :—
 - (a) To import and export raw and manufactured products or other useful articles and as well as live-stock—milch cattle in particular,—for the purpose of making profit thereby.
 - (b) To preserve, breed, and improve cattle, calves and other animals, young and full grown.
 - (c) To buy and sell cattle, calves and other animals, young and full grown.
 - (d) To supply and sell milk whenever possible and practicable and to manufacture and sell all kinds of milk produce.
 - (e) To provide medicine and medical aid for cattle other than Company's at a small fee.
 - (f) To provide the public with the service of high-class stud-bulls at a nominal fee.
 - (g) To keep and breed dry cattle for the public at a small charge.
 - (h) To purchase, take on lease or in exchange, hire or otherwise acquire land or lands for the purpose of pasture ground for the cattle or other animals in which the Company may, from time to time, think fit to deal with.
 - (i) To acquire land as aforesaid, for the purpose of scientific agriculture, horticulture, floriculture, orchard, and other allied works which the Company may from time to time, deem fit to carry on.
 - (j) To sell, lease, hire or exchange, land or lands, to and with the cultivating ryots, for the purposes as aforesaid in clause (i) section 3 of this Memorandum of Association.
 - (k) To sell wood and timber or other produce that may be got from or by clearing the jungle, or other land.
 - (l) To grow, manufacture, buy and sell, grain and other fodder, for cattle and other animals.
 - (m) To apply for purchase or otherwise acquire any patent, trade mark, licenses, concessions, good will and the like, conferring any exclusive or non-exclusive or limited right, to use any secret or other information as to any invention or process which may seem capable of being used for any of the purposes of the Company, or the acquisition of which may seem calculated, directly or indirectly to benefit the Company, and to use, exercise and develop or grant licenses in respect of or otherwise turn to account the property, rights or informations so acquired.
 - (n) To purchase, manufacture, repair or otherwise acquire and sell agricultural, dairy and other cattle-breeding machineries, or any other machineries, instruments, implements and requisites.
 - (o) To manage, improve, develop, lease, mortgage, sell, dispose off or turn to account, or otherwise deal with, or dispose off, all or any part of the property of the Company.
 - (p) To invest and deal with the money of the Company not immediately required upon such securities and in such manner as may, from time to time, be determined.
 - (q) To borrow or raise money in such manner as the Company shall deem fit and in particular by the issue of or upon Bonds, Debentures, Bills of Exchange, Promissory Notes, Hundies or other obligations of securities of the Company or of its uncalled capital or in such other manner as the Company shall think fit.
 - (r) To make, accept, endorse, discount, execute and issue Promissory Notes, Hundies, Bills of Exchange and other negotiable instruments.

- (s) To purchase or otherwise acquire and undertake all or any part of the business, property, liabilities and assets of any other person or company engaged in any business which this Company is authorized to carry on.
- (t) To enter into partnership or into agreement for sharing profits, union of interest, co-operation, joint adventure, reciprocal concession or amalgamation, either in whole or in part with any other company, person or persons, carrying or engaged in or about to carry on or engage in any business or transaction which this Company is authorised to carry on or engage in or any business or transaction capable of being conducted so as directly to benefit this Company and to lend money, to guarantee the contracts of or otherwise assist any such person, persons or company and to take or otherwise acquire shares or securities of any such person or company and to hold, sell, re-issue, with or without guarantee or otherwise deal with the same.
- (u) To sell the undertaking of the Company or any part thereof for such consideration as the Company may think fit and in particular wholly or in part the shares (fully paid up or otherwise), debentures or securities of any other Company or Companies having objects altogether or in part similar to those of this Company.
- (v) To promote any other company for the purpose of carrying into effect any of the objects of this Company and to take or otherwise acquire all or any of the property and liabilities of this Company or for any other purpose which may seem directly or indirectly calculated to benefit this Company.
- (w) To dispose of and deal with any shares and securities of other companies which may be acquired by this Company and in such manner as may, from time to time be determined.
- (x) To open branches to carry on any or all the objects of the Company and for the sale of the Company's products or purchase of goods required for the purposes of the Company and appoint agents and constitute agencies of the Company in India, Europe or elsewhere.
- (y) To remunerate any person or company for services rendered in placing or assisting to place or guaranteeing the placing of any of the shares of the Company's capital or any debenture or other securities of the Company or in or about formation or promotion or organisation of the Company or the acquisition of property for the Company or the conduct of its business.
- (z) To do all or any of the above things as principals, agents, contractors, trustees or otherwise and by or through trustees, agents or otherwise and either alone or in conjunction with others.
- (aa) To do all such other things as are incidental or conducive to the attainment of the above objects or any of them.

4th. The liability of the members is limited.

5th. The share capital of the Company is one hundred thousand rupees, divided into ten thousand shares of ten rupees each, which share capital of the Company may be increased or decreased as the Company may deem fit.

6th. The minimum number of shares on which the Directors may proceed to allot is one hundred shares of rupees ten each.