



ANNUAL REPORT

OF THE

**IMPERIAL COUNCIL OF AGRICULTURAL
RESEARCH**

FOR 1943-44

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IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Report for 1943-44-

CHAPTER I—ADMINISTRATION

1. This is the 14th Annual report of the Imperial Council of Agricultural Research covering the period from the 1st April 1943 to the 31st March 1944, presented by the Governing Body of the Council under Rule 64 of the Rules and Regulations of the Council.

2. *Meetings.*—(i) Annual General Meeting held on 29th February 1944, adopted the Annual Report and the Audited Accounts of the Council for 1942-43.

(ii) Special General Meeting held on 29th February 1944 to consider certain amendments to the Rules and Regulations of the Council.

(iii) Commodity Committees—October to December 1943.

(iv) Scientific Committees—February 1944.

(v) Advisory Board—February 1944.

(vi) Central Agricultural and Livestock Economic (Priority) Committee and Standing Finance Committee—July 1943.

(vii) Governing Body—August-September 1943.

3. *Finance and Accounts.*—The following were the receipts from (i) the cess levied under the Agricultural Produce Cess Act, 1940 and (ii) the grants received from the Government of India :—

	Rs.	AS.	P.
(i) Receipts from the cess	11,71,574	0	9
(ii) (a) Grant for composting town refuse into manure	1,20,400	0	0
(b) Grant for Tobacco Schemes	10,00,000	0	0
(c) Grant for the 'Improvement of crop yield statistics' scheme	11,200	0	0
(d) Grant for Sugar Schemes	3,00,000	0	0
(e) Grant for Provincial Marketing Schemes	60,000	0	0

A statement showing the audited accounts of the Council for the year 1943-44 is appended. (Appendix I).

CHAPTER II—AGRICULTURAL RESEARCH

Rice.—The Council has been financing a chain of rice research schemes throughout the country since its inception. This coordinated scheme was being worked at Bankura and Chinsura in Bengal, Nagina in the U.P., Sabour in Bihar, Raipur in the C.P., Habiganj in Assam and Berhampore, Cuttack and Jeypore in Orissa. The scheme at all the centres terminated on the 31st March 1944. In addition, minor schemes were initiated in 1940-41 in Travancore, Kashmir and Baroda. The main lines of investigation at these stations were :—

(a) general studies including breeding for high yield and high quality types ;

(b) cultural and manurial experiments to develop suitable improved schedules for rice growing ;

(c) research to discover control measures for insect pests and fungal diseases of the crop ;

(d) irrigation experiments ;

(e) miscellaneous commercial tests.

The principal achievements may be summarised as follows :—

(a) the solution of the wild rice problem in the Central Provinces by the production through hybridisation of fixed varieties with purple pigmentation. These varieties can be readily distinguished from wild rices which can be weeded out in the early stages of the growth of the crop. The results of this research if suitably applied are expected to save to the cultivators in the C P. a sum of Rs. 56 lakhs per annum

(b) the evolution of high yielding and high-quality varieties,

(c) from the manurial and cultural data obtained from the rice experimental stations suitable improved cultivation schedules are being prepared for the guidance of paddy growers in the different provinces and States,

(d) the improved strains of *Anan* and *Boro* paddy, which have been evolved in Assam, have been distributed to the paddy cultivators of that province. Double transplantation in *Boro* has given an outstandingly higher yield of 65 per cent. over single transplantation.

At Nagina, in the United Provinces, an important aspect of the breeding work was the combination of the protective sheath character of the coarse *Sathi* parent with the quality types of rice. By this means, it is hoped to impart to the improved quality strains of rice the resistant character of *Sathi* to an important insect pest, known locally as *Gundhi*

Under the Kashmir rice research scheme, successful crosses have been made between the predominant Kashmir types and early maturing and disease-resistant Russian varieties, with a view to produce fixed hybrids which will require less water during their growing period and will be resistant to disease attacks. Experiments on vernalization have given positive results in inducing flowering in varieties T_1 and T_3 from UP by exposure to light

The Council has also been financing since 1930 a scheme of research on the nutrition of the rice plant. The main object of this scheme, which is located at Dacca University, is to examine the relation between the rice plant and algal growth. It has been shown that a considerable amount of nitrogen is fixed in the soils of rice fields by certain blue-green algae.

Experiments have shown appreciable increase in crop yield in the presence of algal growth as compared to that in its absence.

The control methods which were evolved in the Central Provinces to combat *Gangai*, an important rice pest, are being used with success.

Manurial and cultural trials have been undertaken at the various Research Stations. The results are quite encouraging. It will, however, require another year's work before the necessary schedules can be issued to the farmers.

Improved varieties of rice yield more than the old varieties in cultivation and, accordingly, the Council has been financing developmental schemes for increasing the area under improved varieties in Madras, Bengal, U P., Orissa and Central Provinces and Berar. Excepting the Central Provinces, the developmental schemes in the other four provinces terminated on 31st March 1944.

In addition to the schemes mentioned above, the following schemes were initiated during the year :—

- 1 Rice Diseases, Madras, and
- 2 Rice Diseases, Sind.

Wheat.—The fungi known as rust, of which there are three distinct forms, Red, Yellow and Black, constitute one of the greatest enemies of the wheat crop in India. The annual loss occasioned by rust is estimated variously at from 1 to 10 per cent. of the value of the crop. Even at 1 per cent., the damage resulting would represent a loss of about Rs. 1 crore.

The Council has been financing since 1920, a comprehensive ~~research~~ on the question of rust distribution and rust resistance in India. The main conclusion reached is that the persistence of rust from year to year is due to the over-stunning of the disease on volunteer wheat plants and on the early sown wheat crop in the hilly areas throughout India, rather than to the alternate host Barberry. It has also been shown that infection is not carried over from year to year in the plains but originates annually, from foci of infection at altitudes of 5,000 to 7,000 feet in the hills where there is no close period of wheat growing.

Under cereal rust schemes, physiologic races are being studied. Single spore cultures of all the different physiologic races are being maintained in the Laboratory at Simla.

Research to overcome the rust problem in wheat is progressing along two lines :-

- (a) the breeding of rust-resistant varieties,
- (b) the control of foci of infection in the hills,

(a) Under the scheme for the breeding of rust-resistant varieties of wheat at Simla, the botanical and agronomic characters of a large number of hill wheats have been carefully examined. Hybridisation between the best hill wheats and varieties known to be rust-resistant is in progress. Progenies of the crosses are being studied with the object of evolving rust-resistant wheat strains specially suitable for cultivation in the hill districts. Well known varieties from Europe, America, Australia and Africa and a valuable collection of the indigenous wheats of Afghanistan—the original home of *Triticum vulgare*—are being maintained and studied along with improved varieties from provinces and States.

A co-ordinated study of seedling and adult stage resistance of promising wheats and barleys black rust is also being continued.

(b) The scheme for the suspension of the cultivation of wheat and barley in the Nilgiri and Palni hills as an experimental measure to ascertain whether such action will result in controlling the attack of rust on wheat in the plains of South India is being continued.

The sowing of out-of-season crops has been prohibited under the Agricultural Pests & Diseases Act. The Demonstrators appointed for propaganda work have visited nearly all the villages in the areas concerned and carried out propaganda with the aid of leaflets, lantern shows, lectures and by personal talks with individual cultivators.

Another wheat rust scheme is in operation in Peninsular India. Its principal objects are to test the reactions of plants at the seedling stage to black stem rust and also to carry out tests for adult resistance in the field. This work is being done at Mahabaleshwar and Poona. Two hundred and twenty three samples of wheat from Bombay Province and 21 samples from the Central Provinces together with 49 samples from the material received last year which had not been tested, were examined in detail for rust resistance to all races of black rust prevalent in India, except race 21 which is rarely experienced at the seedling stage. Of the samples tested, two from Bombay and three from the Central Provinces were resistant to all the six races.

The wheat breeding research scheme in the Central Provinces is being continued with the object of producing rust and frost resistant strains. A special study is being made of the durum and vulgare wheats.

Under the Punjab milling and baking scheme 79 wheat samples were subjected to complete milling, baking and physical tests, in order to study the effect of environment, intensity of yield per acre and grain shrivelling on the milling and baking qualities. The results showed that environment does not cause

any well defined and consistent difference in milling quality but it considerably affects baking quality. Wheats from the *barani* tracts in general, and particularly from Rohtak and Rawalpindi, showed the highest baking qualities of samples examined from all over the Punjab. Niphad 4 from Bombay (which has grains very much like those of a *durum* wheat but the plant characters of which are said to be *vulgare*-like) showed an exceptionally high milling and baking quality. In fact, it is among the best Indian wheats handled so far at the laboratory.

Experiments in the Lyallpur Laboratory have shown that barley, bajra, juar, maize, rice, gram, mash, and mung flour can be mixed to the extent of 5 to 15 per cent. with wheat flour without appreciably affecting the loaf making qualities of the mixture. Again, 15 to 25 per cent. of these can be mixed with wheat *atta* without affecting either the palatability or the appearance of *chapatis* made from the mixture. These findings are of special interest at the present time when the demand for wheat is so great.

Millets.—A co-ordinated plan of work on the lesser millets which represent the staple food of people living in many hill tracts throughout India has been drawn up by the Council. Assistance is being given to investigations on the botanical, agronomical and disease-resistance aspects of these crops.

The *Kodo* and *Kutki* research scheme in the Central Provinces is concerned with the isolation and production of high-yielding types suitable for both light and heavy soils and the building up of rotations suitable for light soil conditions.

The Bombay scheme dealing with the small millets Nagli and Vari is concerned with simple selection to provide good yield and early maturity.

The scheme on *Striga*—a parasitic pest which causes severe damage to the jowar crop is being continued. The object is to build up pure strains of jowar, resistant to the attack of the pest. So far, four Indian varieties of jowar, viz., Bilichigan, Muddinandyal, Mallemani and Agia Kodai have shown promise of resistance to *Striga lutea* under certain conditions. Two varieties from Burma have also shown high resistance to the same species. Work is now directed to the production of varieties of jowar entirely resistant to both *Striga lutea* and *S. densiflora*.

Pulses.—In addition to schemes of research in Sind and Bombay, which the Council has been financing since April 1941, a co-ordinated research scheme on pulses has been started in Madras, Bengal, U.P., Bihar, C.P., & Berar, N.W.F.P., Orissa, Hyderabad, Mysore and Baroda. In this scheme research is allotted to the individual provinces or States on the particular pulse crops of special importance in them.

The Bombay scheme is concerned with the evolution of high yielding and disease and drought-resistant strains of gram, *urid*, *mung*, *kulthi*, *tur* and other pulses. Breeding for wilt resistance has also been undertaken in gram. The Sind scheme deals with soybean and gowar in the *khari* and *matter* or *lakh*, *lentil* and gram in the *rabi*. Botanical studies and selection are in progress. In the Central Provinces, the Council is financing an investigation into *Heliothis obsoleta*—a pest of gram. In the Punjab, an investigation has been started recently into the control of wilt disease of gram. This disease is prevalent wherever gram is grown and in many places causes very high mortality to the crop.

Oilseeds.—In point of area, oilseed crops come next in importance to rice and wheat.

Apart from the oil which is extracted from them, they produce oilcakes which are of great value both as cattle food and as manure.

The Council is financing the following oilseed research schemes :—

Groundnuts and coconuts (Madras), coconuts (Travancore) ; rape and mustard (Punjab) ; linseed and others (Central Provinces) ; and castor (Hyderabad).

Schemes on pests and diseases of certain oilseeds in Madras, the U.P., Punjab, the C.P. and Hyderabad and one on the storage of groundnuts in Madras have also been initiated.

Two schemes have also been initiated in Bengal and United Provinces for the multiplication of improved strains of linseed. A scheme of manual experiments with groundnut cake has been sanctioned for Hyderabad.

Under the Madras groundnut scheme, the most important work during the year was the multiplication for distribution to provinces and States of seeds of pure line selections which give significantly higher yields than the local varieties.

It has also been found that only a combination of potash and cattle manure is capable of giving increased yields.

Experiments in the Punjab show that the utilization of hive-bred bees give an increased pod setting. High humidity or low temperature during the seed formation period tends to depress oil content.

Under the Travancore Coconut scheme, ten demonstration centres were opened to demonstrate to the ryots control operations for combating the root and leaf disease of coconut palms.

Tobacco.—Tobacco Sub-Station, Guntur.—The Council has been financing a scheme of research on tobacco at Guntur for several years. In addition to breeding of improved varieties of cigarette tobacco suitable for Indian conditions, the investigations include a study of (a) the effect of various manures on the quality of cigarette tobacco leaf (b) the relationship between leaf-quality and the soils on which it is grown and (c) the effect of rotation crops on the growth and quality of the subsequent tobacco crop. The station has done good work regarding the production of tobacco seed in the country. As a result of trials the viz. Amarelo has been found to be promising. During the last three years it has proved to be consistently superior to Harrison's special in colour, while in point of yield it is only a little inferior to the standard variety.

All-India Tobacco Scheme.—The Government of India have placed at the disposal of the Council a non-lapsable grant of Rs. 10 lakhs per annum for undertaking work on the improvement of production and marketing of Indian tobacco, pending the formation of an Indian Central Tobacco Committee. Proposals for achieving the objects underlying the grant were examined by the Tobacco Committee and the Advisory Board at their meetings held in November 1943 and February/March, 1944. On the basis of their recommendations a scheme has been drawn up embracing the three aspects, viz., (a) research, (b) development and (c) marketing. The Tobacco Research Station at Guntur which the Council has been financing so far will be merged in the All-India Tobacco Research Scheme as soon as the latter is put into operation.

Production of Virginia Tobacco Seed—With a view to ensure an adequate supply of seed, the Council subsidised a Scheme for the production of Virginia Seed Tobacco in Madras at a total cost of about Rs. 2,130 shared by the Council and the Government of Madras in the ratio of 50 : 50. Part of the seed thus produced by this Scheme will be utilised for sowing at Exploratory Stations, which will be set up shortly in different parts of India, under the proposed All-India Tobacco Research Scheme, to determine the regions which produce Virginia Cigarette Tobacco of good quality and high yield.

Training of Tobacco flue-curers.—These exploratory Stations will also cure the resultant leaf. In order that a sufficient number of flue-curers may be available the Council has trained at an approximate cost of Rs 30,000 42 officials of the status of Mukkadams, Kamdars and fieldmen of the different Provincial and State Agricultural Departments whose services may be available for curing the produce of the Exploratory Stations as soon as the latter are started.

Fibres.—The main conclusion derived from the Central Provinces Sunn hemp scheme which has now been completed are: (1) A seed rate of 80-100 lbs. per acre gives higher yields than the lower rates of 40 and 60 lbs., (2) Harvesting the crop at the dead ripe stage, gives the highest yield of dry stalk (3) Stalks retted in running water produce fibre better in colour and lustre than when retted in standing water, (4) At the same temperature, retting is quicker in standing water than in running water, (5) Fibre obtained by wet extraction from the retted stalks is much matted, coarse and inferior to that obtained by dry extraction, (6) The tow of sunn fibre is found to yield a pulp suitable for paper making and (7) cultivation of sunn hemp as a fibre crop should easily give a net profit of Rs. 9 to 15 per acre, depending on the price of the fibre.

The Central Provinces scheme for research on the utilization of luseel fibre was transferred to Bihar in January 1944 and the question of extending the scheme beyond the initial 3 year period, with the following additional items of work, is under consideration:—

- (a) Possibility of mixing different percentages of dry-scutched fibre with jute and
- (b) Possibility of mixing different percentages of cottonized fibre with cotton.

Other Crops.—Under the Central Provinces Pan scheme, the experiments conducted during the year show that Bordeaux mixture treated plots supplied less from the incidence of foot-rot disease than the untreated plots, that the Anthracnose disease can be successfully kept in check by spraying the views with 2.2.50 strength Bordeaux mixture and that soils with high contents of organic carbon, nitrogen, calcium carbonate and total exchangeable bases are more favourable to foot rot disease.

Fruit—Fruit Culture.—The various horticultural schemes continued in Madras, Bombay, United Provinces, Punjab, Bihar, C.P., Assam, N.W.F.P., Orissa, Mysore, Hyderabad and Coorg. In all these schemes, the object is to determine from the points of view of both yield and quality, the best variety, the best stalk, the best propagation methods and the best cultural methods. The Council aims at:—

- (a) attaining an increase in the yield of fruit and in its quality through better methods of planting, better orchard management, the use of the most suitable stocks and scions, and
- (b) improving the marketing of fruit so that the primary producer may obtain better returns.

In addition to the above schemes, the following fruit schemes were initiated during the year:—

- (1) Citrus Grading, Madras.
- (2) Citrus die-back diseases, Bombay and C.P.
- (3) Cytogenetics of mango and banana, Calcutta University.

A scheme for San Jose Scale Survey is in progress in Kashmir and a scheme on mango necrosis is being worked at the Lucknow University.

The Bombay scheme for research on the pathology of papaya has been completed and the main conclusion arrived at is that the course of necrosis is essentially the same in the three sex types of papaya and that there are no visible morphological differences between the chromosomes of the three types.

Fruit and Vegetable Preservation.—The scheme on fruit and vegetable preservation, Lyallpur, has continued its useful work. Canning, dehydration concentration and preservation of fruit juices and suitability of various packing materials have all been investigated. It has been found from the study of fifteen summer and winter vegetables that the loss of vitamins in sun drying was more than in the process of artificial dehydration. At the instance of the Supply Department, a standard method for roasting groundnuts has been evolved; the cost of roasting 1 ton of nuts by this method comes to about Rs. 500. Work on fruit canning and preparation of fruit juices is also in progress in Baluchistan.

During the year under review, the Council has taken up the preparation of a Manual on Fruit culture & fruit preservation. Work on the preparation of a comprehensive "Survey of horticultural research" also continued.

Vegetables.—Vegetables Seed Production.—Brief mention was made in the last report concerning the attempts made to produce in India seeds of acclimatized European types of vegetables and to meet a part of the demands by imports from U.S.A. under Lease/Lend. These activities were pursued during the year under report on an increased scale by Agricultural Production Adviser to the Government of India. The Council's scheme at Kashmir was therefore terminated on 30th September 1943. A conference of seedsmen was convened on 2nd March 1944, to advise the Central Government regarding the fixation of maximum and minimum wholesale and retail prices for the seeds grown in Kashmir and Baluchistan and also regarding the quantities of seeds to be imported from U.S.A. for meeting military demands, during the year 1944-45. It was decided at this conference that a Central Seeds Act should be enacted to ensure that only pure and viable seeds are sold in the market. Proposals in this connection are under examination.

Potatoes.—Breeding better varieties.—Since 1935 the Council is financing a scheme at Simla to study the available Indian varieties of potatoes with a view to establish the distinct varieties and utilize the best ones for breeding purposes either by crossing with other desirable cultivated varieties or with South American species:—

(2) to maintain and study large collections of wild and cultivated potatoes collected from South America with a view to determine their breeding value and utilize the best ones for breeding work:

(3) to evolve high yielding, disease-resistant varieties of potatoes for the hills and the plains of Northern India: and

(4) to supply initial seed stocks of superior hybrids to various provinces and states for trial and multiplication and distribution. Valuable work has been done. Classification of potatoes has been completed and a bulletin on the subject is under preparation for publication. Considerable progress has also been made in breeding for resistance to late blight. In order to help in the introduction of better varieties for the plains an intermediate hill station has been established during the year at Bhowali in U.P. The object of this station will be to grow the potatoes selected from the Simla Station at a lower altitude and make the seed available to the big stations and Government farms in the plains for multiplication and distribution to the cultivators at the proper sowing time.

Storage Pests and Diseases.—The objects of the scheme located in Bihar are to make a study of the insect pests injurious to the potato crop both in the field and in store, particularly the potato moth, and to make a critical survey of the existing methods of storing potatoes and their efficacy with a view to suggesting improvements and suitable control measures. The scheme was started in March 1943 and only preliminary work has so far been done.

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Potato Seed Certification—Potatoes suffer from virus diseases which reduce their yield. The disease is transmitted through the "seed". In order to produce a nucleus of disease free seed the Council examined number of sites and has decided to locate a central station at Kufri in the Patala State at a cost of Rs. 90,000 in 5 years. It is expected that 50,000 maunds of seed, carefully inspected, would be ready for issue as certified seed by September 1949.

Seed Production Scheme.—In view of the urgency of the problem of growing more food at the present moment, the Government of India have agreed to place at the disposal of the Council a sum not exceeding Rs. 75,000 for financing a scheme for the production and distribution of comparatively disease free potatoes at Karnal. The work will be started early next year.

Soils and Manures.—The following soil schemes were in operation during the year:—(1) All India Soil Survey, (2) Coastal Soils, Calcutta University, (3) Colloid Soil Constituents, Calcutta University, and (4) Sewage Farming, Bangalore. The objective of the first scheme is to collect information for the purpose of classification and mapping of soils and to carry out a land utilization survey to record the present use of land, the slope, stoniness, water supply, and other features of the land, to note the crops grown, crop yields, nutritional deficiencies, land tenures, and other matters, and to investigate the problem of crop adaptation, manuring, soil adjustment, etc., to assist the cultivator. The second scheme aims to carry out a general survey of the soils of coastal tracts with special reference to the formation of pan soils and conditions of salinity of the soils and to formulate measures of amelioration of such soils. The third scheme contemplates investigations on the colloidal constituents of Indian soils by physical and chemical methods with a view to (a) the elucidation of their fundamental electrochemical character as manifested in their base exchange properties and their manner of association in and contribution to the properties of soil and (b) differentiation of clays obtained from various soils and identification of secondary silicate minerals contained in them. The sewage Farming scheme aims at developing a simple and suitable method of land treatment in order to grow crops continuously under sewage. Research under these schemes continued during the year according to the programmes of work laid down for them.

All-India Compost Scheme—The Government of India placed at the disposal of the Council a sum of Rs. 2,25,000 for the rapid introduction of the "Bangalore" process of converting town refuse into manure in all the important municipalities of the country. According to the programme 14 officers representing Travancore, Mysore, Madras, Hyderabad, Bombay, Baroda, Sind, Punjab, U.P., C.P. and Berar, (Bihar), Orissa and Bengal were trained at the Indian Institute of Science by Dr. C. N. Acharya who had carried out the investigations under the auspices of the Imperial Council of Agricultural Research originally. After finishing the theoretical course, these officers were taken to centres in Bombay where the work was already in progress and were required to organise work centres in different municipalities. After finishing the course they returned to their provinces where they have started to train Assistant Bio-chemists according to the next stage in the schedule. The work is in progress in all Provinces and States concerned.

Agronomy.—Research into methods of effecting improvements in the existing methods of farming in areas of precarious and inadequate rainfall had been in progress under the dry farming research schemes in Madras, Bombay, Hyderabad and the Punjab for 8 years. These experiments terminated in June 1943.

The results achieved under these schemes are now being put into cultivators' practice. Schemes for dry farming developmental research have been sanctioned

for Madras and Hyderabad. The objects of the Madras scheme are (a) the results obtained from the Dry Farming Research Scheme at Hagari will be tried in an area of about 500 acres to test on a large scale the suitability of the improved dry farming practices (b) to demonstrate to the cultivators under their own conditions of soil and cultivation the value of the improved practices and (c) to acquire knowledge on the costs of treatment and their economics. Similarly the Hyderabad scheme aims at trying out improved practices on cultivators' fields singly or in combination, in a simple way to study their economics in comparison with the corresponding local practices. Both these schemes started in 1943.

At Lyallpur, the water requirements of crops are being studied. The object of the scheme is to study water requirements of crops under different cultural and manural treatments, to determine the best way of utilizing the water available by varying time of application depth of irrigation and frequency of applications and to find out the economic use of water by simple cultural methods. Some interesting results have been obtained in this investigation but no final conclusion can yet be drawn.

In the Bombay scheme for determining the water requirements of crops other than sugarcane, it was found that in the case of Spanish pea nut the fixed interval treatment yielded significantly more than the control, while in the case of onions and wheat the control treatment yielded significantly more than the fixed interval treatment.

A scheme for the preparation of a monograph on "mixed cropping" practices was initiated during the year.

Physiology.—Scheme of research on plant physiology and cytology, Vavekananda Laboratory, Almora.—Vernalisation experiments have been carried out on Indian and foreign wheats as also hybrids, mustard, garden pea, sweet pea and cotton. Further experiments on Giant Star Grass have shown that the hay is extremely palatable and that the digestibility co-efficient of its constituents are so high that mature star grass hay could by itself form a maintenance ration.

Agricultural Meteorology.—From 1932 to 1942 the Council financed a scheme of investigation in agricultural meteorology at Poona. The chief objects of this investigation were :—

(1) experimental work of a fundamental nature leading to an understanding of the processes by which climate affects the growth and yield of plants in general and agricultural crops in particular and the incidence of associated pests and diseases ;

(2) examination of pest data of crop outturns and weather factors over a long series of years to determine how weather has affected crop outturns in the past and to standardise the methods of recording in future ;

(3) special investigations on problems in which climate and weather play a part, e.g., incidence of pests, ability to withstand drought, effect of wind-breaks, etc ;

(4) co-operation with agricultural research workers in India and advice on meteorological aspects of their problems.

The Government of India have taken over this scheme from April 1943 but contact is being maintained with the Council by placing the annual reports of the Agricultural Meteorology Section before the Advisory Board and its Committees.

Besides continuing the fundamental investigations on the various processes controlling the fate of radiation and rainfall, micro-climates of crops, vertical gradients of temperature and wind, soil temperatures, evaporation, movement of water and solutions of certain salts through the soil, the section devoted much

time to the development of sampling technique suitable for the estimation of the growth and yield of short and tall crops.

Mycology.—*Plant Virus Scheme, Poona*—The object of the scheme which is in progress since 1939 is to study virus diseases in plants and examine the fundamental nature of plant viruses. During the year under report the yellow vein-mosaic of bhendi, Enation *Dolichos* Mosaic, Yellow mosaic of *Phaseolus*, *Lunatus*, Mosaic of *Datura alba*, "Katte" disease of cardamoms, Yellow vein—Mosaic of *Ageratum Conyzoides* and Mosaic of *Vigna Catjang* were under study. The following new virus diseases—Mosaic of *Vigna Catjang*, Mosaic of *Euphorbia heterophylla*, leaf curl of *Cassia Sophera* and leaf curl of *Euphorbia geniculata* were collected. The virus of enation *Dolichos* Mosaic has been isolated in a pure form from diseased plants. The virus forms rod-shaped para-crystals of the tobacco mosaic virus type.

Entomology—The following schemes were initiated during the year —

(1) Insect pests of stored cereals, Punjab, (2) Control of insect pests of grains by use of mercury Vapour, Punjab. University, and (3), Survey of *Icerya Purchasi*. Imperial Agricultural Research Institute.

Crops and soils wing.—The fifth meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India was held at Baroda in November 1943.

The Board discussed problems of *large scale seed storage* including the structure of stores, ventilation, protection against damp, vermin and insects and recommended an immediate intensive study of insect damage in existing seed stores of various sizes kept by the small cultivator, the big farmer and the seed merchants. It also recommended experiments on the pre-treatment and pre-conditioning of seeds to avoid damage in storage. Attention was drawn to the need for licensing vegetable seed merchants, and to the need for the enactment of a "seeds act" to prevent dealings in spurious seeds.

The Board examined *the scope for increasing agricultural production* by collective or joint farming and recommended consolidated farming achieved voluntarily or by compulsion as the most promising form of cultivation in Indian conditions. In view of the potentialities of this type of farming, the Board express the view that experiments should be laid out as early as possible in combination with the use of power and machinery so that reliable data might become available. The Board also commended certain experiments which the Baroda and Hyderabad States had under contemplation and suggested that similar experiments might be taken up in other States and Provinces.

The conditions under which *outbreaks of insect pests and plant diseases* occur in India and measures necessary to control them were also considered. The Board recommended research on the climatic and other conditions which favour their multiplication in order to be able to predict outbreaks and on the preparation of insecticides and fungicides from indigenous materials to combat them.

Measures were advocated for the prevention and control of outbreaks by the breeding of resistant varieties, the use of gases and other chemicals readily available, the utilisation of light traps, the introduction of biological control and the adoption of suitable cultural practices. It was further recommended that there should be an adequate organisation for adopting control measures and that there should be close collaboration between the scientists concerned, between them and the cultivators and between neighbouring administrative areas.

The Board also passed a resolution calling on the Central, Provincial and State Governments to start preparing plans now for the absorption of demobilized soldiers on the land. The objective was defined as the provision of profitable employment for the soldier according to his aptitude and experience before

enlistment. It was emphasised that although the demobilized soldier should be given a special start in life the policy should be to absorb him as quickly as possible in the general, social and economic life of the region to which he belongs and that the question of the postwar absorption of soldiers should be regarded as part of a large-scale plan for the development and welfare of the whole country. Specific proposals were made for a survey of culturable waste, catchment areas and unused cultivable lands, extension of irrigation and of road and river communications. For greater efficiency in agricultural production, it was recommended that co-operative technique, consolidation of holdings and cropping, security of tenure and technical advice and educative propaganda should be adopted. Measures for improving the amenities of rural life and the development of industries ancillary to agriculture were also suggested.

For the achievement of this objective the immediate appointment of Developmental Commissions in each province and state was urged together with a strong directing authority at the Centre. It was also emphasised that the plan of development would involve expenditure on a large-scale and it was recommended that provision for the required finance should be made.

With a view to provide information for the preparation of a country-wide plan of rationalized production of agricultural commodities, the Board discussed the maximum potential of different regions from the technical aspects of agriculture. Certain specific suggestions for increasing the total production were made and it was recommended that experimental work should be undertaken in different regions for working out cultivation schedules in order to secure highest possible yields.

The various recommendations have been commended to the authorities concerned.

CHAPTER III—SUGARCANE.

A. *General*.—The sugarcane research survey begun by Sir T. S. Venkataraman is being continued by Mr. Nand Lal Dutt, Imperial Sugarcane Expert on account of the former's inability to complete the survey owing to ill health. It is expected that the report will be available by the end of October 1944.

The Sugar Committee at its meeting in November 1943 considered proposals for the extension of the various sugarcane schemes which were due to expire in March 1944. Pending the establishment of the Indian Central Sugarcane Committee, and an analysis of the whole research position after receipt of the report of the sugarcane research survey, the committee have recommended an extension for a further period of one year on the existing basis. The sugarcane schemes in Mysore and Sind are being closed down as the committee felt that there was no longer any necessity to continue them.

Following the tour report of the Agricultural Commissioner the Sugar Committee appointed an ad hoc sub-committee to go into the programme of work of the Central Sugarcane station at Shahjahanpur and to chalk out a comprehensive programme for the future. The report of this sub-committee has been received and it is proposed to refer the comprehensive programme to the Indian Central Sugar Cane Committee.

B. *Breeding and Agronomy*.—The two central sugarcane stations at Shahjahanpur and Pusa have completed their second year of work. In the U. P. Co. 453 was released to the growers in the western and central tracts in view of its highly satisfactory performance. CoK. 26 promises to be a good midseason variety and has shown its adaptability to adverse conditions. The mycological section conducted a survey of the major diseases of sugarcane as a result of which it was found that only red rot was a major disease the others being secondary and minor. The soil survey conducted in the Gorakhpur district has been

almost completed and the soil has been classified into three types. Outstation work on Government factory farms and private holdings was also a feature of the year under report. In Bihar there was further expansion of the area under Co. 313. This resulted in an increase in sugar recoveries in factories. It was proved that this variety was extensively adaptable and that its yield potential was even better than Co. 213 in its peak days. The results of three years' manual experiments have conclusively proved that the effect of green manure depends on season and soil whereas, F. Y. M. consistently increase yields. It was further proved that mustard, mahua and groundnut cakes could be substituted successfully for oastor cake and that bonemeal could easily replace double super. The R. C. M. method of soil survey was continued during the year.

The Padegaon research station continued the work of genetic soil survey and soil mapping in the various factory estates. The work entails the survey of nearly 10,000 acres annually. In the Crop Physiology Section work was done on the water requirements and the mineral nutrition of the cane plant and the physiological behaviour of the soil types.

The various regional stations in Madras, Punjab, Bengal, Assam, the N.-W. F. P., Sind, Baroda and the Mysore continued their work according to programme, which consisted in determining the varieties, cultural practices and manurial requirements best suited for the particular tracts.

The Council continued to maintain the live herbarium at Karnal. This sub-station continued its liaison with Coimbatore. It has been observed that certain varieties which do not flower at Coimbatore do so at Karnal. This result is likely to prove of great use to the breeding work at Coimbatore. Studies are being made to perfect the method of transport of pollen in a viable condition so as to effectively utilise the varieties which flower at Karnal but which do not do so at Coimbatore. The genetics scheme at Coimbatore which began in 1934 was completed in March 1944.

C. Insect pests and disease.—The new Tricogramma control experiments have completed one full year's working at all the centres. The results indicate that Tricogramma control may have possibilities but further investigation is necessary.

The sugarcane diseases scheme at the I. A. R. I. was continued during the year. The sources and modes of infection were studied. It was found that greater spread of red rot infection would occur if the secondary infection through irrigation water took place earlier in the season. In nature the great movements of water occur during the rainy season, i.e., July and August, in northern India. The study of the spread and perpetuation of the disease was continued. Hot water treatment against surface infection proved successful. Chemical treatment of setts is also a satisfactory control measure, the results indicating only 4 per cent. infection in treated setts as against 20 per cent. infection in untreated controls. The efficacy of systematic roguing and seed selection has been completely confirmed.

D. Sugar Technology.—(Imperial Institute of Sugar Technology).—*Research and Experiments.*—*Sugar Engineering.*—(i) *Formation of Clinker in Bagasse Furnaces.*—Preliminary investigations have been conducted in a few factories and the conditions giving rise to hard glass like substance in the furnace have been studied. Attempts were made to remove clinker in liquid form by draining it through side openings from a combustion chamber having a sloping floor but the results were not found satisfactory. It is now proposed to induce factories experiencing this trouble to try the following methods in order to make the clinker fragile and easily removable—(a) using a grid of tubes inserted below the floor and lower portion of the side wall, and, (b) introducing secondary air.

(ii) *Adjustment of Mill Engine Valves and Governors.*—This problem has been studied by taking indicator diagrams at different loads on the mill engines and a few factories have been given advice on the problem.

Sugar Technology.—(a) *Experimental Sugar Plant.*—(i) *Refining of Baluchistan Sulphur Ore.*—About 36 tons of the ore was refined for the Research Station, Bilari, in the autoclave designed by the Institute. As the quality of the ore was poor, the recovery of sulphur was low. Further experiments for improving the recovery of sulphur are on hand.

(ii) *Manufacture of White Sugar without the use of Sulphur.*—These experiments were started in the cane season 1942-43 but could not be completed due to the short duration of the season, and so continued during 1943-44. The raw juice was clarified by the single defecation process from which raw sugar was produced. This was melted in a tank provided with a false bottom. The syrup (about 55° Brix) was treated with the lime and superphosphate liquor and filter pressed. The clear syrup thus obtained yielded sugar of 27 I. S. S.

(b) *Outside Factories.*—*Manufacture of Solidified Molasses.*—Having completed semi-large scale experiments in the Experimental Sugar Plant, further trials were arranged in an outside factory during the monsoon months. About 5,000 mds. of liquid molasses were solidified and packed in baskets lined inside with date-palm matting. Each basket contained 2 to 2½ mds of molasses. On account of the short duration of these trials and high prices of packing material, the cost of manufacture was about Annas 13 per md., which can, however, be appreciably reduced in factories using surplus bagasse and working under normal conditions. A part of the solidified molasses was transported in closed wagons during rainy weather to distant places in Bengal and Assam. Out of six wagons, five were reported to have reached in good condition.

Biochemistry.—(i) *Manufacture of Glucose.*—The manufacture of glucose was taken up in the Institute Workshop on behalf of Messrs. Narang Industries, Ltd., 275 lbs. of good and uniform quality of glucose and 35 lbs. of crude glucose (cerulose) were manufactured from 1,832 lbs. of starch, the yield being about 17 per cent. on the weight of starch.

Good quality glucose was obtained after three crystallisations which was fairly pure, the only impurity being an infinitesimal excess of chlorides and moisture. Attempts will be made to crystallise glucose anhydrous from methyl alcohol or carry out crystallization in the pan at temperature about 40°C.

(ii) *Manufacture of Yeast and Yeast Extract.*—A miniature plant for the manufacture of yeast has been set up at the Institute Workshop for continuous production of yeast. The present capacity of the plant is 16 lbs of yeast or 2 lbs. of yeast extract per day. Samples of both the products are being sent to the All India Institute of Hygiene and Health for vitamin assay in order to finally adjust the technical details of the process and to calculate the manufacturing cost of the products. A scheme for the installation of a pilot plant for the production of 60 lbs of yeast or 10 lbs. of yeast extract per day is under the consideration of the Imperial Council of Agricultural Research.

Sugar Chemistry (Organic).—(i) *Cane Wax from Press Mud.*—Since cane wax has been proved to be a good substitute for carnauba and other waxes which are now difficult to obtain, arrangements have been made to build up a pilot plant in the Institute Workshop. From the preliminary data obtained in the laboratory the cost of production works out to about annas 4 per lb, which is cheaper than the present cost of any other wax. This cost of production was arrived at by taking into account the loss of the solvent during extraction and assuring supply of press mud free of charge. It is expected that the loss of solvent could be minimized in an air-tight semi-commercial extraction plant.

The solvent oil supplied by the Burmah Shell Co., was found to be cheaper than any other chemically pure solvent. Since high boiling point fractions of petroleum gave higher yields of wax in the laboratory experiments, 50 p. c. and 90 p. c. commercial benzole may prove more economical. Necessary arrangements are being made for taking up this work on a large scale.

(ii) *Storage of solidified molasses in a dry state.*—Solidified molasses suffers from the disadvantage that it reabsorbs moisture from the atmosphere. The mass gets sticky and offers difficulty during transport and unloading. To overcome this difficulty one or two preliminary coating tests were tried to prevent the external surface of the solidified molasses from coming in direct contact with the surrounding atmosphere. Of the different coats tried a thin layer of wax was found to be the most satisfactory. The laboratory experiments were then tried on a factory scale. Hot solidified molasses was poured into oblong moulds. On cooling the block, weighing nearly 25 lbs., could be easily detached. The block was then dipped into melted paraffin wax. This process of coating works successfully if the molasses is properly solidified. Dipping in super-heated wax should be avoided.

Sugar Chemistry.—Potash Salts and Activated Carbon from Molasses.—Preliminary trials have been made to prepare activated carbon and to recover simultaneously potash sulphate from molasses. The recovery of the char is expected to be about 20 per cent. depending upon the quality of molasses. The activated char thus prepared could remove 40 to 60 p. c. colour compared to a standard activated carbon. The washed liquor contained the soluble salts mostly potash. The solution evaporated and dried to a powder is expected to yield potash salts. Quantitative tests for which are on hand. Steam activation of the char is also being tried for increasing its activity.

Physical Chemistry.—Use of Press Mud as Fuel.—Boiler tests were conducted in coal and bagasse furnaces of the Experimental Sugar Factory using press-mud in its natural, sun-dried lump-form as fuel. A comparative test with coal was also carried out. It was found that a bagasse furnace was more suited to the volatile nature of the fuel than a coal furnace although as far as the easy and frequent removal of the ash was concerned, the coal furnace had a definite advantage. The results were confirmed by large scale tests carried out at the Harkhua Factory, where sulphur dioxide and sulphur trioxide concentrations were also determined. Observations made at the M. P. Sugar Mills, Majhulia, with briquetted fuel, did not show any additional advantage of this form of fuel over the natural sun-dried lump fuel.

Statistical.—(i) Relation between Manufacturing Expenses of Sugar Factories and the length of their Crushing Season.—Manufacturing expenses are classified under the following heads—(a) Power-fuel and stores, (b) Repairs and renewals, (c) Salaries and wages, (d) Packing, (e) Depreciation, (f) Interest on working capital, and (g) Other miscellaneous items. All the items except packing are known to vary with (i) Capacity of the Factory (ii) Recovery of sugar from cane, and (iii) the number of days worked by the factory in the season. The actual manufacturing expenses incurred by factories in seasons 1936-37 to 1939-40 were first calculated. The variation in these due to capacity and recovery was eliminated by excluding factories with capacities less than 600 tons per day and making adjustments for recoveries above and below 95 per cent. The residual variation was now due exclusively to variation in the number of days worked by the factories. The expenses due to each item in terms of the number of working days were then found out by regression equations and a table worked out giving expenses on each item, for seasons of varying lengths.

(ii) *Hours lost in Sugar Factories.*—It was found possible to calculate the number of working days which the number of 24 hours operation by a regression equation. For the season 1939-40 this was

No. of days of 24 hours operation = $\frac{1}{2} \times$ No. of working days + a small constant.

Thus on an average working day in 1939-40, a factory operating under normal conditions, lost 2 hours and was able to work for 22 hours. For 1940-41 and 1941-42 the factor was $\frac{1}{4}$, showing an average daily loss of 5 hours. But these two seasons were not normal, as crushing was restricted by Government Order.

Schemes.—1. *The Sugar Research and Testing Station, Bilari.*—(a) *Research*—(i) *Fractional liming in the Open Pan System with sulphitation Tower.*—The juices first fractionally limed to 6.65 pH, then over-sulphited to 4.5 pH and finally limed to 7 pH settles better than juice to which whole quantity of lime is added at a time before sulphitation and at the same time the consumption of both lime and sulphur is less in the former case.

(ii) *Use of Sulphur Dioxide for Clarification of Melt in the Manufacture of Sugar from Neutralised Gur.*—The sugar in purity from gur to rab prepared from sulphated melt is 2.6 units against 1.1 units in unsulphated rab and the yield is also comparatively less; but the quality of sugar produced from sulphated melt is much better than from unsulphated melt.

(b) *Designing and Testing.*—I C A R Crusher Nos 1 & 2 were combined to make a six-roller crusher and tested. The working was found to be smooth. Sordar Furnace, Bijnor bel of two pans, Modified Bijnor bel and a large size semi-circular masonry crystallizer with a stirrer were also tested. A cottage industry unit of 25 mds and khandsari plants of 200 mds., and 400 mds. cane capacity per day were set up and tested. Final reports on these are awaited.

(c) *Publicity, Demonstration and Training.*—A press note regarding the sugar making plant on cottage industry scale and sulphitation process was published in English and Vernacular newspapers for the information of the general public.

Demonstrations of sugar making plants on cottage industry scale evolved at the Research Station were given in the Agricultural Exhibition at Badaun, Medcowala Farm, Bijnor, and Darni Farm, Moradabad. A demonstration week was also organised at the Research Station to demonstrate the improved plants and processes evolved at the station to the public.

Two candidates have been trained in khandsari supervisors' course and one candidate in Artisan's Course this year. Ten scholarships of Rs. 15 each have been announced to be awarded to bel karigars to encourage them to take up training at the Research Station.

2. *Scheme for Research on the Manufacture of Sugar Candy in India.*—*Research.*—(i) *Experiments on the utilization of final candy mother liquor for making confectionery on a large scale.*—Data have been collected from a large scale trial to find out if a small scale confectionery unit can be combined with candy manufacture for utilizing the final candy mother liquor. Detailed figures are being worked out. Confectionery such as lozense, drops, china balls were made both from final and first mother liquors. At the Ravalgaon centre it was found that the use of mother liquor promises a good scope for almost all types of confectionery.

(ii) *Manufacture of Soft Sugar.*—Laboratory as well as semi-large scale experiments on the manufacture of soft sugar from candy final mother liquor have been successfully tried. The soft sugar so manufactured is of the desired quality and keeps moist for a long time.

3. *Scheme of Research into the Factors forming the Basis for the Grading of Gur and Rab.*—Experiments in this connection were carried on by standardized methods for measurements of (1) Colour, (2) Texture, (3) Sweetness and

(4) *Hardness.* Some gur standards were also prepared for trial by dealers in this commodity. Experiments on the keeping quality and dehydration of gurs were also carried on. As the number of types of gur in India is very large, it is now proposed to prepare gur standards on a regional basis.

4. *Scheme of Research for the Prevention of Deterioration of Sugar in storage.*—A special godown for storage has been designed with devices for humidity and temperature control and the work of construction has been entrusted to the Central P. W. D.

The results of laboratory experiments on the effect of impurities in sugar on moisture absorption have been published. Influence of containers on storage was also studied. Out of the eight sugar factories in India which wanted to collaborate in the scheme four factories sent their sugar samples for analysis. The whole working of the scheme will be re-organised as soon as the godown is completed.

Technical Assistance and Advice.—Final manufacturing reports for the season 1942-43 received from 149 factories were duly scrutinized and necessary suggestions for improvement, abnormal working, etc., conveyed to the factories concerned. Seven sugar factories availed of the facility of scrutiny of their run and final manufacturing reports. Specifications for open pan factories, cane-wax plant and additional machinery for a factory were drawn up and supplied to the firms concerned. In addition to the above, a large number of technical enquiries were received and dealt with through correspondence.

The total number of sets of the I. S. S. sold during the year under report was 174 as against 206 in the previous year. A number of samples sent to the B. S. S. by sugar factories under orders of the Sugar Controller for India were tested and the test reports sent to the Controller. Samples were also tested for the Inspectorate of Food Supplies.

Indian Sugar Trade Information Services.—The re-organised Sugar Trade Information Services are being continued although their popularity has suffered a set back with the advent of All-India Sugar Control as the market rates no longer vary from day to day as they used to and the utility and value of market statistics to industrialists and traders, have decreased to some extent.

Training.—The number of students admitted in the various courses of the Institute during 1943-44 was 37. Twenty-one students completed their training during the year compared with 25 students in the previous year.

Experimental Sugar Factory.—The factory started working on 7th December 1943 and closed down on 28th February 1944 on account of shortage in cane supply. It crushed 56,154 mds. of cane producing 4,658 mds. of sugar with a recovery of 8.25 p. c. on cane.

Publications.—The first, second and final notes on the production of sugar direct from cane and of sugar refined from gur, consolidated statements of sugar prices paid for cane, sugar production and stocks, monthly manufacturing data from factories and refineries and the review of the quality of sugar manufactured in India have, as usual, been published.

CHAPTER IV.—ANIMAL HUSBANDRY RESEARCH.

(1) *Animal Breeding.*—During the year under report the Council investigated the possibility of inducing the directors of existing gowshalas and pinjrapals (about 3,000 in number with an estimated annual income of 4 to 5 crores of rupees) to modify their policy and management so that their resources may be used for the production of suitable bulls, for increasing the milk supply and for the salvaging of dry city cows. With this object in view, a meeting of the representatives of a few important gowshalas was held in Delhi on the 25th

March 1944, under the chairmanship of the Hon'ble Member-in-Charge, Education Health and Lands Department. The question as to what extent help could be obtained from the gowshalas' authorities was carefully considered. It was recommended that the resources, income, activities, etc., of the important gowshalas in British India should be ascertained through the circulation of a questionnaire to them. It was further recommended that those gowshalas which could conveniently do so should organise their establishment into three sections, namely,

- (1) for the production of milk and good breeding bulls,
- (2) for maintaining dry city cows during the interval between lactations, and
- (3) for old and infirm animals

In return for the production and supply of good bulls, they may receive help from the Government by :-

- (1) the supply of a few good bulls from Government Farms to initiate the breeding operations under a definite policy,
- (2) the provision of grazing lands where practicable,
- (3) arrangement for technical advice for the management of the animals on scientific lines, and
- (4) the placing the income of these institutions on a more stable basis if this is found on further enquiry to be necessary and feasible.

It was further recommended that a central organisation should be set up for co-ordinating and guiding the work of the gowshalas and this should be supplemented by provincial committees and unions of the smaller institutions where feasible.

The Advisory Board of the Council, at its meeting held in February-March 1944, discussed the cattle position in India and it was considered necessary that, with a view to conserving the best cattle, immediate steps should be taken to prevent indiscriminate slaughter of cattle both for military and civilian consumption. With this object, the Board recommended that :-

- (i) Dry cows and buffaloes should be included in the restriction imposed by the Education, Health, and Lands Department Notification of November 1942 ;
- (ii) The slaughter of all cattle below the age of 10 should be prohibited ;
- (iii) Animals purchased for slaughter by the military contractors should be examined by the staff of the Civil Veterinary Department ;
- (iv) Clause (II) of the contract form for military purchases should be amended ;
- (v) Arrangements should be made for salvage of dry cattle in large cities and fattening of cattle should be practised by the Military Authorities before slaughter ; and
- (vi) Embargo should be placed on the export of cattle wherever necessary.

Advantage was taken of the presence of Dr. Ralph. W. Phillips of the Bureau of Animal Industries, U.S.A., at the February 1944 meeting of the Animal Breeding Committee to obtain his advice on the broad outlines on which animal breeding work should proceed in this country. His views on the possibility of breeding disease resistant strains were that it was a difficult task and that the animal husbandry workers should be on constant look out for such breeds and, when they find any, they should try to develop them. As regards breeding cattle for the dual purpose of milk and draught, he believed that such animals could be evolved as had been done in Switzerland where two such

breeds have been developed. Although bull indexing was the right approach to sound breeding of animals, yet a quicker method appropriate for India would be to select bulls on the basis of individual merit and on the performances of sires and brothers; progeny testing could be left to be done on farms. As regards artificial insemination, he thought that there were immense possibilities but certain difficulties peculiar to the country must be overcome before the operation could be applied in practice. For breeding the required number of bulls, he suggested a careful survey to determine the types of animals required in different regions and then apply a definite plan of production.

(a) *Cattle Breeding*.—On investigation into the possibilities of the introduction of artificial insemination on a wide scale as a means of the rapid improvement of livestock in India, and the perfecting of the technique of the operation under Indian conditions was commenced at the Imperial Veterinary Research Institute, Izatnagar.

Two schemes, one on the private herd of Kangayam cattle maintained by the Pattagar of Palavakottai, Coimbatore District, Madras, and the other at the Government Cattle Farm, Hissar, Punjab, which were sanctioned last year to deal with general questions in relation to animal genetics and their application to the breeding of livestock continued during the year under report.

Milk yield and conformation are the two chief criteria in making preliminary selection for admission to the Central Herd Books operated under the supervision of the A. H. Bureaux which is also responsible for guiding provinces and states in the initiation and maintenance of herd books in respect of local breeds and in organising milk recording. As a preliminary step for the establishment of herd books, characteristics of breeds of cattle and buffaloes have already been defined. Two schemes for the definition of the characteristics of the Malvi and several grey breeds of cattle of Northern India have also been sanctioned, and the definition of the Deoni breed of cattle is under consideration of the Council.

Central Herd-Books have already been established in respect of the Hariana, Sindhi, and Sahiwal cattle and Murrah buffaloes, and during the year under report about 500 animals were registered.

The Council has also under consideration two schemes for the improvement of village livestock in Ajmer-Merwara and the improvement of the Gir cattle in Baroda. The Council's five milk recording schemes in Bombay, United Provinces, Punjab, Sind and Travancore continued to function during the year. Two more milk recording schemes in Ajmer-Merwara and Baroda were sanctioned in July 1943. The A. B. recommended the appointment of a Special Committee to review the working of the existing schemes.

(b) *Sheep breeding*.—Eight sheep breeding schemes are being financed by the Council in Madras, Bombay, Punjab, Bihar, Baluchistan, Mysore, Kashmir and N.-W. F. P. The primary object of these schemes is to breed pedigree sheep, bearing wool of desired standard, suitable for Indian as well as foreign markets and also to observe the effect of selective breeding and nutrition on wool, body weight and reproduction.

In the N.-W. F. P. the up-grading of sheep for Karakul pelt production is going on with good results. The value of the pelt is at least 2 to 3 times higher than the lamb when sold for mutton at the age of three months. A scheme for the development of the milk-yielding quality of the Damani sheep in N.-W. F. P. has been sanctioned but not yet started.

(c) *Goat Breeding*.—The question of increasing the production of large-sized goats to meet the requirements of meat dehydrating factories, engaged the attention of the Council. A scheme prepared by the Delhi Administration for this connection was considered and has been returned for resubmission with

certain modifications suggested therein by the Advisory Board. Another goat breeding scheme, financed by the Council is in operation at Etah where Baruari goats are maintained. In Hissar tuberculosis in goats was brought under control and the Board has recommended the continuation of this scheme up to 31st March 1949. The Angora cross breeding work is being continued. An article defining the characteristics of some seven important breeds of goats in India has been published in *Indian Farming* (Vol. IV, No. 11, Nov. 1943).

(d) *Poultry breeding*.—A developmental scheme aiming at improving the existing methods of poultry breeding under village conditions has been started in three typical tracts in the U. P. under the supervision of the Officer Incharge of Poultry Research Section, I. V. R. I. In Bombay, the study on the combination of useful economic characters of Chitt-Rhode and Chitt-Sussex crosses was continued and pedigree records of the White Leghorn and Rhode Island Red with a view to developing high yielding strains were maintained. The Advisory Board at its meeting held in Feby.-March 1944, has recommended for sanction the following two developmental schemes:—

- (i) Developmental Research in Poultry in the C. P. & Berar.
- (ii) Improvement of poultry and eggs in Orissa.

A scheme for the study of Inheritance of Quantitative Characters with Special Reference to Lgg Production and Egg size in Poultry has also been recommended for sanction, to be carried out at the headquarters of the Council for a period of five years.

(2) *Animal Nutrition*.—It is well-known that the quantity of foodstuffs available in India is inadequate, the shortage is particularly pronounced in protein concentrates. Even if all the oil-cakes, cotton-seed and bran were available as cattle feed and no oil seeds were exported and no oil cakes used as manure, it has been estimated that by this additional feed the production would be increased only up to 1/4 of the requirements of the country. One way of lessening the gap between the amount available and the amount required is by a system of rational feeding based upon the nutritive properties of the foodstuffs. Several schemes on Animal Nutrition are being financed by the Council, e.g., 'nutritional requirements of working bullocks, milch cows and heifers' in the Punjab; 'feeding values of indigenous fodders' in Bihar; 'driving of grasses' in Bombay; 'feeding value of molasses to cattle' at the I. V. R. I. and 'a study of the comparative economics of feeding cotton seeds and a balanced ration to milch cattle' in Baroda State, as well as two similar schemes in Bengal and Hissar.

The work in digestibility trials with linseed cake, til cake, guar, etc., for growth and milk production and the effect of different soil and climatic conditions on their values was undertaken in the U. P. This scheme has been extended up to 31st March 1947 in order to carry out:—

- (i) Comparative feeding values of Barley, Maize and Jowar grains for growing animals of both the Hissar and Murrah breeds.
- (ii) Comparative feeding values of paddy, wheat and jowar straws for growth and milk production.
- (iii) to devise cheap concentrates mixtures for use with paddy, wheat or jowar straws for production of milk.

Work under a developmental scheme for the extensive use of alkali-treated straw for feeding cattle, horses and mules has commenced under the supervision of the Officer Incharge, Animal Nutrition Section, I. V. R. I., at the substations of Sodepur (Bengal), Puri (Orissa), Montgomery (Punjab). The demonstration work will be carried out in villages near Puri, Izatnagar and Sodepur with villagers' animals.

The planning and co-ordinating of animal nutrition work in India were further discussed. The Council has recommended that the sub-stations should be established and financed by the Govt. of India. Details for working out the scheme are being prepared by the Director, I.V.R.I. In the meantime it has been proposed that existing nutritional schemes should continue with the financial aid of the I.C.A.R. The Board also agreed that simple feeding experiments might be carried out on Govt. farms in collaboration with the Izatnagar and other provincial laboratories. The Board has recommended for sanction a scheme from the Punjab to study the milk yield and growth of animals with improved feeding under village conditions.

(3). *Animal Diseases and Pests.*—Disease control embraces the adoption of both preventive and curative methods. A great deal of research is needed to evolve suitable methods of control in respect of most diseases. The Council has been financing a number of schemes for the survey and adoption of control measures in respect of important diseases prevalent in different provinces by appointing Veterinary Disease Investigation Officers in provinces and Hyderabad State since 1932. The schemes have at present been sanctioned up to the 31st March 1945, and now they have been recommended by the Advisory Board for extension for a further period of 5 years. Two more similar schemes have been started in Kashmir and Ajmer-Merwara.

In Madras it has been definitely confirmed that cases of tuberculosis occurring in the conservancy cattle of Madras Corporation are of bovine origin. Braxy in sheep in Hosur Cattle Farm has been recorded for the first time in India and has been confirmed as one of *Vibrio septique* infection.

In Bombay a survey of tracts where cases of nasal granuloma occur has been carried out and investigation on methods of its control are contemplated.

Some important diseases of special interest to Bengal, viz., hump-sore, sarcoptic mange in calves, ringworm, parasitic pneumonia have been investigated in Bengal and measures for their control have been tried.

Satisfactory results have been obtained by adopting scarification method of vaccination against rinderpest in the U. P. The use of rinderpest desiccated goat spleen vaccine as an immunizing agent against rinderpest in cattle and buffaloes has shown promise of being an improvement on other vaccines in vogue at present. Work has reached the stage when it has been found necessary to appoint a pharmaceutical chemist for perfecting the technique of preparing suitable pills of desiccated materials. The Board has recommended for sanction such a post in the U. P. Experiments on the evolution of a suitable method of vaccination against rinderpest in sheep and goat indicate that (1) goat tissue virus is more virulent for sheep and goats, and (2) serum from hyperimmunized goat appears to be more efficient and economical.

In the Punjab tuberculin tests have been carried out in a number of animals with a view to determining the incidence of tuberculosis in cattle and a few animals have been found positive re-actors. Rinderpest in goats and sheep was controlled effectively by the use of anti-rinderpest serum. The use of goat tissue virus has also been tried and the work is being continued. Immunity tests against sheep pox have also been conducted to ascertain the degree of immunity conferred by sheep-pox vaccination.

Experiments on nasal granuloma have been completed in Bihar and the results are under examination. Investigations in filariasis haemorrhagic septicaemia, *ditto* (gillar) have also been carried out. Definite progress has been made in establishing the possibility of transmission of haemorrhagic septicaemia organisms between rodents and large animals through the agency of the flea.

Study into the incidence of tuberculosis and contagious abortion, coccidiosis, rhinosporidiosis has been made in the Central Provinces and Berar. Investigation on flourine intoxication in the animals has also been carried out.

In Assam, investigations into hump and ear sore, and into the incidence of bovine contagious pleuropneumonia have continued. Data relating to seasonal and regional distribution of bovine contagious pleuropneumonia have been collected and field trials of contagious pleuropneumonia vaccine have been undertaken. Survey of the occurrence of rinderpest in relation to movement of cattle particularly of those imported from neighbouring provinces and outlying areas of Assam was made.

In the North-West Frontier Province experimental work has been done on contagious pleuropneumonia in goats and prophylactic and curative methods tried. Feeding experiments carried out have shown that *Dadum Sorghum halepense pers* is responsible for poisoning in animals.

Tuberculin tests conducted in Orissa have indicated a fairly high incidence of the infection in the cattle population of Cuttack and Puri. Diagnostic tests conducted with Johnin have indicated existence of the John's disease in certain parts of the Province. Prompt disposal of the reactors by slaughter and effective segregation and hygienic precautions reduce the incidence of the disease. The results of agglutination test demonstrate a high incidence of contagious bovine abortion. Investigations have been made to see if lack of requisite minerals in the fodder account for the deterioration of cattle.

Investigations into circling disease of sheep and osteomalacia in cattle have been carried out in Hyderabad.

Tuberculosis and John's disease.—The incidence of tuberculosis studied by examination of carcasses in slaughter houses and by means of tuberculin tests. Large quantities of concentrated synthetic medium tuberculin and concentrated and ordinary broth tuberculin were prepared. Investigations into the type of the tubercle bacillus responsible for tuberculosis in human beings have been carried out. Tests made to investigate the virulence of Indian and English strains of tubercle bacilli have shown that Indian strains are as virulent as English ones. Tests to determine the incidence of John's disease have also been conducted with Johnin, Avian tuberculin and mammalian tuberculin. 3,695 doses of Johnin were prepared at the Imperial Veterinary Research Institute from Long's synthetic medium.

In Mysore in order to settle finally the question of the relative merits of various Johnins and avian tuberculin for detection of John's disease detailed tests employing Johnin and Avian tuberculin have been carried out with cows, sheep and young calves.

Contagious abortion.—Survey of the occurrence of contagious abortion has been carried out under the Imperial Veterinary Research Institute in several provinces and States and investigations on the occurrence of the diseases have been made. Classification of the causes of abortion has also been made. The All-India standard brucella agglutination test is being undertaken by most of the provinces for diagnosis of the disease.

Helminthic diseases.—Survey of the incidence of helminthic parasites in the North-West Frontier Province, Sind and the Punjab under the Imperial Veterinary Research Institute has been completed. The data collected during the survey will be useful in connection with future work on the parasites. In Madras, Lucknow and Lathnagar life-histories of some helminths parasites in cattle and sheep were studied in order to effect control. With a view to having an idea of the nature and incidence of the helminth parasites a survey conducted in the Central Provinces and Berar has been completed.

Plant poisoning.—Investigations on the toxicity of various indigenous plants and their therapeutic value were carried out under a scheme financed by the Council in the Madras Presidency.

Poultry Diseases.—Poultry Diseases Investigation schemes continued to operate in all the Provinces (except Orissa and Sind) and the States of Hyderabad, Mysore and Baroda. A similar scheme has now been recommended for sanction in Orissa. Surveys were carried out in all places in order to study the incidence and prevalence of contagious, parasitic and other diseases, their distribution, seasonal occurrence, sources of infection, mortality rates, etc. Primary attention has been directed to the investigation of the following diseases and pests :—

Ranikhet disease, fowl pox, fowl paralysis, spirochaetosis and parasitic diseases. The first named disease ranks foremost and is responsible for periodic heavy mortality of poultry. At the recommendation of the Poultry and Eggs Committee, all the Poultry Diseases Investigation Officers were given further training at the Imperial Veterinary Research Institute, Izatnagar for a period of 2 months in order to acquaint them with methods of quick diagnosis in the field of common diseases of fowls. A scheme for conducting research on the taxonomy, habits, and morphology of poultry and cattle lice at the Aligarh Muslim University has been sanctioned for a period of two years with effect from the 1st April 1944. Another scheme for investigating the factors controlling the natural, acquired and age resistance of poultry and for the investigation of the biology of the common helminth parasites of poultry, especially the viability of eggs under different conditions has also been recommended for sanction. At the Imperial Veterinary Research Institute, fowl pox vaccine was prepared and tested with very good results on a farm where sporadic cases of pox were occasionally encountered. Quick methods for the diagnosis of Ranikhet disease have been evolved. Vaccination of fowls with Past aviseptica has been found to confer a solid immunity to experimental infection with virulent fowl cholera organism.

(4) **Dairying.**—Investigations on the problem of supplying milk from villages to towns have been undertaken under a scheme at Lucknow and fundamental work associated with it is being carried out in Bangalore by the Director of Dairy Research. Adulteration of milk with skim milk powder and water to tone it down to the standard fixed for market milk is a common practice. A scheme for the detection of adulteration of milk with milk powder is continuing at the Imperial Dairy Research Institute, Bangalore.

The shortage of finned-steel material due to war has necessitated the need of investigating the possibilities of finding out substitutes for steel milk containers. With this end in view the Council has sanctioned a scheme on the subject at the Imperial Dairy Research Institute, Bangalore.

In order to meet the rapidly increasing demand for *ghee* for the forces, it has been found essential to encourage the production of more *ghee* so that the requirements of the civil population shall not suffer. Schemes have, therefore, been invited from several provinces for developing this industry on intensive lines. A scheme for the development of *ghee* in the Jhallar Tract, Central Provinces and Begar, has been sanctioned and started during the year, as an experimental measure. It is proposed to start similar work at fifty other centres in the Central Provinces.

(ii) A scheme for improvement in the manufacture and grading of 'yellow *ghee*' has also been sanctioned at the Imperial Dairy Research Institute, Bangalore.

(iii) The question of prevention of adulteration in *ghee* was considered by the Governing Body at its last meeting held in August-September 1943 and the following recommendations were made :—

(1) The Food Adulteration Laws should *where this can conveniently be done* be extended to the whole of a Province or State, and their scope should not be confined to certain municipal or town areas only.

(2) These laws should be administered more effectively, exemplary fines being levied on the delinquents where necessary.

(3) Marketing Officers should *ordinarily* be empowered to carry out inspection and collect samples under the Food Adulteration Acts.

(4) All dealers, retailers and hawkers of *ghee* and *vanaspati* or other hardened vegetable oils should be licensed free of charge and *in the case of wholesale licensees* the same man should not be allowed a license for both products.

(5) It should be made compulsory on all manufacturers of hardened vegetable oils (such as *vanaspati*) that they should *suitably colour the same as may be prescribed, where this can be done without making the article repulsive, unusable or unhealthy.*

(6) *Vanaspati* and other hardened vegetable oils should be retailed in sealed tins with proper labels thereon, *the use of the word 'ghee' for the same should be prohibited.*

(7) Further research should be carried out with a view to improving the existing methods of testing and preparing *ghee* and butter.

These recommendations have been passed on to the Central, Provincial and State Governments for necessary action.

(iv) The scheme for the study of the different methods of manufacture of *ghee* at the Indian Institute of Science, Bangalore has been started with effect from the 1st April 1943.

(v) The scheme for detecting adulteration in *ghee* at the Indian Institute of Science, Bangalore, a mention of which was made in the last year's report, terminated on the 31st March 1944, and a further investigation on the determination of the structure of glycerides in *ghee* at the same Institute has recently been sanctioned and it is proposed to start work under this scheme from the 1st April 1944, i.e., in continuation of the previous scheme.

(vi) The schemes for the—

(a) Prevention of high acidity in *ghee* at the Imperial Dairy Research Institute, Bangalore, and

(b) Investigation of Vitamin 'A' content of *ghee* and nutritive value of *vanaspati* and vitaminised *vanaspati* at the Imperial Veterinary Research Institute, Izatnagar,

started during the year under report.

(vii) The Council has also sanctioned the following schemes at the Imperial Dairy Research Institute, Bangalore—

(i) A study of the chemical and nutritive qualities of vegetable oils, hydrogenated oils, *ghee*, and other animal fats,

(ii) Bio-Chemical Research on 'Dahi', and

(iii) Preparation of Vegetable Rennet.

The need for an All-India Dairy Development Officers' Organisation on the lines of the Veterinary Disease Investigation Officers has been recommended by Dr. Wright (*vide* para. 55 of his report) and the Animal Husbandry Wing of the Board of Agriculture and Animal Husbandry in India. Accordingly all

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Provincial Governments and Constituent States of the Council were invited to submit schemes for the appointment of dairy development officers on the lines recommended. Two schemes were received from the Govts. of Madras and the N.W.F.P., and have been recommended for sanction by the Advisory Board.

A scheme for investigating the composition and nutritive value of milk of cows, buffaloes goats and sheep at the Imperial Dairy Research Institute, Bangalore has been under consideration of the Council. In addition, the Advisory Board, recommended :

(a) that an intensive study of fat, solids-not-fat, specific gravity, lactose, ash, protein, and freezing point of milk should be carried out at four centres,

(b) that a rapid enquiry into fat, solids-not-fat, and specific gravity of milk should be made throughout the country. With that aim in view the latter recommendation has been forwarded to the Provinces, States, and the Universities, for necessary action.

A scheme for the development of milk production of Damani sheep in the North West Frontier Province by selective breeding has been sanctioned by the Council.

(5) *Other Industries.*—(a) *Wool.*—In conformity with the Council's decision that sheep breeding farms should each be provided with a wool analysis laboratory for estimation of wool quality, two more wool Analysis Laboratories have been established in the Punjab and N.W.F.P. during the period under report. The Advisory Board has recommended for sanction a wool analysis laboratory to be attached to sheep breeding scheme financed wholly by the Govt. of Baroda.

(i) In the Bombay University Wool Analysis Laboratory fibre characteristics of about 547 wool samples from 97 animals maintained on various experimental sheep breeding farms at Togh, Kohat, Kashmir, U.P. and Baluchistan, were analysed. A large number of samples of wool from different parts of India and commercial wool from the Agricultural Marketing Adviser had also been analysed and classified according to their fineness, uniformity, length and medulation. Realising the importance of the work done by this laboratory, the council has approved the proposal for its extension up to 31st March 1946.

(ii) The need of establishing a Central Sheep and Wool Research Station at Izatnagar has been felt very strongly by the Council. The Board recommended that the Govt of India should finance the station. The proposal is now under consideration of the Central Govt.

(iv) The question of compulsory grading of Indian wool has been engaging the attention of the Council for some time. In November 1942, it was recommended that a rough grading should be introduced and that the A.M.A. to the Govt. of India might work out the economics of grading. The A.M.A. expressed the opinion that besides a substantial margin of difference which exists between the returns from ungraded and graded wool, more tangible results could be achieved by linking grading with improved and organised marketing. An enquiry was accordingly made from the Provincial and State Govts. as to (i) what areas in their respective Provinces and States were most suitable for opening rough grading, washing and shearing centres and (ii) how these centres could be linked with an efficient marketing organisation which would arrange for the better marketing of the graded products.

The replies so far received reveal that the majority of the Provinces and States are not disposed to follow up the recommendation regarding rough grading of wool during the present emergency.

(v) The Board considered a scheme for shearing, washing and grading of wool in Ajmer-Merwara and recommended it for sanction.

(b) *Hides and Skins*.—The scheme for effecting improvement in flaying in some of the largest slaughter houses in the country by payment of premium to flayers, is still under consideration. A scheme for the establishment of village flaying parties in the Bombay Province has been started with the object of demonstrating to village *Muhars* and butchers, the improved methods of flaying and curing of hides. In the N.W.F.P. Master flayers were trained in the art of flaying, and through them instructions have been imparted to a number of flayers. Damage caused to hides and skins by ticks and warbles is of a serious nature and measures to control these pests are of great value to the hide industry. A survey of the Punjab and N.W.F.P. has accordingly been carried out under the supervision of the Director, I.V.R.I. with a view to ascertaining the damage caused to hides and skins by ticks in those localities. The dipping experiments against ticks in Bombay have given encouraging results. Among dipped cattle ticks infestation has been brought under control and sheds are also freed from the pest. Increase in milk yield and improvement in condition have been observed in animals regularly dipped. As regards warbles, singeing operations and the use of both tobacco-lime and derris dressings have been tried in the Punjab. In view of the encouraging results achieved so far, the scheme has been recommended for extension for a further period of 3 years with effect from 1st April 1944.

(c) *Pisciculture*.—The Council has not lost sight of the possibilities of expansion and development of both marine and inland fisheries and the important part which fish, as a food, should play in the nutrition of the nation. If fishery resources are properly husbanded, they would constitute a stabilising factor in food supply, fluctuations and they would to some extent meet the deficiency of high class proteins which is such a feature of Indian diet.

With this view, the Advisory Board recommended the establishment of a Central Fishery Research Institute at Calcutta where facilities for systematic work on inland and estuarine fishes are available, and a sub-station in Bombay for researches on marine fisheries. The aims and objects of this Institute will be deepening and widening of the basis of the practical utilization of the fishery resources of the country and undertaking researches with this end in view. Its main functions will be :

(a) to plan, coordinate, conduct and guide all relevant scientific researches in the country on the ecology and bionomics of Indian fishes and other aquatic products with a view to elucidating factors which influence their growth, movements, periodic fluctuations and development,

(b) to conduct an investigation into the present state of commercial fisheries in India with a view to opening and developing new grounds and new objects of fishery,

(c) to carry out researches into the technological aspects of the fishing industry,

(d) to devise suitable means for the proper marketing of the produce and

(e) to ensure the training of research and development personnel both by the Institute itself and in cooperation with the fishery departments in the Provinces and States.

2 The Board recommended that the institute should be financed by the Govt. of India. The proposal has been referred to them for favourable consideration. The scheme for development of India's marine fisheries received from Diwan Bahadur Dr. Sundar Raj has been recommended by the Board for sanction

with the remarks that the scheme should be financed by the Govt. of India from the 'Grow more food campaign' fund. The matter is still under the consideration of the Central Government.

3 It is now an established fact that if a fish farmer were to pay as much attention to his pond as an agriculturist does to his land, aquaculture could be made more paying than agriculture. Compared with agriculture, culture of fishes entails practically no labour and very little outlay on the part of a fish farmer.

The scheme for the rural pisciculture in Madras to carry on researches on fish parasites, diseases, and mortality, live-fish transportation, biological control of water-borne diseases has started its operation. In spite of the various difficulties due to the prevailing war conditions, it has been possible to get the activities of the research station into full swing.

The scheme on the investigation of the life-history, bionomics and development of fresh water fishes in Bengal has been extended up to 31st March 1946. The following schemes have also been sanctioned:

- (1) Preservation of fish by curing, pickling and smoking in Baroda
- (2) Improvement of preserved fish industry in Bengal.
- (3) Investigation of fish eggs and larvae in Bombay.
- (4) Investigation of fish eggs and larvae in Madras.

In order to test the suitability of the CO_2 method of preservation for blackish-water species of prawn, suitable containers and the keeping quality of the products, a scheme for the manufacture of semi-dried prawns in Madras and another for experimentation on the 'Barn' type of dehydrating plant in Orissa has been recommended by the Board for sanction.

(d) *Apiculture*.—The scheme for the establishment of a Central Bee-keeping Research Station at Lyallpur and a Sub-Station at Nagrota in the Punjab has been recommended for sanction by the Advisory Board. A sum of Rs. 500 per annum for three years, for bringing out the Indian Bee Journal as a monthly illustrated publication has also been sanctioned.

Miscellaneous - Monographs.—Of the three monographs, mentioned in last year's Report, the work on (i) Animal Nutrition in India by Dr. K. C. Sen, Officer-in-Charge, Animal Nutrition Section, Imperial Veterinary Research Institute, Patnagar, has been completed and approved by the Board for publication; (ii) Rinderpest in India and (iii) the Anatomy of the Ox are still in the course of preparation.

Manuals.—Of the five Manuals, which it is proposed to bring out on the Animal Husbandry side, the Manual on the Feeding of Farm Animals in India by Dr. P. E. Lander, ex-Agricultural Chemist to the Govt. of the Punjab, has been completed and is awaiting publication. The work on the Manual of Dairying in India has been taken up by Prof. James N. Warner of the Allahabad Agricultural Institute and that on Manual of Maintenance of Farm Animals in Health in India has been entrusted to Rai Bahadur P. N. Nanda, Supdt., Government Cattle Farm, Hissar. The question of preparation of a "Manual on breeding of farm animals in India" is under consideration and the preparation of a "Manual on Animals and Animal Products for the Indian Market" has been postponed for the present.

CHAPTER V—COMBINED AGRICULTURAL & ANIMAL HUSBANDRY.

Village Projects.—The working of the village-projects schemes in Bombay, U.P., C.P., & Berar and Travancore, which are still in the initial stages, was reviewed by the Developmental Research Committee of the Council in February 1944. The Committee made the following recommendations about the lines along

which the schemes should run in future. The most important of them related to the inclusion in the scope of the projects of work on the improvement of the nutritional condition of the villagers residing in the areas affected by the projects. The objective of the village projects as now defined by the Committee is to improve the economic as well as the nutritional conditions of the villagers; for this purpose, to increase acreage yields and production by the adoption of all proved agricultural improvements and to develop marketing in the village.

In order that the nutritional aspect of the projects may proceed on right lines, it has been arranged that the agricultural assistants in charge of the projects should receive intensive training in nutrition for about six weeks, at the Nutrition Research Laboratories, Coonoor.

Mixed Farming.—The first results of the experiments on the mixed farming schemes in the U.P., C.P. and Berar, N.W.F.P., and Sind generally indicate an increase in income in cash and food crops in the mixed farming units as compared with the control units. Income from milk and milk products is obtained, in addition, in the mixed farming units.

The Developmental Research Committee examined the reports on these schemes in February 1944 and made certain suggestions regarding their future working. The committee stressed that the experiments should be made with the aim of providing two sets of data, viz., (i) the average yield per acre for each of the principal crops under trial, year by year, both in the mixed farming and in the control units and, (ii) the actual cash value of the total production year by year in the control units and in the mixed farming units. For the collection of these data a set of special forms is being prepared for supply to the officers in charge of these schemes.

Desert Farming.—The object of the desert farming scheme in Sind, sanctioned by the Council, is to study the various methods of dry farming for the conservation of soil moisture, and for its best and fullest utilization for successful cultivation. The introduction of trees to provide shade and fodder for cattle, specially during emergency periods has been included. Work was actually initiated in November, 1942.

Fodder and Grazing.—The Kudzu vine (*Pueraria, Thunbergiana*) is said to be a most promising leguminous crop. A scheme has been sanctioned at the Fergusson College, Poona, to study the conditions under which the vine flowers and sets seed and for its distribution by arranging for the cultivation and plantation by layerings in grazing grounds on hill slopes around Poona.

Improvement of Statistics.—A special grant of Rs. 1,07,000 was received from the Government of India, E. H. & L. Department for the improvement of agricultural statistics. The Council has sanctioned from this grant two schemes—one under Dr. V. G. Panse, Statistician, Institute of Patent Industries, Indore, for conducting an enquiry into the existing system of preparing agricultural statistics and crop forecasts in the Punjab and the C.P. & Berar and suggesting improvements; the second under Dr. P. V. Sukhatme, Statistician, Imperial Council of Agricultural Research, for conducting crop cutting experiments on the rabi 1943-44 wheat crop in the U.P. and the Punjab.

Statistical Section: Advisory Work.—The Agricultural and the Animal Husbandry units of the Section continued their advisory work during the year. Technical programmes and progress reports of the Council's schemes were examined, and a large number of enquiries from workers from the Provincial and State Departments of Agriculture, Veterinary Services, and from Universities in respect of the statistical aspect of their work was attended to.

Training.—Arrangements for the training of officers and workers from the Provinces and States and for post-graduate work of University students were continued during the year. Five officers from Bombay, the Punjab, Sind

and Baroda came on deputation for training, and two new scholars were admitted for post-graduate research.

Research.—The tabulation of 5 and 1 per cent. values of Fisher and Behrens d by the method of quadrature and by the asymptotic approach developed by Fisher was completed during the year. The tables were published by Fisher and Yates in their standard book of statistical tables for the use of Biological research workers. Investigation on the efficiency of the d test, is in progress.

Another aspect of the research carried out by the Section relates to the development of statistical procedures appropriate to the types of data with which research workers are actually concerned. Some methods of practical importance developed during the year are :

(1) The method of estimating the mineral requirements in metabolism studies in animals.

(2) The method of using the progeny data for evaluating the sire.

On the agricultural side a development of a very far-reaching importance took place during the year. A sample survey scheme for conducting crop-cutting experiments all over the wheat belt of the country for estimating the yield of wheat was prepared, and has been just launched in the Provinces of the U.P. and the Punjab after completing all the preliminary arrangements connected with the procedure of work, and training of the field personnel. This sample survey is the first of its magnitude that has ever been undertaken in this or any other country, and its results are being awaited with interest.

CHAPTER VI.—AGRICULTURAL MARKETING. CENTRAL AGRICULTURAL MARKETING DEPARTMENT.

Headquarters Staff—Dr N. Das, I.C.S., handed over charge of the office of the Agricultural Marketing Adviser to Mr D. R. Sethi, M.A., B.Sc. (Edin.), I.A.S., in September 1943, who holds also the post of the Director of Agricultural Production, (Food), in the Education, Health and Lands Department. The post of the Deputy Agricultural Marketing Adviser was revived and Khan Bahadur A. R. Malik, M.A., B.Sc. (Edin.), was appointed to the post in September 1943, with headquarters at Ajmer.

2. *Grant to Provinces.*—The Government of India's grant to provinces for marketing work was further reduced to Rs 60,000 during the year under review as against Rs. 1,10,000 made available during 1942-43.

3. *Surveys.*—All-India marketing survey reports on Sugar, Hides, Skins, Citrus Fruits, Co-operative Marketing, Markets and Fairs and Lac were released. Most of these reports were completed in 1942, but could not be released earlier on account of printing difficulties. That the reports issued so far are appreciated by the public is evident from the fact that a second edition of the Report on Milk and an abridged edition of that on tobacco had to be brought out during the year. Reports on Bananas, Sheep and Goats, Barley, Cashewnuts, Gram and Coconuts have been completed and are in the press. The reports on 8 other commodities were in different stages of preparation. Under the instructions of Government of India, the Central Agricultural Marketing Department also conducted rapid surveys on certain English types of vegetables, bones and bone-meal and on India's requirements of agricultural implements and machinery.

4. *Grading and Standardisation.*—(i) *Standard Contracts.*—Three leading firms of exporters of groundnuts in Madras who adopted the Standard Groundnuts' Contract in 1942 expressed their satisfaction with the working of the contract. The question of giving statutory backing to the Standard Contract for groundnut is under consideration.

(ii) *Grading Stations.*—In spite of short supplies of certain commodities, difficulties of transport, rise in the prices of containers etc., a steady progress was maintained in the standardised grading and marking of commodities. During the year the total value of the produce graded rose to Rs. 546 lakhs as against 241 lakhs in 1942 and 146 lakhs in 1941. The increase recorded in the case of ghee, butter, edible oils, eggs, *gur* and *bura* was particularly noteworthy.

(iii) *Quality Control.*—With the growth in demand, it has been found necessary to stiffen the control over the quality of graded products and suitable steps are being taken to ensure the maintenance of quality. Arrangements for the analysis of the control and check samples at Central Control Laboratories at Cawnpore, New Delhi, Lyallpur and Nagpur were continued.

5. *Publicity.*—Suitable measures such as advertisements in leading newspapers, demonstration stalls at exhibitions etc., etc., were taken to popularise the AGMARK products. The feasibility of setting up departmental AGMARK stalls at suitable centres with the specific object of selling only AGMARK products and linking them up with producers' cooperative societies engaged in the grading work is under examination.

6. *Other activities.*—(i) *Market intelligence.*—The daily market rates of a number of commodities continued to be broadcast from Delhi. Weekly reports and monthly reviews on prices and stocks relating to various commodities were continued to be published.

(ii) *Development of export markets.*—Mention has already been made in previous reports of the attempts made by this Department to introduce Indian tobacco in Egypt. These efforts were continued. It is proposed to make organised attempts to standardise and improve the quality of exported goods. A beginning has already been made by prohibiting all exports of sunhemp unless graded and marked under the AGMARK and the principle has to be extended to other important products such as tobacco, wool and hair, sheep and goats skins, edible nuts etc.,

(iii) *Miscellaneous.*—A large number of references received from various Departments of the Government of India calling for information on various agricultural products were attended to. The Central Agricultural Marketing Department was repeatedly called upon to give information and advice particularly in regard to tobacco, groundnuts, oils and oilseeds. Similarly, references and enquiries received from other official and non-official parties were suitably dealt with.

CHAPTER VII.—GENERAL.

A Library.—*Books & Publications in Stock.*—The Council's Library has now on its shelves more than 45,000 books, pamphlets, translations etc. The whole stock is increasing at the rate of 2,500 to 3,000 publications per year. The following figures would throw some light on the steady growth of the Library during the last 5 years :—

Year.	New books added.	Pamphlets received.	Periodicals received.	Books and periodicals circulated.
1939	1,384	2,100	422	16,222
1940	1,446	2,400	445	17,413
1941	515	1,876	452	18,781
1942	613	1,633	460	18,808
1943	684	1,324	447	19,965

The Council has established wide exchange relations with important Scientific institutions all over the world, and receives by far the greater number of publications on exchange basis. During 1943-44, we received no less than 2008 books and publications of which only 183 were purchased. Of the total number of 447 Current Journals and papers only 86 are paid for from the Research Funds.

Details of the new books added to the Library are as follows :—

1. By purchase	183
2 Through exchange	1,684
3. Bound Volumes of Journals	141

Loan Statistics.—The circulation statistics show a marked increase in the use of the Library. The number of books loaned out and of regular circulation of Scientific periodicals reached a total of 19,965 as against 18,808 last year.

1. Loan of books	2,646
2. Circulation of Periodicals	17,319

The following analysis of loan statistics shows the demand for books on various subjects :—

1. Social & Economic Sciences	587
2. Pure science	175
3. Medicine & Veterinary Medicine	111
4. Agriculture (General)	1,148
5: Agronomy, crops, etc.	299
6. Animal Husbandry & Dairying	173
7 Technology	54
8. Miscellaneous	99

Classification and cataloguing—As the Library is intended to aid research, it is necessary to index and catalogue its material thoroughly. The books are classified by subject according to Dewey's Decimal System and the cataloguing and indexing is done on American lines. About 2500 typed cards were added to the Dictionary card catalogue during the year.

Reference Service.—Supply of bibliographical information, and reference aid to research workers all over India forms an integral part of the Library Service as is evidenced from the increasing number of inquiries received. Ninety-four enquiries excluding those made by the Staff and Officers of the Council, about references on specific topics were registered during the year and the relevant information furnished.

B. Publications.—Indian Farming.—In spite of the abnormal times, the circulation of *Indian Farming* during the year rose to 2173, of which 1506 represents permanent subscribers, 127 casual sales & 545 free copies. With a view to disseminating results of research on agricultural and allied subjects, 70 newspapers in English, and 74 papers in Indian languages continued to be on the free distribution list.

Sons of the Soil.—The third edition of the *Sons of the Soil* is in press and printed copies are expected to be ready shortly.

Scientific Journals.—The Indian Journal of Agricultural Science (bimonthly) and the Indian Journal of Veterinary Science and Animal Husbandry (quarterly) continued to be published during the year. In view of the acute shortage of paper, a new layout providing a larger type area and

the use of smaller types have been adopted and these together are estimated to have effected a saving of about 40 per cent in paper.

Miscellaneous bulletins.—The printing of a number of miscellaneous bulletins and other publications had to be postponed on account of the present paper shortage. Three miscellaneous bulletins Nos. 57, 58, & 60 were issued during the year.

The first edition, of bulletin Nos. 57, entitled, 'Stored Grain Pests & their Control' by Hem Singh Pruthi and Mohan Singh and 60, entitled, 'Preparation of compost manure from town wastes' by C. N. Acharya, were rapidly sold out within a short time of their publication, and steps are being taken to issue second editions of these.

Supply of Publications.—Over 600 institutions in India and abroad continued to receive one or more of the Council's publications either free or on exchange basis.

The first edition of the pamphlet 'Vegetable growing in the Delhi Province' having sold out rapidly, a second edition was issued during the year.

Editorial Committee and Referees.—The personnel of the Editorial Committee remained unchanged during the year. The committee continued to receive the assistance of a large number of specialist referees in the examination of papers received for publication and the Council takes the opportunity of acknowledging the valuable help received from them. With a view to improving the present system of refereeing, it has been recommended that the Council should have a panel of honorary Associate Editors. Steps are being taken to implement this scheme at an early date.

APPENDIX.

Annual Account of the Imperial Council of Agricultural Research for 1943-44.

Receipts		Payment						
Name of Account	Receipts during the year	Grants		Serial No.	Head of Account	Expenditure	Excess (-) or savings (+) over net grant	Remarks
		Original	Net						3	4	5	6	7	8
1	2	Rs.	Rs.	5	6	Rs. A. P.	Rs. A. P.	9
I.—AGRICULTURE SCHEMES.								
I. Opening balance	43,870 11 2	5,000	5,000	1	Rice breeding, Bengal	5,000 0 0		
II. General receipts—		1,800	1,800	2	Rice breeding, United Provinces	1,776 14 0	+23 2 0	Incon- siderable:
1. Receipts under the A.P.C. Act.	11,71,574 0 9	1,800	1,450	3	Rice breeding, Bihar	1,452 14 3	+17 1 9	"
2. Grants from the Govt of India—		1,800	1,600	4	Rice breeding, Central Provinces	1,570 0 0	+30 0 0	"
(i) for composting of town refuse into manure.	1,20,400 0 0	4,250	Nil	5	Rice breed ng, Assam			"
(ii) for tobacco schemes	10,07,000, 0 0	24,000	2,100	6	Rice breeding, Orissa	2,073 12 4	+26 3 8	"
(iii) for improvement of crop yield statistics.	11,200 0 0	4,400	1,250	7	Rice breeding, Baroda	1,248 1 6	+1 14 6	"
		5,600	2 2 0	8	Rice breeding, Kashmir	2,200 0 0		"
		8,000	5,800	9	Rice breeding, Travancore	5,750 0 0	+50 0 0	"
		15,700	15,700	10	Seed Multiplication, Madras	15,700 0 0		"
		13,150	13,150	11	Seed Multiplication, Bengal	13,150 0 0		"
		5,000	6,300	12	Seed Multiplication, U. P.	6,300 0 0		"
		22,800	Nil	13	Seed Multiplication, Orissa			"
		9,700	106	14	Nutrition of rice plant, Dacca	60 8 0	+39 8 0	"
3 Grants from Indian States—		1,650	300	15	Monograph on Rice Breeding and Genetics	255 0 0	+45 0 0	"
(i) Mysore	5,000 0 0	6,900	6,900	16	Freezing rust resistant wheat, I. A. R. I.	6,850 0 0	+50 0 0	"
(ii) Baroda	5,000 0 0	4,400	4 4 0	17	Wheat breeding, Central Provinces	4,400 0 0		"
(iii) Kashmir	5,000 0 0	3,900	4,000	18	Cereal Technologist, Punjab	4,000 0 0		"
(iv) Travancore	5,000 0 0	3,000		19	Testing malting qualities of barley, U. P.			"
(v) Cochin	5,000 0 0							"
(vi) Gwalior	20,000 0 0	7,150	6,850	20	Rust Research, Bombay	6,850 0 0		"
(vii)-Bhopal	3,500 0 0	12,800	8,200	21	Rust Research, Agra	8,193 14 0	+6 2 0	"

4. Interest from investments—		25,000	26,000	22	Rust Research, Madras	26,000	0	0		
(a) 2½% loan 1948-52	10,972	8	0	23	Pulse breeding, Bombay	4,234	14	6	+65	1
(b) 3½% loan 1947-50	19,201	12	0	24	Pulse breed n., Sind.	1,800	0	0		
(c) 3% loan 1963-65	40,361	4	0	25	Stripa attack on Jowar, Bombay	2,566	8	0	+23	8
(d) Fixed deposits, etc.	12,588	5	0	26	Jowar Storage—J A R I.	3,700	0	0		
5. Miscellaneous Receipts—				27	Jowar Storage, Madras	100	0	0		
(i) Receipts realised from schemes.	29,863	7	9	28	Jowar Storage, Punjab	425	0	0	+5	0
(ii) Receipts on account of unspent balances of grants.	3,355	11	3	29	Jowar Storage C. P.	46	15	6	+3	0
(iii) Miscellaneous	5,436	15	0	30	Jowar Storage Bihar	390	0	0	+10	0
III. Sugar Receipts—				31	Jowar Storage Hyderabad					
1. Grant from Sugar Excise Fund.	3,00,000	0	0	32	Gram wilt research, Punjab	4,100	0	0		
2. Miscellaneous receipts—				33	Castor breeding, Hyderabad					
(i) Receipts realised from schemes.	25,430	12	0	34	Groundnut breeding, Madras	1,450	0	0	+50	0
(ii) Receipts on account of unspent balances of grants.	909	9	5	35	Rape & mustard breeding, Punjab	5,150	0	0		
(iii) Miscellaneous	5,105	12	6	36	Linseed breeding, C. P.	3,000	0	0		
IV. Marketing receipts—				37	Coconuts, Madras	5,500	0	0		
1. Grant for Provincial marketing scheme.	60,000	0	0	38	Coconuts—root disease, Travancore	12,000	0	0		
V. Debts & Remittances—				39	Rice diseases, Madras	2,200	0	0		
1. Recovery of loans and advances to Council's servants.	90	0	0	40	Rice diseases, Sind.	960	0	0	+10	0
2. Recovery of income tax, provident fund, etc.	1,901	11	0	41	Rice seed multiplication C. P.	3,200	0	0		
Total receipts	29,19,092	7	10	42	Insect pests of paddy, Bengal	1,770	0	0	+30	0
				43	Barley rusts, Agra	75	0	0	+50	0
				44	Insect pests of gram, C. P.	2,400	0	0		
				45	Pulse breeding, Madras	4,000	0	0		
				46	Pulse Breeding, Bengal	1,300	0	0		
				47	Pulse breeding U. P.	4,000	0	0	+50	0
				48	Pulse breeding, Bihar	2,750	0	0	+50	0
				49	Pulse breeding, C. P.	2,500	0	0		
				50	Pulse breeding, N. W. F. P.	1,100	0	0	-300	0
				51	Pulse breeding, Orissa					
				52	Pulse breeding, Hyderabad					
				53	Pulse breeding Mysore	1,060	0	0	+40	0
				54	Pulse & Millet breeding, Baroda	2,250	0	0	+50	0
				55	Small millets, Bombay	750	0	0	+50	0
				56	Small millets, C. P.	850	0	0	+50	0
				57	Linseed grating					
				58	Pests & diseases of groundnuts, Madras	2,300	0	0		
				59	Insect pests of stored groundnuts, Madras	1,575	0	0	+25	0
				60	Pests and diseases of t l, U. P.	2,280	0	0	+20	0

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Annual Account of the Imperial Council of Agricultural Research for 1943-44.

Receipts.		Payments.						
Head of Account 1	Receipts during the year 2	Grants		Serial No 5	Head of Account 6	Expenditure 7	Excesses (-) or savings (+) over net grant 8	Remarks. 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.		I—AGRICULTURE SCHEMES—contd.	Rs. A. P.	Rs. A. P.	
Repayment of investments and re-investments.	8,00,000 0 0	2,300	2,500	61	Posts and diseases of brassicas, Punjab	2,480 0 0	+10 0 0	Incon-
		2,100	1,500	62	Posts and diseases of linseed, U. P.	1,480 0 0	+20 0 0	derable.
		2,400	2,400	63	Pests and diseases of castor, Hyderabad	2,400 0 0	..	"
GRAND TOTAL	37,19,062 7 10	16,200	27,000	64	Storage of groundnuts, Madras	27,000 0 0	..	
		2,400	2,800	65	Multiplication of improved Linseed, Bengal	..	..
		3,200	2,800	66	Multiplication of improved Linseed, U. P.	2,800 0 0	..	
		3,600	1,600	67	Manual experiments with groundnut cake, Hyderabad.	1,600 0 0	..	
		25,000	16,200	68	Tobacco sub-station, Guntur	16,200 0 0	..	
					I. A. R. I. TRAINING OF OFFICERS.			
		1,000	1,000	69	Tobacco seed, I. A. R. I.	940 0 0	+60 0 0	"
			25,300	70	Training of tobacco curers—			
					{ Headquarters	25,011 6 0	-11 6 0	"
					{ Punjab	300 0 0	..	"
		7,900	6,700	71	Horticulture, Madras	6,689 8 0	+10 8 0	"
		25,350	22,200	72	Horticulture, U. P.	22,200 0 0	..	"
		9,200	2,500	73	Horticulture, Punjab	2,478 2 4	+20 13 8	"
		11,400	12,900	74	Horticulture, Bihar	12,900 0 0	..	
		7,000	..	75	Horticulture, C. P.	..	..
		Nil	50	76	Horticulture, Bengal	68 12 11	(-)18 12 11	"
		5,100	4,900	77	Horticulture, N. W. F. P.	4,900 0 0	..	"
		9,000	..	78	Horticulture, Assam	..	..
		10,050	3,600	79	Horticulture, Orissa	3,570 0 0	+30 0 0	"
		6,980	..	80	Horticulture, Hyderabad	..	..
		31,380	..	81	Horticulture, Mysore	..	..
		440	440	82	Papaya breeding, Bombay	440 0 0	..	
		6,350	6,100	83	Orange cultivation, Coorg	6,100 0 0	..	

8,400	9,300	84	Mango necrosis, Lucknow	9,170	0 0	+30	0 0	"
6,700	7,000	85	San Jose Scale Survey, Kashmir	6,970	0 0	+30	0 0	"
13,400		86	Fruit preservation, Punjab	32	8 3	(-)	32 8 3	"
23,400	20,600	87	Fruit Preservation, Baluchistan					"
		88	Testing of canned fruits and vegetables, Punjab.	20,601	6 7	(-)	1 6 7	"
5,000	4,600	89	Cytogenetics of mango and banana, Calcutta.	4,600	0 0			"
1,900	1,100	90	Citrus grading Madras	1,070	0 0	+30	0 0	"
2,950	2,250	91	Citrus die back, Bombay	2,250	0 0			"
18,700	30,800	92	Potato breeding, I. A. R. I.	30,570	0 0	+30	0 0	"
5,200	15,800	93	Potato seed certification survey	15,330	0 0	+470	0 0	"
4,800	3,100	94	Diseases of stored potatoes, Bihar	3,070	0 0	+30	0 0	"
14,700	8,200	95	Empire potato scheme	8,160	0 0	+40	0 0	"
1,350	Nil	96	Vegetable seeds production, Kashmir					"
2,650	2,200	97	Citrus die back, C. P.	2,200	0 0			"
2,500	700	98	Manual on fruit culture	665	0 0	+35	0 0	"
	1,000	99	Fruit preservation manual	950	0 0	+50	0 0	"
3,550	2,450	100	Utilization of husked fibre, C. P.	2,450	0 0			"
15,400	7,100	101	Medicinal plants, Col. Chopra.			+7,100	0 0	"
3,000	1,000	102	Drug plant cultivation	947	5 0	+62	11 0	"
2,400	2,800	103	Pan cultivation, C. P.	2,800	0 0			"
3,200	Nil	104	Turmeric, Orissa					"
3,000	2,150	105	Pyrethrum cultivation, Punjab	2,130	0 0	+20	0 0	"
6,200	2,000	106	Monograph on locust research	2,000	0 0			"
3,900	3,600	107	Soil moisture studies, Bengal	3,580	0 0	+20	0 0	"
6,000	6,300	108	Coastal soils, Calcutta	5,270	0 0	+30	0 0	"
7,100	12,700	109	Colloid soil constituents, Calcutta	12,700	0 0			"
43,800	34,100	110	All-India soil survey	34,100	0 0			"
13,500	9,000	111	Sub-surface investigations, Sind	8,950	0 0	+60	0 0	"
27,700	12,600	112	The water requirements of crops, Punjab	12,579	7 9	+20	8 3	"
9,900	9,900	113	Sewage Farming, Bangalore	9,877	12 9	+22	3 3	"
7,300	12,600	114	Demonstration of improved method of composting.					"
4,300	3,500	115	Dry Farming, Madras	3,500	0 0	+30	12 0	"
9,100	5,100	116	Dry Farming, Bombay	5,069	4 0			"
7,700	5,500	117	Dry Farming, Punjab	5,488	15 9	+11	0 3	"
2,300		118	Dry Farming, Hyderabad Deccan					"
3,000	2,400	119	Dry Farming developmental work, Madras	2,395	0 0	+5	0 0	"
3,930		120	Dry Farming developmental work, Hyderabad.					"
8,000	8,600	121	Plant Physiology, Dr. Boshi Sen	8,656	7 0	(-)	56 7 0	"

Receipts				Payments				
Name of Account 1	Receipts during the year 2	Grants		Serial No. 5	Name of Account 6	Expenditure 7	Excesses (-) or savings (+) over net grant 8	Remarks. 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		7,400	2,500	122	Physiology of cane and wheat, Benares Hindu University.	2,506 8 0	(-) 6 8 0	Incon- siderable.
		4,200	3,900	123	Insect pests of stor'd cereals, Punjab	3,900 0 0		
		15,800	1,000	124	Survey of leerya Panchas	10,000 0 0		
		1,000	1,000	125	Monograph on Insect Pests of Indian crops	1,000 0 0		
		3,000	1,800	126	Control of insect pests of grains, Lahore	1,800 0 0		
		14,650	13,600	127	Virus diseases, Bombay	13,600 0 0		
		1,300	300	128	Development of type culture fungi	270 0 0	+20 0 0	"
		50,300	48,600	129	Expansion at the I. A. R. I.	48,550 0 0	+50 0 0	"
		1,400	1,400	130	Kans eradication, Bhopal	1,390 0 0	+10 0 0	"
		Nil	Nil	131	Cold storage, Bombay	2 13 0	(-) 2 13 0	"
			33,600	132	Manure composting—			
					(i) Madras	8,000 0 0		
					(ii) Bombay	2,950 0 0		
					(iii) Bengal	3,200 0 0	-213 14 6	"
					(iv) Punjab	4,750 0 0		
					(v) Sind	2,500 0 0		
					(vi) Baroda	2,020 0 0		
					(vii) Central work under Chief Biochem- ists	10,393 14 6		
			3,900	133	Appointment of a Tobacco Adviser	3,899 14 0	+0 2 0	"
			150	134	Crop-cutting experiments	148 12 0	+1 4 0	"
					II.—ANIMAL HUSBANDRY.			
		5,800	3,600	135	Livestock investigation, Punjab	3,600 0 0		
		4,350	5,700	136	Herd books and pedigree registration of cattle, Hariana breed, Punjab	5,700 0 0		
		16,900	Nil	137	Artificial insemination in animals, I.V.R.I.			

9,200	6,900	138	Improvement of Kangayam breed of cattle, Madras	6,900	0	0	
3,900	200	139	Herd book registration for the Sahiwal breed	200	0	0	
6,800	6,800	140	Method of yoking bullocks	6,800	0	0	
1,600	1,400	141	Kankrej breed society	1,350	0	0	
20,000	Nil	142	Characteristics of grey breeds				
5,400	6,800	143	Monograph on "Anatomy of the Ox"	6,800	0	0	
4,000	4,000	144	Goat breeding, Dr. Slater	3,992	2	9	+7 13 3
2,800	1,100	145	Goat breeding, Punjab	1,100	0	0	
1,160	200	146	Angora goat breeding, Punjab	200	0	0	
8,000	7,100	147	Sheep breeding, Madras	7,073	8	8	+26 7 6
			Sheep breeding—				
6,350	7,200	148	(i) Bombay	7,177	1	6	+22 4 6
300	400	149	(ii) Purchase of extra Deccan Plateau sheep	400	0	0	
1,200	1,200	150	(iii) Development of scientific research work on sheep breeding	1,150	0	0	+50 0 0
4,300	4,500	151	Sheep breeding, Punjab	4,500	0	0	
2,800	3,000	152	Sheep breeding, Bihar	3,000	0	0	
4,500	4,300	153	Breeding of lambs with Karakul pelts, N. W. F. P.	4,250	0	0	+50 0 0
8,900	Nil	154	Sheep breeding, Baluchistan				
6,700	Nil	155	Sheep breeding, Mysore				
5,000	2,900	156	Sheep breeding, Kashmir	2,850	0	0	+50 0 0
3,650		157	Goat breeding, Bengal				
600		158	Animal Nutrition, Madras				
26,300	26,300	159	Animal Nutrition, Bengal	26,370	0	0	(-70 0 0
15,400	16,800	160	Feeding of cattle on departmental farms, U. P.	16,800	0	0	
	400	161	The feeding values of certain food grains, oilseeds and cakes for heifers, Punjab	380	2	9	+10 13 3
2,900	1,300	162	Nutritional requirements of milch cows, Punjab	1,261	2	6	+38 13 6
7,600	8,700	163	Feeding trials with working bullocks, Punjab	8,700	0	0	
4,450	4,450	164	Feeding value of indigenous fodders, Bihar	4,350	0	0	+100 0 0
16,300		165	Animal Nutrition, Assam				
1,000	600	166	Drying of grass, Bombay	550	0	0	+50 0 0
3,000		167	Feeding oilcakes to milch cattle				
1,609	1,100	168	Manual of "Feeding of farm animals in India"	1,105	0	0	(-5 0 0
800	1,300	169	Feeding alkali treated cereal straw	1,300	0	0	

Receipts		Payments.						
Name of Account 1	Receipts during the year 2	Grants		Serial No 5	Name of Account 6	Expenditure 7	Excesses (—) or savings (+) over net grant 8	Remarks. 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		6,900	12,200	170	Veterinary Investigation officers — (i) Madras	12,501 0 0	-301 0 0	Inconsi- derable.
		4,700	5,300	171	(ii) Bombay	5,300 0 0	..	
		20,000	6,500	172	(iii) Bengal	6,500 0 0	..	
		5,540	5,000	173	(iv) United Provinces	5,000 0 0	..	
		4,000	4,600	174	(v) Punjab	4,600 0 0	..	
		7,200	7,200	175	(vi) Bihar	7,100 0 0	+100 0 0	
		3,500	2,000	176	(vii) Central Provinces	1,950 0 0	+ 50 0 0	
		4,650	7,700	177	(viii) Assam	7,660 0 0	+ 40 0 0	
		6,700	..	178	(ix) Orissa . . . . .	..	..
		6,750	6,750	179	(x) N. W. F. P.	6,760 0 0	(-10 0 0	..
		4,700	4,700	180	(xi) Sind and Ajmer-Merwara	4,650 0 0	+ 50 0 0	..
		4,400	4,600	181	(xii) Hyderabad	4,500 0 0	+10 0 0	..
		4,400	2,200	182	Manufacture of ghee, Bangalore	2,200 0 0	..	
		2,950	2,000	183	Development of ghee industry, C. P.	2,000 0 0	..	
		..	2,000	184	Manual on " Dairying in India "	1,940 0 0	+60 0 0	
		5,000	..	..	..	..	..
		3,700	..	..	..	..	..
		17,400	3,650	186	Six combined schemes at I.D.R.I.	18,150 0 0	(-)14,500 0	..
		4,200	..	..	..	..	..
		25,000	..	..	..	..	..
		3,840	..	..	..	..	..
		2,600	Nil	186	John's disease among cattle, Mysore . . . . .	..	..
		29,600	24,000	187	Tuberculosis and John's disease among animals I. V. R. I.	23,980 0 0	+20 0 0	..
		38,800	27,700	188	Contagious abortion in cattle goats and sheep. I.V.R.I.	27,630 0 0	+70 0 0	..
		5,200	4,900	189	Etiology of sheep diseases, Bihar	4,860 0 0	+40 0 0	..
		32,500	15,300	190	Control of warble fly pest	15,240 0 0	+60 0 0	..
		7,300	..	191	Life history of helminth parasites . . . . .	..	..

27,900	7,700	192	Vaccination against foot and mouth diseases	7,640	0 0	+00	0 0
8,800	8,800	193	Damage caused by ticks and wall fleas	8,720	0 0	+80	0 0
3,508	2,500	194	Control of ticks, Bombay	2,534	0 0	(-)	34 0 0
11,200	..	195	Indigenous d.ugs of India	..	..	..	..
400	..	196	Survey of helminth infection in India, I. V. R. I.	..	..	..	..
4,200	3,700	197	Helminthiasis of cattle, Madras	3,700	0 0	..	..
9,200	6,200	198	Helminthiasis, United Provinces	6,200	0 0	..	..
400	400	199	Helminthiasis, C. P.	394	0 0	+8	0 0
1,860	..	200	Monograph on 'Rinderpest in India'	..	..	..	..
..	..	201	Appointment of a Protozoologist	2	9 5	(-)	2 9 5
12,700	100	202	Diseases caused by anaerobes	90	0 0	+10	0 0
100	..	203	Milk recording Societies—	..	..	..	..
..	..	(i) Bombay	..	24	0 0	(-)	24 0 0
550	550	(ii) U. P.	..	800	0 0	(-)	50 0 0
2,000	900	(iii) Sind	..	900	0 0	..	..
1,000	1,000	(iv) Travancore	..	970	0 0	+30	0 0
4,300	Nil	207	Detecting adulteration in ghee, I. D. I.	..	..	..	..
1,880	..	208	Salvage of dry city cows	..	..	..	..
4,800	6,400	209	Poultry Husbandry, Bombay	6,373	4 7	+26	11 5
Nil	800	210	Poultry for table purposes, Punjab	769	6 3	+30	9 9
..	..	Diseases of Poultry—		..	..	..	..
17,700	..	211	(i) I. V. R. I.	..	..	..	..
4,000	4,300	212	(ii) Madras	4,000	0 0	+300	0 0
2,100	1,800	213	(iii) Bombay	1,800	0 0	..	..
3,850	1,700	214	(iv) Bengal	1,700	0 0	..	..
1,950	1,950	215	(v) U. P.	1,900	0 0	+50	0 0
2,100	2,000	216	(vi) Punjab	1,950	0 0	+50	0 0
2,400	1,600	217	(vii) C. P.	1,550	0 0	+80	0 0
4,450	2,000	218	(viii) Bihar	2,000	0 0	..	..
3,500	..	219	(ix) Assam	..	..	..	..
1,500	2,000	220	(x) N. W. F. P.	1,900	0 0	+40	0 0
4,200	..	221	(xi) Hyderabad	..	..	..	..
9,800	..	222	(xii) Mysore	..	..	..	..
2,100	..	223	(xiii) Baroda	..	..	..	..
3,700	..	224	Poultry breeding (village extension)	..	..	..	..
1,630	630	225	Fish preservation (Baroda)	655	0 0	(-)	25 0 0
1,150	..	226	Improvement of preserved fish	..	..	..	..
3,670	..	227	Improvement of cured fish	..	..	..	..
4,200	4,700	228	Fresh water fishes—Calcutta	4,730	0 0	(-)	30 0 0
10,800	8,600	229	Rural pisciculture—Madras	8,600	0 0	..	..
500	200	230	Fresh water fishes (Development)	200	0 0	..	..

Receipts				Payments				
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure 7	Excesses (-) or Savings (+) over net grant 8	Remarks 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		9,000	8,300	231	Wool analysis—Bombay University	8,330 0 0	-30 0 0	Incon- siderable.
		1,600	2,100	232	Laboratory for wool analysis, Bombay	2,050 0 0	+50 0 0	"
		1,000	800	233	Laboratory for wool analysis, Punjab	800 0 0		"
		1,200	900	234	Village shearing and grading, N. W. F. P.	870 0 0	+30 0 0	"
		1,760	1,900	235	Village flaying centres, N. W. F. P.	1,680 0 0	+20 0 0	"
		3,800	1,200	236	Village flaying centres, Bombay	1,170 0 0	+30 0 0	"
	11,000	2,500	11,800	237	Animal Husbandry Bureau	11,788 9 6	+11 6 6	"
		2,500	Nil	238	Monograph on "Statistical methods in Ani- mal Husbandry".			
					III.—COMBINED AGRICULTURE AND ANIMAL HUSBANDRY SCHEMES.			
					Development project—			
		2,100	1,900	239	(a) Bombay	1,900 0 0		
		3,650	3,150	240	(b) U. P.	3,150 0 0		
		3,700	4,600	241	(c) C. P.	4,600 0 0		
		2,200	1,100	242	(d) Travancore	1,040 0 0	+60 0 0	"
					Mixed farming—			
		2,700	2,800	243	(i) U. P.	2,800 0 0		
		4,100	2,700	244	(ii) C. P.	2,700 0 0		
		2,700	2,600	245	(iii) N. W. F. P.	2,600 0 0		
		5,000	1,600	246	(iv) Sind	1,540 0 0	+60 0 0	"
		6,200	7,300	247	Desert Farming, Sind	7,300 0 0		
		16,000	Nil	248	Pasture lands improvement, Baroda			
			12,300	249	Improvement of agri statistics	12,210 10 3	+59 5 9	"
		14,000	8,000	250	Experimental errors in field trials, Statisti- cal Institute, Calcutta University.	8,000 0 0		
		3,550	3,550	251	Comparison of sample means	3,490 5 0	+9 11 0	"
		23,000	22,300	252	Statistical Section of the Council	22,177 0 9	+122 15 3	"

IV.—GENERAL SCHEMES.

58,050	42,060	233	Imperial Agricultural Bureaux	42,054	2	8	—4	2	8
			Imperial Institute of Mycology						
			Imperial Institute of Entomology						
			Farnham House Laboratory						
			Imperial Bureau of Dairy Science						
650	650	254	Fruit, Preservation Research Station, Campden.	666	10	8	—16	10	8
250	250	235	Tobacco Federation of the British Empire	240	0	0	+10	0	0
750	750	236	Indian Society of Soil Science	750	0	0			
500	500	257	Entomological Society of India	500	0	0			
7,000	4,300	258	The Council's Library	3,985	5	0	+314	11	0
14,500	12,500	259	Editorial Staff for Indian Farming	12,167	8	0	+339	8	0
1,000	800	260	Editorial Committee	492	9	0	+7	7	0
11,000	8,800	261	Accounts and Audit	9,607	3	6	+192	13	6
9,000	7,900	262	Travelling allowance of non-official members of the Council.	7,867	4	0	+32	12	0
24,000	21,000	263	Travelling allowances of visitors for attending meetings of the Advisory Board and the Committees of the Council.	21,062	2	0	—62	2	0
1,000	600	264	T. A. of non-official members of the Board of Agriculture and Animal Husbandry in India.	555	0	0	+45	0	0
3,000	1,800	265	Miscellaneous	1,791	0	0	+9	0	0
V.—SUGAR SCHEMES.									
7,100	5,200	266	Karnal Station, I. A. R. I.	5,190	0	0	+10	0	0
11,500	11,700	267	Anakapalle and Gudiyatam Stations, Madras	11,700	0	0			
24,400	37,400	268	Padegaon Station, Bombay	37,331	9	6	+68	6	6
6,100	5,900	269	Dacca Station, Bengal	5,870	0	0	+30	0	0
5,700	7,500	270	(i) Muzaffarnagar Station, U. P.	7,469	0	0	+31	0	0
11,000	72,500	271	(ii) Shahjahanpur Station, U. P.	72,461	0	0	+30	0	0
65,000			(ii) Central Station, U. P.						
14,700	24,700	272	Lyallpur Station, Punjab	24,666	4	0	+33	12	0
65,000	63,800	273	(i) Pusa Station, Bihar	63,870	11	9	+129	4	3
			(ii) Central Station, Bihar						
7,200	3,600	274	Jorhat Station, Assam	3,540	0	0	+60	0	0
11,700	11,000	275	Tarnab Station, N. W. F. P.	11,000	0	0			
5,150	5,000	276	Sakrand Station, Sind	5,000	0	0			
4,700	4,000	277	Hebbal Station, Mysore	3,970	0	0	+30	0	0
2,050	2,050	278	Vyara Station, Baroda	2,020	0	0	+30	0	0

Receipts.			Payments.					
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure 7	Excesses (-) or savings (+) over net grant 8	Remarks. 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		4,100	5,800	270	Ratooning Experiments—			
					(i) U. P.	5,752 2 0	+47 13 3	Inconsi- derable.
		5,000	5,900	280	(ii) Bihar	5,900 0 0	..	
		5,600	3,000	281	Sugarcane Genetics, I. A. R. I.	3,000 0 0	..	
		14,000	..	282	Sugarcane and gur yields U. P.			
		4,600	4,800	283	Sugar Physiology	4,590 0 0	+10 0 0	"
		2,120	2,300	284	Biology of insect pests, Aligarh University	2,250 0 0	+50 0 0	"
				285	Entomological work with sugarcane—			
		21,700	20,900		(i) Insect pest, I. A. R. I.			
		9,000	8,700		(ii) Madras	8,628 5 0	+72 11 2	"
		4,230	4,150		(iii) Bombay	4,150 0 0	..	
		6,950	..		(iv) Bengal			
		6,500	5,700		(v) U. P.	5,700 0 0	..	
		9,050	11,200		(vi) Punjab	11,200 0 0	..	
		6,150	5,900		(vii) Bihar	5,885 4 8	+14 11 4	
		7,000	3,900		(viii) Orissa	4,042 0 0	+58 0 0	"
			800		(ix) Orissa (Original scheme)			
		6,000	..		(z) Bhopal			
		3,800	1,800		(zi) Hyderabad	1,860 0 0	+40 0 0	"
			5,000		(zii) India/Statistical Institute	5,000 0 0	..	
		24,000	17,500	286	Mosaic and other diseases, I. A. R. I.	17,430 0 0	+50 0 0	"
		50,300	50,000	287	Bilari Testing Station	49,970 0 0	+30 0 0	"
			600	288	Grading of gur and boora	600 0 0	..	
		4,000	4,200	289	Factors forming the basis of grading gur and rab.	4,225 0 0	-25 0 0	"
		19,650	17,100	290	Manufacture of sugar candy	17,040 0 0	+60 0 0	"
		340	340	291	Fe ding value of Molasses to cattle	340 0 0	..	
		14,900	4,400	292	Sugar Storage	4,310 0 0	+60 0 0	"
		3,250	..	293	Monograph on "Gur making industry in India"			

12,330	8,600	294	Sugarcane survey	8,681	7	3	-81	7	3	..
3,000	1,800	295	Sugar Committee	1,737	7	0	+62	9	0	..
VI.—MARKETING SCHEME.										
1,04,700	88,000	296	Provincial marketing scheme	93,917	8	6	-5,917	8	6	..
VII.—COLD STORAGE SCHEME.										
..	300	207	Cold storage scheme, Punjab	282	5	9	+17	10	3	..
..	8,200	298	Development of refrigerated rail transport	8,216	0	0	-16	0	0	..
VIII.—DEBTS AND REMITTANCES.										
100	Nil	200	Loans and Advances	..	..	..	..	..	..	..
..	100	300	Deposits and advances repayable	100	0	0	..	..	..	..
1,600	1,900	301	Remittances of income-tax provident funds, etc.	2,061	11	0	-161	11	0	..
				Total expenditure	17,78,250	6	8	..	..	..
				Investments and re-investments	8,00,000	0	0	..	..	..
				By balance	11,40,812	1	2	..	..	..
				GRAND TOTAL	27,19,062	7	10			

III. Particulars of securities, etc.	Face Value.		Purchase value.		Approximate Market value.	
	Rs.	A. P.	Rs.	A. P.	Rs.	
1. 3% stock 1963-66	16,49,500	0 0	15,54,330	0 0	Bar	16,21,664-11-0 (At Rs. 98-5-0 for Rs. 100).
2. 3½% stock 1947-50	6,50,000	0 0	5,91,495	1 0		5,66,500 (At Rs. 103 for Rs. 100).
3. 2½% stock 1948-52	4,00,000	0 0	4,02,736	0 0	Rs.	3,98,500 (At Rs. 99-6-0 for Rs. 100).
4. 3% stock, Defence Bonds, 1948	25,000	0 0	25,117	9 0	Rs.	25,468-12-0 (At Rs. 101-14-0 for Rs. 100).
5. 10 Post Office 10-year cash certificate dated 25th September 1935, for Rs. 1,000 face value each	10,000	0 0	8,625	0 0		
6. 5 Post Office 10-year Defence Savings Certificate dated 22nd October 1940	5,000	0 0	5,000	0 0		
7. Eight fixed deposit receipts Nos. C.28260 to C.28267 dated 10th December 1943 for Rs. 1 lakh each repayable after 12 months	8,00,000	0 0	8,00,000	0 0		
8. Six fixed deposit receipts Nos. B05594 to B05599, dated 23rd January 1940, for Rs. 50,000 each repayable at a week's notice	3,00,000	0 0	3,00,000	0 0		
9. Eight fixed deposit receipts Nos. A78872 to A78879 dated 4th November 1941 for Rs. 50,000 each repayable at a week's notice	4,00,000	0 0	4,00,000	0 0		
10. Two fixed deposit receipts Nos. A79840 and A79841, dated 13th August 1941 for Rs. 50,000 each, repayable at a week's notice	1,00,000	0 0	1,00,000	0 0		
11. Two fixed deposit receipts Nos. B96263 and B94264 dated 23rd November 1942 for Rs. 50,000 each, repayable at a week's notice	1,00,000	0 0	1,00,000	0 0		
IV. Particulars of closing balance—						
1. Cash in hand with the Secretary of the Council					7	3 0
2. Cash in current account with the Imperial Bank of India, New Delhi and Simla					11,40,804	14 2
					11,40,811	14 2

(Sd.) S. M. SRIVASTAVA, Secretary,
Imperial Council of Agricultural Research.

The accounts have been examined and according to the best of my information and in consideration of the explanations given as a result of last audit of the books of the Imperial Council of Agricultural Research the accounts are correct subject to the remarks made in my report of May 1944.

(Sd.) K. H. RAHMAN,
Examiner, Outside Audit Deptt.,
Office of the A.G.C.R., New Delhi.



ANNUAL REPORT

OF THE

**IMPERIAL COUNCIL OF AGRICULTURAL
RESEARCH**

F 1944-45

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APPENDIX

IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH

Report for 1944-45

CHAPTER I—ADMINISTRATION

1. This is the 15th Annual report of the Imperial Council of Agricultural Research covering the period from 1st April 1944 to the 31st March 1945 presented by the Governing Body of the Council under Rule 64 of the Rules and Regulations of the Council.

2. *Meetings.*—(i) Annual General Meeting held on 7th March 1945 adopted the Annual Report and the Audited Accounts of the Council for 1943-44.

(ii) Commodity Committees—October—December 1944.

(iii) Scientific Committee—February 1945.

(iv) Advisory Board—July 1944 and March 1945.

(v) Central Economic (Priority) Committee—July 1944.

(vi) Standing Finance Committee—August 1944.

(vii) Governing Body—September 1944.

3. *Finance and Accounts.*—The following were the receipts from (i) the cess levied under the A. P. C. Act, 1940, and (ii) the grants received from the Government of India:—

	Rs.	A.	P.
(i) Receipts from the cess	16,02,320	3	10
(ii) (a) Grant for composting town refuse into manure	1,01,550	0	0
(b) Grant for improvement of crop yield statistics	6,600	0	0
(c) Grant for tobacco schemes	10,00,000	0	0
(d) Grant for sugarcane schemes	3,00,000	0	0
(e) Grant for Provl. marketing schemes	80,000	0	0
(f) Grant for crop cutting experiments	1,19,426	0	0
(g) Grant for seed-potato scheme	58,000	0	0
(h) Grant for pyrethrum cultivation	1,370	0	0

A statement showing the audited accounts of the Council for the year 1944-45 is appended (Appendix).

4. *Planning.*—At its meeting held in February, 1945 the Advisory Board of the Council decided that a comprehensive and co-ordinated plan for the development of Agriculture and Animal Husbandry in India should be prepared by a special committee for the consideration of the Board.

2. The plan, as it emerged from the Committee, was considered by the Advisory Board at a special meeting in July 1944, and accepted with certain modifications. The plan has since been published as the Memorandum on the Development of Agri. and Animal Husbandry in India of the Advisory Board of the I. C. A. R.

3. The Memorandum discusses the problems connected with increased production and with the marketing of agricultural horticultural and animal husbandry products and makes suggestions regarding the future programme and policy to be adopted for the development of agriculture and animal husbandry in India.

4. The recommendations made in the Memorandum have generally been approved by the Policy Committee on Agriculture, Forestry and Fisheries of the Reconstruction Committee of the Executive Council of the Governor General.

5. The question of implementing the recommendations of the Memorandum is receiving the attention of the Council and of the Government of India.

CHAPTER II—AGRICULTURAL RESEARCH

Rice.—The co-ordinated schemes on rice research in Bengal, U. P., Bihar, C. P. and Berar, Assam and Crissa, terminated on the 31st March, 1944. During the last two years of these schemes work was directed mainly towards recording of manurial and cultural experiments and the working out of a table schedule for the guidance of cultivators. At Chinsura (Bengal) green during with *dhaincha* gave by far the highest yield with regard to both grain

and straw. Complex manurial experiments with oil cakes were continued at both Chinsura and Bankura. At Nagina (U. P.) the main findings were (i) Green manuring with *sana* gave the highest yield at the lowest cost as compared to other inorganic and organic manures such as Ammonium Sulphate, Nicifos II, oil cakes and compost, (ii) Whole plants of *Sana* appeared to possess the highest manurial value as compared to tops only, and leaves, roots and tops (removing the sticks for fibre) and (iii) Molasses at 100 to 200 mds. per acre give statistically significant increase in the yield of paddy as compared to no molasses. The seed rate recommended was 25 or 30 seers per acre under normal soil fertility conditions. As a result of the investigations carried out at Sabour (Bihar) a schedule on manuring for the paddy growers has been prepared. The main findings were (i) Ordinary manuring of seed-beds should only be practised as heavy manuring, has no definite advantage, (ii) The general application of artificial manures was found economically sound, (iii) The best time for the application of artificials was found to be 30 days after transplanting, (iv) Both *dhaincha* and sunnhemp were found to be good green manures and (v) Catch crops had no deleterious effect, even though not beneficial, on the subsequent paddy crop, if such crops were gram, peas and khesari. At Raipur (C. P.) it was confirmed that the combination of nitrogenous and phosphatic fertilisers in the ratio of 1 N: 1P, O gave the highest yield and the largest net profit. At Habiganj (Assam) broadcasting in Aman gave a significantly higher yield of 98 per cent. over transplanting. Double transplanting in Boro gave an increased yield of 65 per cent. over single transplanting.

The schemes initiated in 1940-41 in Travancore, Kashmir and Baroda continued to work on the approved lines. In the Kashmir scheme, crosses have been made with Russian, Chinese and American varieties which have given heavier yield and also ripen earlier than other varieties.

The results of the research scheme on the nutrition of the rice plant, at the Dacca University, show that algae fix a considerable amount of nitrogen in the soil. Pot culture experiments have shown that differences in yield in the presence and absence of algal growth are significant. These findings are still to be tested under field conditions. In the scheme the effect of algal residues in the soil has been investigated and it has been shown that the decomposition of such residues leads to a decrease in the amount of available phosphate and an appreciable increase in the amount of dissolved iron and manganese. The developmental schemes for increasing the area under improved varieties in Madras, Bengal, U. P. and Orissa, terminated during the year. At Tanjore (Madras) a seed farm area of 6,967 acres was arranged. The rice crop was rogued and 37,479 bags of seed sufficient to cover 200,000 acres, were purchased. Similarly, in the East and West Godavari Districts, an area of 7,385 acres was arranged under seed farm conditions. The crop was carefully rogued and 60,000 bags of seeds were purchased, sufficient to cover 300,000 acres. The scheme in Bengal did not work up to expectations. The work in the U. P. was continued on the approved lines. The scheme in the C. P. started a year later and the area covered with improved varieties, upto June 1944, was 103,901 acres.

The possibilities of inducing flood, drought and saline resistance in paddy by pre-sowing treatments are being investigated at the Ravenshaw College, Cuttack.

Preliminary investigations are being carried out in the schemes of research for the investigation of blast and foot-rot diseases of rice in Madras and *Helminthosporium* in Sind.

A monograph on rice breeding is under publication.

The following new schemes were initiated during the year under review:—

1. Improvement of the rice crop, Bombay.
2. Improvement of the rice crop, Hyderabad.
3. Manurial work and water requirement of rice, Sind.

Wheat.—The fungi known as rusts of which there are three distinct species, Brown, Yellow and Black, constitute the greatest enemies of the wheat crop in India. Since 1930 comprehensive research on this subject has been carried on under the auspices of the Council. The main conclusion reached is that the persistence of rust from year to year is due to the over-summering of the rust spores on volunteer wheat plants and on the early sown wheat crop in certain hilly areas in the country. It has also been shown that infection is not carried over from year to year in the plains but originates annually from foci of infection at altitudes of 5,000 to 7,000 feet in the hills where there is no close period of wheat sowing.

Under the Cereal Rusts Scheme (Agra College), physiologic races which exist in the country, are being determined. Since spore cultures of all the different physiologic races are being maintained in a laboratory at Simla and tests of wheat varieties, their crosses and progenies in connection with the breeding of rust resistant varieties for cultivation in the hills are being carried out.

The botanical and agronomic characters of a large number of hill wheats have been examined in the scheme for the breeding of rust-resistant wheat at Simla and the work of hybridisation between the best hill wheats and varieties known to be rust-resistant has been completed. The study of crosses is being continued. Two crosses were tested for resistance to black rust and three each for brown and yellow, while two crosses were under study for resistance to all the three rusts. Anatomical studies undertaken with a view to correlate rust resistance with some easily determinable morphological characters, were concluded. The testing of barley varieties for resistance to black and yellow rusts was also continued on a small scale.

The scheme, for the suspension of the cultivation of wheat and barley in the Nilgiris and Palni hills, which was sanctioned for three years from March 1948 as an experimental measure to ascertain whether such action will result in controlling the attack of rust on wheat in the plains of South India, was continued during the year. The working of this scheme was, however, re-examined and in view of the heavy cost of compensation required for payment to cultivators it was decided that it should be closed down on the completion of its second year.

The wheat rust scheme for Peninsular India under which work is being done at Mahabaleshwar has as its objects the testing of reactions of plants at the seedling stage to black stem rust and the conduct of tests for adult resistance in the field. Work is proceeding on approved lines.

Another scheme for breeding improved wheat strains suited to the black soil areas, especially from the point of view of rust resistance is in operation in the C. P. The work comprises collection of rust samples from all over the province, collection of indigenous and exotic wheats and their testing for rust resistance, inter-varietal crossing and inter-specific crossing.

A scheme for testing the milling and baking qualities and biochemical properties of Indian wheats with a view to helping wheat breeders in the evolution of wheats combining good baking quality with good yielding capacity is in operation in the Punjab. Milling and baking tests were carried out on 28 samples, five from C. P. and Berar, five from Gwalior, 11 from Orissa and two (Australian and Manitoba) from the Wallace Flour Mills from Bombay. The samples from the C. P. and Berar were characterised by high protein content varying between 18.7 and 14.1 per cent. All the wheats except Australian, showed good baking results. The wheat protein survey work for the U. P. was taken in hand and completed during the year. Investigations on the *chapati*-making qualities of wheat *ata* ground in different ways, *vis.*, *Kharas* (Stone-mill, driven by a pair of bullocks), Power Driven *Chakki* (stone-mill) *gharat* (water-driven stone-mill), *chakki*, (hand-mill) a modern roller mill, etc., were continued. The *gharat ata* made the best *chapatis* which were smooth, flexible and quite white in colour and also took longer to go stale than others.

Pulses.—Research on pulses is being financed in Madras, Bombay, Bengal, U. P., Bihar, C. P., N.-W. F. P., Orissa, Sind, Hyderabad, Mysore and Baroda. The underlying object is to evolve high yielding, disease and drought resistant strains of pulses possessing commercially desirable qualities. The pulses concerned are:—red gram, green gram, black gram, horse gram, Bengal gram, cowpea and Lablab in Madras; *Tur, Mug, Urid, Kulthi, Math* and Gram in Bombay, lentil, gram, mung, rahar and soyabean in Bengal, Arhar, Urd, Mung, Soyabean, Moth, Gram, Pea and lentil in the U. P.; *Rahar, Gram, Pea, Khesari* Kulthi, Mung and Kalaj, in Bihar; *tur, mung, urid, moth, gram* and lakh in the C. P.; *Mung, Moth, Duffin*, beans, *arhar, lentil* and gram in the N.-W. F. P., *Rahar, Biri, Kulthi, Mung* and Soyabeans in Orissa; *Gram Mattar, Guar* and Soyabean in Sind; *Gram, Tur* and *Kulthi* in Hyderabad; *Togari-Tur, Avare-Wal, Kadala-Gram, Hurali-Kulthi* and Soyabean in Mysore; *tuer, kodra, math, guvar* and *bajri* in Baroda. Investigations at all the centres are proceeding on approved lines and conclusive results are expected to be available after sometime. A separate scheme on soyabeans is in operation in the Punjab.

A scheme on gram wilt is being run in the Punjab with the object of investigating the life-history of the disease, devising simple measures for its control and discovering varieties resistant to it. An investigation on *Heliothis obsoleta* Fabr. as a pest of gram and for evolving methods for its control is in operation in the C. P. and Berar. Preliminary investigations are proceeding under both the schemes.

Millets—The Council is also financing research on small millets which form the staple food of many people in this country. The investigations include breeding, agronomical and disease resistant aspects of these crops. The scheme in Bombay deals with *Nagli* and *Vari* and that in the C. P. with *kodo* and *kutki*. Recently similar schemes have been sanctioned for the U. P. and Mysore. In Baroda work on lesser millets is combined with that on pulses.

Jowar which is an important food crop for the poor and is also a good fodder crop for cattle suffers heavy losses during storage through the agency of insects. Under a scheme which is in operation at the IARI, a survey of the insect pests is being made and the indigenous methods of storage are being critically studied with a view to suggest improvements in receptacles and to find out suitable methods of control. As a result of a survey carried out in collaboration with regional centres twelve different species which damage jowar grains in stores were recorded. The distribution of the pests seems to be very much controlled by climatic conditions. Common materials in use as preservatives are ashes, sand, cust, bhusa, neem leaves, etc. *Pucca* underground pits can be recommended safely for large scale storage for a year or two. Control measures are being studied at the Institute.

The scheme on *Striga*, a parasitic pest which causes severe damage to the jowar crop, is being continued in Bombay. The object is to build up homozygous strains of jowar resistant to *striga* attack. Some varieties resistant to *Striga lutea* under certain conditions were found and work is now directed to the production of varieties resistant to both *Striga lutea* and *Striga densiflora*.

FRUITS

Fruit culture.—The various horticultural schemes continued in Madras, U. P., Punjab, Bihar, C. P., Assam, N.-W. F. P., Orissa, Mysore, Hyderabad and Coorg. In all these schemes, the object has been to determine best varieties, suitable stocks and scions and quick and cheaper methods of propagation. Suitable cultural methods for various kinds of fruit trees are also under investigation. The following schemes are also in progress:

- (1) Citrus Grading, Madras,
- (2) Citrus die-back diseases, Bombay and C. P.
- (3) Cytogenetics of mango, and banana, Calcutta University,

- (4) San Jose Scale survey, Kashmir.
 (5) Preparation of Manuals on fruit culture and fruit preservation.
 (8) Survey of horticultural research in India.

The following new schemes were initiated during the year under review:

- (1) Manurial trials on citrus in the Punjab.
 (2) Possibility of collecting yield data from individual trees in uniform fruit orchards, Punjab, C. P. & Berar, N.-W. F. P. and Kashmir.

Fruit and vegetable preservation.—The Council has been financing two research schemes on fruit and vegetable preservation—one at Lyallpur and the other at Quetta. In both these schemes useful work has been done on canning, dehydration, concentration and preservation of fruit juices, etc. The Lyallpur scheme terminates on 31st March 1945 and the facilities at this station have been made available temporarily by the Provincial Government as a nucleus for the Establishment of an Indian Institute of Fruit Technology. The Institute will provide for (a) teaching, (b) research, (c) advisory and publicity work, (d) quality control of commercial products and (e) co-ordination between regional stations (when established) and the Institute.

VEGETABLES

Vegetable seeds production.—The Government of India has been financing schemes in Kashmir and Baluchistan for the production of seeds of acclimatised European types of vegetables. Part of the military demands for these seeds is met by imports from the U. S. A. under Lease/Lend. A conference of seedsmen and the D/As was convened on the 9th and 10th March 1945 to advise the Central Government regarding:

- (i) Planning of indigenous production of vegetable seeds and developing sources of production other than Kashmir and Quetta;
 (ii) Passing of a Seeds Act and establishment of a Central Seed Testing Station;
 (iii) Import of vegetable seeds from foreign countries
 (a) for the Army;
 (b) for multiplication purposes;
 (iv) Fixation of the wholesale and retail prices of European types of vegetable seeds for the next season;
 (v) Export of vegetable seeds to Ceylon, and
 (vi) Importation of flower seeds from foreign countries, etc.

Potatoes.—Breeding better varieties.—Since 1935 the Council is financing a scheme at Simla (i) to study the available Indian varieties of potatoes with a view to establish the distinct varieties and utilize the best ones for breeding purposes either by crossing with other desirable cultivated varieties or with South American species—

- (ii) to maintain and study large collections of wild and cultivated potatoes collected from South America with a view to determine their breeding value and utilize the best ones for breeding work;
 (iii) to evolve high yielding, disease-resistant varieties of potatoes for the hills and the plains of Northern India and;
 (iv) to supply initial seed stocks of superior hybrids to various provinces and states for trial and multiplication and distribution. Valuable work has been done. Classification of potatoes has been completed and a bulletin on the subject has been received for publication. Considerable progress has also been made in breeding for resistance to late blight.

Intermediate Hill Station, Bhowali.—This station was started in October 1943 with the object of growing the potatoes selected from the Simla Station at a lower altitude and to make the seed available to Government farms, etc. in the plains for multiplication and distribution to the cultivators at the proper sowing time. During the year under review 15 hybrids, some of which have done well in preliminary trial in the plains at Delhi and Pusa were grown for multiplication. A collection of 1,592 hybrids sent from the Simla Central

Station was planted early so as to supply initial seed stock for trial at Delhi and Pusa.

Storage pests and diseases, Bihar.—From the study of different methods of storage, it seems that considerable reduction in losses due to moth attack, rotting and drriage may be brought about by storing potatoes on the floor under cover of sand about $\frac{1}{4}$ " in thickness and garlic during months of April, May and June and transferring them to 'Machans' during the following three months. The 'Machans' to be used should be made of plaited bamboo strips and mats supported on strong wooden poles. Potatoes are placed on them under cover of sand about $\frac{1}{4}$ " in thickness. Storage on 'Machans' during the first three months is unsuitable due to danger of Black heart disease and due to higher temperature prevailing in them as compared to floors.

Pretreatment of tubers.—The experiments undertaken in this connection of sand about $\frac{1}{2}$ " in thickness garlic during months of April, May and June and show that phenyl corrosive sublimate and sinwari leaf extract treatments are best. 'Mehdi' leaf-extract is fairly satisfactory but the disadvantage lies in the fact that the tubers get stained. Phenyl and 'Sinwari' leaf-extract seem to be the safest treatments. Tubers treated with corrosive sublimate are fit only for seed purposes. Black heart disease of course cannot be controlled by any of these treatments. The only treatment that seems to afford effective protection against the disease is the storage of early harvested tubers when the crop is more or less green and about $3\frac{1}{2}$ months old. In case of late harvested tubers every precaution should be taken to avoid exposure of tubers to hot winds prior to storage under cover of sand.

Potato Seed Certification.—Potatoes suffer from virus diseases which reduce their yield. The disease is transmitted through the "seed". In order to produce a nucleus of disease-free seed the Council has started a central station at Kufri in the Patiala State at a cost of Rs. 94,300 for 5 years. During the year under review a small quantity of virus free material of Darjeeling Red Round variety has been raised in the insect proof house. It is expected that 50,000 maunds of seed, carefully inspected, would be ready for issue as certified seed by September 1949.

Seed potato production scheme, Karnal.—This scheme for the production and multiplication of comparatively disease-free seed potatoes was initiated by the Council with effect from the 1st May 1944 at Karnal. It is expected that about 4,000 maunds of seed potatoes will be available annually for distribution to Provinces for further multiplication from September 1945 onwards. In order that the Provinces may take up further multiplication work the Council has arranged for the training of Virus Inspectors from the U. P., Bihar, Bengal and Assam at the I. A. R. I.

Oilseeds.—In point of area oilseeds come next in importance to rice and wheat. The Council has been financing the following schemes:—

Groundnut breeding (Madras), Rape and mustard breeding (Punjab), Linseed (and other oilseeds) breeding (C. P.), Castor breeding (Hyderabad), Coconuts (Madras), Coconut root diseases (Travancore), Insect pests of stored groundnuts (Madras), Co-ordinated schemes of research on the pests and diseases of oilseeds in Madras, U. P., Punjab, C. P. and Hyderabad, Storage of groundnuts (Madras), Manurial expts. with groundnut cake (Hyderabad), Multiplication of improved linseed, U. P. and Bengal.

A scheme on brassicae and sesamum breeding at the Calcutta University and a groundnut breeding scheme in Mysore were also sanctioned during the year.

Under the Groundnut breeding scheme (Madras), work on the production of superior strains combining high yield and high oil content and resistance to diseases, pests and drought was continued. The improved strains were multiplied and distributed to other provinces and states.

In the Punjab scheme on Rape and Mustard, work on the improvement of toria, sarson and taramira was continued.

In the C. P. (Linseed) and Hyderabad (Castor) scheme's work continues on approved lines.

The coconut scheme in Madras aims at establishing criteria for the selection of seedlings that would ultimately give good yields, studying the copra and oil content of trees in relation to their morphological characters and at investigating the quality and quantity of crops, oil and fibre obtained from nuts of different stages of maturity.

In the Coconut diseases scheme (Travancore) control operations to arrest the spread of diseases were instituted and are in operation. Ten demonstration centres were opened in representative coconut areas of the State.

Preliminary work is going on in the remaining schemes.

Tobacco.—All-India Tobacco Scheme.—The proposals drawn up by the Council in connection with the scheme for the improvement of the production and marketing of tobacco, to be financed from the Special Tobacco Grant, were approved in principle by the Government of India. Preliminary steps in regard to the acquisition of land for experimental purposes, building sites for research laboratories and leasing of lands for exploratory stations were taken by the Council. The scheme will be taken over by the Indian Central Tobacco Committee, which is expected to function shortly.

Tobacco Research Sub-station, Guntur.—The station was started by the Council in August 1936. It is being financed from the funds of the Special Tobacco Grant with effect from 1st April 1944. The station will be merged into the proposed Central Tobacco Research Station, when established, as envisaged in the All-India Tobacco Research Scheme.

As a result of 4 years' trials the variety Amarelo-5 was found to be consistently superior to Harrison's Special in its curing properties and in giving an higher percentage of high grade cured leaf. A white flowered mutant of Amarelo-5 was also discovered and trials made during the year under report show that it was as good as Amarelo-5 both in yield and in curing properties. Being a white flowered type, unlike its parent (Amarelo-5) and other standard types of tobacco which are slightly pink in shade, the mutant can be distinguished easily from 'rogues' in fields. This white flowered colour characteristic will be of value in maintaining the purity of this strain.

Scheme for the production of Virginia cigarette tobacco seed.—As stated in last year's Annual Report a part of the seed produce will be used in sowing seed-beds at the cigarette tobacco exploratory stations during the year 1945-46. The remainder of the seed will be utilised in developing the indigenous sources of seed supply in India with a view to make her independent of foreign imports as soon as possible.

Other crops.—In the Central Provinces Pan scheme, investigations were continued with a view to devise control methods for the diseases of pan vines, particularly the foot-rot disease, and to find out the effects of manuring by linseed cake or its equivalent chemical fertilisers on the diseases and the yield. 4:4:50 strength Bordeaux mixture, one gallon for 12 linear feet every two months has proved the best in checking the progress of the foot-rot disease. The different manures tried had no significant effect on the incidence of foot-rot disease or on the yield of the pan leaves. Anthracnose was kept successfully in check by spraying the vines with Bordeaux mixture of 2:2:50 strength, every two months. Analysis of the soils indicates that soils with high contents of calcium carbonate, nitrogen, and organic carbon are more favourable to foot-rot disease.

In the medicinal plants and food poison's scheme which is being carried out under the supervision of Col. Sir B. N. Chopra, work was continued on the 'Monograph on the Poisonous Plants of India'; the survey of medicinal plants, collection of species for the herbarium and the preparation of a glossary of medicinal plants.

The following new schemes were approved during the year:—

Cardamoms (Madras), Pepper diseases (Madras), Turmeric (Orissa), cloves (Travancore).

Soils and manures.—The following soil schemes were in operation during the year:—

1. *All-India Soil survey (I. A. R. I.)*.—The object of this scheme is to collect information for the purpose of classifying and mapping soils and of carrying out a land utilisation survey to record the present use of land, the slope, stoniness, water supply and other features of the land, to note the crops grown, crop yields, nutritional deficiencies, land tenures and other matters and to investigate the problem of crop adaptation, manuring and soil adjustment to assist the cultivator. The collection of data has been completed in Bengal, Assam, Punjab, Sind, C. P. & Berar, Madras and is nearing completion in the U. P., N.-W. F. P., Orissa, Bombay, Hyderabad, Mysore and Baroda. The areas to be taken up next are Travancore, Cochin, Baluchistan, Bihar, Rajputana and Central India States.

2. *Coastal soils (Calcutta University)*.—This scheme aims at carrying out a general survey of the soils of coastal tracts of Bengal with special reference to the formation of pan soils and conditions of salinity of the soil and to formulate measures of amelioration of such soils. Work was continued on approved lines.

3. *Colloid Soil constituents (Calcutta University)*.—This schemes undertakes investigations on the colloidal constituents of Indian soils and natural deposits of clay minerals with a view to (a) the elucidation of their fundamental electro-chemical character as manifested in their base exchange properties and their manner of association in and contribution to the properties of soil (b) differentiation of clays obtained from various soils and identification of clay minerals contained in them and (c) the elucidation of soil forming processes. Research during the year continued according to the programme of work laid for the scheme.

4. *Sewage Farming, Bangalore*.—The object of this investigation is to study the effects of the various treatments of sewage, such as the changes in consequence of its dilution and intensive aeration, to ascertain the fundamental cause of sewage sickness of soil, and to devise a simple method of reclaiming sick soils as also to explore the possible methods of preventing the sickness of soils.

The main conclusions reached are.—(a) The frequent application of undiluted raw sewage reduces the crop yield, whereas sewage diluted with water can be applied more frequently; (b) Plants grow very well in intensely aerated sewage and the yields are generally several times more than those obtained under the best soils conditions; (c) Sewage sickness of soil is steadily brought about by improper or incomplete oxidation of organic matter consequent on inadequate air supply and suppression of the important micro-organisms; (d) Sewage grown crops carry heavy superficial infection which would make them generally unfit for human consumption; (e) Application of lime (preferably burnt) in suitable quantities followed by rest for about a month is generally efficacious in the treatment of sick soils; (f) Suitable provision for drainage and soil aeration, such as by having underdrains, is most important in sewage farming and (g) Experiments with sewage trade waste mixture on the Municipal sewage farm at Ahmedabad have indicated the possibility of utilising the treated trade waste along with domestic sewage for agricultural purposes.

5. *Soil studies, Bengal*.—This scheme which was sanctioned to study the movement of distribution of water in soils and its effect on soil cultivation and plant growth terminated during the previous year. The main results can be summarised as follows:—

1. The soils of Bengal can be grouped conveniently under two heads Laterite and red soils form one group all others constitute the other. In each group it has been possible to correlate certain properties with the clay content of the soil. The heavy clay soils have shown highest ignition loss, maximum water-holding capacity and stick point moisture.

2. The moisture studies to a limited depth of 30 inches have shown that only the top few inches suffer from the loss of moisture due to evaporation.

8. The evaporation of soil water has been shown to take place in three distinct stages representing three different functions of water and with each stage is associated the physical property of the soil. From this a new method has been devised for the determination of the wilting point. The advantage of this method over the existing methods is that it is easy to manipulate; it takes very little time and, as it is based on theoretical considerations, it is accurate.

The following new schemes were initiated during the year:—

- (1) Trace elements in Indian Soils, Calcutta University;
- (2) Control of Erosion (Visva-Bharti Institute);
- (3) Crop production by catalysis, Bangalore.

All-India Compost Scheme.—This scheme aims at the rapid introduction of the Bangalore process of converting town refuse into manure in all the important municipalities of the country and is in operation in 17 areas. The progress of work is well ahead of the scheduled programme as originally laid down. Compost production was organised at over 100 centres scattered throughout the country before 31st July 1944 and over 2,500,000 c. ft. of compost (about 50 thousand tons) were prepared. The main difficulties encountered were (a) apathy of the municipalities to depute sanitary inspectors for compost training, (b) shortage of sweeper labour, (c) absence of proper Refuse Disposal Depots at several centres, (d) existing contracts by which municipalities have agreed to give the rights of collection and ownership of refuse to contractors, (e) non-maintenance of carts or motor lorries for removal of refuse by some municipalities, (f) the system existing at some centres by which the ownership of refuse at night soil belongs to sweepers themselves.

Agonomy.—Research into improvements in the existing methods of farming in areas of precarious and inadequate rainfall which had been in progress in Madras, Bombay, Hyderabad and the Punjab came to an end some time ago and final results are now available from Madras, Bombay and Hyderabad. These are summarised below:—

The Dry Farming Scheme at Madras has shown that the moisture content in the second-foot layer of the soil has a decisive influence on the yield of crops in addition to the influence of the moisture content of the soil at the sowing time. Inter-culturing was found to be helpful in the removal of weeds and confirmed the practice of the cultivator of cultivating sorghum and cotton two or three times. Deep ploughing has not proved profitable and is considered necessary only when the soil is infested with deep rooted weeds. Spacing experiments have shown that 18" spacing for sorghum and 36" for cotton are more suitable. Among the sorghums an improved variety 473 from Bombay proved higher yielding and earlier than the local strains. A strain K23 Slaria has proved suitable for a variety of soils and does well in low rainfall tracts. Another strain K68 is better suited for higher rainfall tracts in deep soils.

The Dry Farming investigations in Bombay have shown, as in Madras, that banded areas give better yields of crops than non-banded areas. The findings of this scheme indicate that ploughing of the land once in three years only is desired with a dressing of five cartloads of farmyard manure per acre. An improved variety 35-1 of sorghum has been found to give better yields. Contrasted to fewer harrowings found in Madras, Bombay work shows that four harrowings and four inter-culturings are essential to eradicate weeds and conserve moisture. The best form of rotation for medium soils was gram-juar and for deep black soils cotton-juar respectively.

The Hyderabad Scheme has also found that frequent inter-culturing and 5 to 6 harrowings are helpful in conserving moisture and eradicating weeds. Experiments under the scheme show that ploughing for cotton is essential and should be done in alternate years. The Bombay improved strain 35-1 of sorghum has proved good in this tract also.

The schemes of dry farming developmental research in Madras and Hyderabad which aim at trying out the improved dry farming practices, evolved as a

result of research, on a large scale on cultivators fields, continued work on approved lines.

At Lyallpur the agronomical, physiological and chemical studies are being made of the water requirements of crops under different cultural and manurial treatments, the best way of utilising the water available by varying quantity of irrigation, time of application, depth of irrigation and frequency of application, and economic use of water by simple cultural methods. Some results have been obtained but conclusive data are not yet available.

A similar scheme was in operation in Bombay with the object of determining the water requirements of crops other than sugarcane which are either grown or can be profitably grown under irrigation. It was found that the yield of *Hundi* with fixed interval treatment was significantly better than for control treatment.

The monograph on "mixed cropping" practices was completed during the year.

Physiology—In the scheme of research in plant physiology and cytology which is being carried out at Vivekananda laboratory, Almora, U. P. under Mr. Boshi Sen, vernalisation experiments on wheat, barley, cotton seed, mustard, vegetables and flowers, were continued.

Agricultural Meteorology.—In the Agricultural Meteorology Section at Poona fundamental experimental work was continued on (a) thermal and moisture balances, crop climates and crop growth and yield in relation to climate and (b) on borderland problems in meteorology, plant physiology and soil physics. Special attention was given to the development of a technique suitable for the estimation of the growth and yield of tall crops by random sampling. The statistical branch made precision observations on paddy and jowar. The section has taken up collection of data for use in forecasting and warning service to agriculturists.

Entomology—In the scheme of research on insect pests of stored cereal grains in the Punjab preliminary investigations were made on the biology and ecology of stored cereal grain pests. Experiments were also undertaken on control measures.

Another scheme on the control of insect pests of grains by the use of mercury vapour was in operation at the Punjab University. Final results are awaited:

The scheme for the survey of *Icerya purchasi* (I.A.R.I) was continued. The areas where the pest was found were recorded, as also the host plants and natural enemies of the pest.

A conference of entomologists on the co-ordination of entomological research in India was held in July 1944. The conference examined the programmes of research of the various provincial and State Governments, universities and other institutes. The programmes finally approved represent the largest common measure of agreement between the various entomologists and have been designed to secure the main object of co-ordination *viz.*, the avoidance of any duplication of work. The Conference also recommended the establishment of schools of research for certain important aspects of entomological work. The object is to encourage specialisation so that the country may ultimately possess highly trained specialists in different aspects of entomological science, working at different centres, each surrounded by a batch of pupils thus ensuring the development and continuity of their lines of study. The conference further recommended the strengthening of the entomological staff throughout the country and special staff for research on pests of rice, fruits, vegetables, stored grains and other foodstuffs. Other recommendations were that the Inter-University Board of India should be asked to take early steps to institute or include definite courses of general entomological study in the Zoology Departments of Universities, that entomology be given the status of a subject for M.Sc. and higher degrees and that entomological research be encouraged in the University laboratories.

Mycology.—The object of the plant virus research scheme in Bombay is to make an extended study of the fundamental nature of plant viruses and to

prosecute research on virus diseases of plants. During the year under review the Yellow Vein-Mosaic of Bhendi, Enation Dolichos Virus, Yellow Mosaic of *Phaseolus lunatus*, Mosaic of *Datura alba*, "Katti", Disease of Cardamoms, Yellow Vein Mosaic of *Ageratum convolvuloides* and Mosaic of *Vigna Cutjang*, were under study. The following new virus diseases were collected; yellow vein mosaic of *Althea rosea*. Yellow mosaic of *Phaseolus vulgaris*, yellow mosaic of *Phaseolus aureus* and green mosaic of a *Lilium longiflorum*. Rosette of peanut was also collected with a view to investigate its insect vectors. The study of the effect of the virus on the enzyme activity of virus affected plants was continued. Except in the case of leaf curl of tobacco, evidence was obtained in confirmation of last year's results that no correlation seems to exist between catalase activity and the type of virus infection.

A small scheme for the development of type culture fungi in India is in operation at the I. A. R. I. New Delhi. Four hundred and twenty three cultures were obtained and are being maintained.

Development of certain lines of research at the I. A. R. I.—The various lines of research which are being developed under this scheme are in Agronomy, Chemistry, Entomology, Pathology and Botany. In the agricultural and chemistry sections methods of sampling important soils and crops are being studied and a comparison is being made in field experiments of the relative values of nitrogen in green manure, farm yard manure, compost, oilcake and sulphate of ammonia. Investigations on quality in crops are also included. In the Entomology Section Insect Population Study is being carried on. The study of Environmental Resistance which is the foundation of biological control is also included. In the Pathology Section detailed study of potato, tomato and tobacco viruses with a view to evolving control measure is being made. The position with regard to the occurrence of virus diseases in India is also being generally investigated. The various items under study in the Botany Section are cytogenetic investigations on the oleiferous brassicaceae, determination of chromosome numbers of the potato varieties and species and study of meiosis in them and collection and registration of varieties of crops from India.

Conference on Agricultural Machinery.—In order to advise the Government of India regarding the essential requirements of agricultural machinery and spare parts which must be imported during the year 1945, and the first half of 1946, a meeting of the interests concerned was convened under the auspices of the Council in August 1944. The Conference considered the following questions:—type of agricultural machinery to be imported, number of machines required for replacement purposes and for expanding production, the sources from which imports should be made, the procedure to be adopted to scrutinize and pass demands, and for distributing the imported machinery, the extent upto which spare parts for the existing machinery should be imported, imports of small size hand-operated cream separators, imports of small size ball bearings for pumps and motor wheels, import of small hand-operated and portable straw baling presses, the rate of depreciation allowed by several agricultural departments for tractors and tractor drawn implements, basis on which tractor ploughing charges are collected from ryots and the type of propaganda conducted for popularisation of tractor ploughing.

CHAPTER III—SUGARCANE.

A. *General.*—The term of the Sugar Committee of the I. C. A. R. terminated on the 30th September, 1944, and the Indian Central Sugarcane Committee, constituted by the Govt. of India, came into being in October 1944. The responsibility, which was discharged by the Sugar Committee of the Council, was assumed by the Central Sugarcane Committee. The control of the Imperial Institute of Sugar Technology was taken over by the Indian Central Sugarcane Committee with effect from 1st March, 1945, and of the sugarcane research schemes from the 1st April, 1945. The Sugarcane Research Scheme at Padegao, Bombay, terminated during the year under report. The Sugarcane

Research Survey was completed by Mr N. L. Dutt, Govt. Sugarcane Expert in November, 1944, and a copy of his report was sent to the Central Sugarcane Committee.

B. Breeding and Agronomy.—The two central sugarcane stations at Shahjahanpur and Pusa continued their work. In the U. P., Co. 453, Co. K, 26 and Co. K, 80 gave, on the whole, the highest yields under all the three (i.e. wet, normal and dry) conditions thus confirming the results of the last year. Co. S.245 did well under dry conditions. Sulphate of ammonium either alone or in combination with farmyard manure basal dressing showed better yields than farmyard manure alone. Plant-canes gave higher yields than ratoons. No appreciable differences were found in the borer incidence during the year under report except that top borer attack was severer, in manured plots than in unmanured ones. In April and May, the attack of borers and pyrilla was much severer in ratoon crop than in plant cane but with the advance of season plant cane was more attacked than ratoons by stemborer.

In Bihar, Co. 313 continued to the dominating variety in Tirhut. Co. 513 has been gradually forging ahead, chiefly in heavy soils and areas subject to inundation. Co. 336 was displaced by Co. 395. Another variety that was released for general cultivation in Tirhut was Co. 508. The varieties released for co-ordinated testing during the year were B.O. 10 and Co. 453 in North Bihar and Co. K 28 and Co. K 32 in South Bihar. At the main station the outstanding varieties were B.O. 11, B.O. 20 and Co. 383 and at the sub-station, B.O. 21. In the N. P. experiments in clayey loam 40 lbs. of N increased the yield by 81 mds. and 80 lbs. N by 109 mds. over the control yields of 580 mds. per acre. In the NPK experiment K affected neither tonnage nor juice qualities. In the basal treatment experiment FYM was 37 and 72 mds. better than green manure and fallow, respectively. In the trial with molassic manures, no significant increases in yield were obtained.

112. In Madras, Bombay, the Punjab and the N. W. F. P., the various sugarcane research stations continued their work according to programme to determine the varietals, cultural and manurial requirements best suited for the particular tracts.

The Council continued to maintain the live herbarium at Karnal and it worked in close liaison with Coimbatore. Special attention was paid to wild *Saccharum*, portion of the Herbarium, particularly with regard to their flowering behaviour. The Burma and Lahore forms of *Saccharum spontaneum* which do not usually flower at Coimbatore, but do so fairly profusely at Karnal were successfully potted at a suitable stage and transported to Coimbatore where they flowered and were used in crossing. Studies regarding the chemical composition of flowering and non-flowering varieties, photo-period factor in relation to flowering and chemical treatment to induce flowering were carried out at Coimbatore during the year under report. A new photo-periodic treatment was discovered to induce flowering in *S. spontaneum* Burma—a wild cane variety. It was also made possible to effect a considerable delay in the times of flowering of a number of cane varieties and thus synchronize the dates of flowering of some of the very early flowering varieties with those that flower late in the season. It was found that manuring with groundnut cake and ammonium sulphate, which is the usual practice at this station, inhibited flowering in certain cane varieties.

C. Insect pests and diseases.—The scheme for research on the biological control of sugarcane borers completed two years' working at all the centres. It was found out that Trichogramma played a very important part in reducing the population of borers.

The sugarcane diseases scheme at the IARI was continued during the year under report. The work was mainly concentrated on red rot, smut and wilt. Several methods of testing cane varieties for susceptibility to red rot were further perfected with a view to find out the true resistance of cane varieties to the entry and spread of the parasite within the cane. A number of cane varieties were tested for determining their relative resistance to wilt by the

plug method. No reliable results were, however, obtained. While testing 107 varieties of cane to find out their relative susceptibility to smut, by dipping sets in smut spore suspension, 18 reacted as fairly resistant, 18 as moderately susceptible and 72 as highly susceptible. Various combinations of temperature and exposure were tried on smutted sets. It was found out that 55-60°C for 10 mts. fully controlled the smut but greatly impaired germination.

D.—Sugar Technology.—(Imperial Institute of Sugar Technology).—*Research and Experiments.*—*Sugar Engineering.*—(a) *Optimum conditions for burning auxiliary fuels such as coke breeze, Press-mud and Molasses.*—Burning of Coke-breeze on a special perforated plate grate with forced draught has been tried. This fuel burns very efficiently giving an evaporation of about 7.9 lbs. per lb. of coke-breeze. The temperature of combustion chamber is about 2160°F. Better results were obtained by injecting a small quantity of steam through the fuel bed. The appearance of the flames is intense white with no black smoke through the chimney.

Experiments with briquettes of coke, breeze, molasses and press-mud in the ratio of 2.1:2 have also been carried out on horizontal coal grate. The briquettes do not burn so readily with natural draft but burn quite satisfactorily with forced draft, the temperature of combustion chamber being about 1750°F.

(b) *A study of the conditions of factories having very high extra fuel consumption with reference to their steam generating and steam consuming units.*—Three factories where extra fuel consumption was very high were visited. In order to make a comparative study some factories, which were saving bagasse, were also visited some of the important points so far investigated, suggest that the chief causes of high extra fuel consumption are:—

1. Defective design and operating conditions of furnaces.
2. Mill stoppages for more than about 18 per cent, of working hours.
3. Unbalanced units—particularly the steam consuming prime-movers giving rise to more exhaust steam than can be utilised in boiling house.
4. Moisture content of bagasse, above 48 per cent.
5. Fibre per cent. in cane lower than 13 per cent.
6. Insufficient concentration of syrup in evaporators (Below 50° Brix).
7. Defective insulation of the steam pipes and other heating vessels.
8. Improper setting of the valves of mills and other engines.
9. Use of too many prime-movers, where one big unit would serve the purpose.

Sugar Technology.—(a) *Use of Phosphoric acid for improving the colour of sugar.*—It is common practice to use low grade sugars obtained from the final massecuites as seed magma for boiling high grade massecuites. If the colour of this sugar is inferior it reflects on the colour of high grade sugars obtained from the resulting massecuites, particularly when manufacturing crystals of large size. For reducing the colour in low grade sugars a high degree of bleaching particularly of that portion of the syrup which is used for graining in such massecuites is essential so as to avoid absorption of colours by the nuclei during their formation. In the absence of proper sulphitation arrangements, the use of phosphoric acid before graining has been tried as its decolourising value has already been established in the sugar refining industry.

(b) *Effect of artificial addition of reducing sugars to the graining liquor used in final massecuites on the exhaustion of final molasses.*—Juices containing low glucose/ash ratio interfere with the proper exhaustion of molasses. The effect of artificially raising the glucose/ash ratio by the addition of reducing sugars to the syrup required for graining in C massecuites, was therefore tried in a carbonation factory. The glucose/ash ratio in the syrup, which was originally about 0.8 was raised to 1.2-1.3. The C massecuites (with and without addition of reducing sugars in the syrup) were boiled as usual and the purity of final massecuites was maintained at 57.59. In order to observe the drop in the purity of molasses a sample of the massecuites at about 50°C in each case was cured. These experiments indicated that the purity of molasses in the case of massecuites grained with syrup whose glucose/ash ratio

had been artificially raised was 1.0 to 1.5 units lower than the purity of molasses from massecuite whose glucose/ash ratio had not been raised.

Biochemistry.—Manufacture of molassic manure.—The process consists in developing yeast in the sludge by fermenting molasses and filter press cake under conditions of heavy aeration and neutralisation with milk of lime. Under these conditions the quantity of sludge obtained is maximum. Molassic manure prepared by the improved technique is of high nitrogen content varying from 2.5–3 per cent. P₂O₅ 4.24 to 10.8 per cent. and K₂O 10–11 per cent. The process of manufacture is on the same lines as the manufacture of food yeast using small amount of ammonium sulphate as nutrient. Manures have been prepared under the above conditions and are being analysed for, total N, humus N, aminoacids, nitrite and nitrates.

Cropping tests with the molassic manures have been carried out at Shah-jahanpur Experimental Station in the year 1943–44 and full data including germination, tiller counts, juice analyses figures, and analysis of the variance in the yield have been obtained. The experiments indicate the superiority of these manures, particularly the manure molasses—filterpress cake—lime, having given the highest yield as compared with other inorganic and organic manures viz., ammonium sulphate, mahua and neemcakes.

Cropping tests at Patna and Pusa Agricultural Farms have undergone first and second year's test and are being continued in the third year. Manures have been despatched to these farms.

(B) *Manufacture of Commercial diastase.*—Commercial diastase is prepared as desizing material from malt but a more potent source is from *Aspergillus oryzae*, which produces diastase of much higher activity. A mould has been isolated at the Institute, which will be useful for manufacturing colourless glucose syrups for commercial purposes. Maltng properties of barley, wheat, maize and millet are being studied. The conditions of obtaining diastase from malt by precipitation with alcohol and ammonium sulphate are being investigated. Whereas malt has a maximum diastatic activity of 1600 linter units, that obtained by alcoholic precipitation comes to 4000 and by ammonium sulphate to 1660 linter units. The enzyme isolated from *Aspergillus oryzae* gave only 130 linter units.

Juice extraction by oil expeller and cage presses.—Sugarcane was shredded and then fed to the Standard Expeller for extraction of juice. The sucrose extraction without any maceration was about 93 per cent. and the undiluted juice lost per cent fibre was about 28. During milling the bagasse dries up and loses moisture as it comes out from the expeller rather heated.

As there is no arrangement in the expeller to know what pressures are being exerted a few experiments were carried out in the laboratory with a screw press. The sucrose extraction was about 92 per cent. and the undiluted juice lost per cent, fibre was about 42.

Tests with cage press gave very encouraging and better results than the expeller, the sucrose extraction was about 95.5 and the undiluted juice lost per cent, fibre was 22. These results are much better, than those obtained by the best working 14 roller milling tandem using 20 to 30 per cent, maceration. Besides the bagasse produced contains very low moisture, which is less than 30 per cent, giving the bagasse a very high value as fuel.

Sugar Chemistry (Organic).—L-Cellulose from bagasse.—(a) Since pure cellulose is the starting point for the preparation of most of the cellulose derivatives its correct estimate had first to be obtained by some standard method. Accordingly (1) Cellulose by Shri Khand's method=45 per cent, (2) Hemi-cellulose by Tollen's method=15.9 and (3) Lignin by the 72 per cent, H₂ SO₄ method=18.6 per cent. The L-cellulose therefore works out to nearly 31 per cent, by deducting the hemi-cellulose content from the cellulose content of bagasse. A method having commercial possibilities has been developed for the preparation of L-cellulose from bagasse.

(b) *Dark brown plastic directly from bagasse.*—Good plastic samples have been prepared by using a small auto-clave. Further work on the problem has been held up for want of a high pressure autoclave.

(c) *Edible syrup from Khandasari molasses.*—A simple and cheap method for making edible syrup from Khandasari molasses has been developed. The molasses is diluted by one-fourth of its volume of water and 1 gram of koalin per 100 gms. of molasses is added to it. The mixture is well stirred and heated in a water bath for 30 minutes. The mixture is allowed to settle well and then filtered through a hot funnel to facilitate filtration. The filtrate is concentrated under reduced pressure to about 80° Brix. The colour of the syrup can be improved by treatment with either sulphur dioxide or sodium hexameta phosphate. The resulting syrup is quite tasty.

Physical Chemistry.—Utilisation of carbonation press-mud.—Research work carried out has shown that carbonation press-mud can be profitably utilised for the preparation of (a) Board Chalk, (b) putty paste, (c) Tooth powder and paste and (d) metal polishing powder. Of these the first three are particularly capable of being exploited industrially. Regarding board chalk it is proposed to design and fabricate proper moulds and study the nature of the product obtained and also study the various attractive shades which can be obtained from press-mud.

It is known that carbonation mud from beet sugar factories add to the strength of the mortar or cement if it is added prior to setting. It is proposed to investigate if the same is true of the mud from cane sugar factories.

Statistical.—Relation between the area under sugarcane and the prices of cane, gur and other alternative crops.—It is a general belief that the market price of a crop in any year influences the area under it in the subsequent year. The evidence before the Indian Tariff Board, 1931, showed divergence of opinion as to the influence of gur prices on the area under sugarcane. The problem has been investigated for U.P. & Bihar and the following results have been obtained.

(a) During the period 1912 to 1932, the area under sugarcane in U.P. was not significantly affected by variations in the prices of gur or of alternative crops. But there was a slow increase in area with time, subject to short-term fluctuation.

(b) During the period 1933 to 1944, the area was significantly correlated with the prices of both gur and sugarcane, and the proportion of the total crop utilised by sugar factories.

(c) There was no evidence of correlation between the area under sugarcane and the price of wheat.

(d) Sugarcane is replaced by wheat or bajra, at times when due to poor prices of cane and gur, cane cultivation becomes unprofitable. The total area under the three crops, sugarcane, wheat and bajra has remained fairly constant in recent years.

Schemes.—1. The Sugar Research and Testing Station Bihar.—(a) *Commercial trials*—(i) *Sugar manufacture by sulphitation process.*—During the season 1944-45, the Research Station conducted comparative trials on commercial scale of the process of sugar manufacture by the indigenous process as against the improved sulphitation process, developed by the research station, for a period of two months. All the relevant data have been collected and the economics of the two processes are being worked out. The total recovery of sugar per cent cane obtained by the improved process is 1.5 units higher, which conforms to earlier experiments.

(ii) *Cottage Industry Plant.*—The cottage industry plant, evolved at the Research Station, was worked on commercial scale for over two months. The plant which consists of (i) Bilari Kolhu (bullock driven), (ii) Bilari Bel, (iii) Masonry crystalliser (bullock driver) and (iv) pedestal centrifugal, can be worked without the use of mechanical power. The sugar produced is, therefore, not liable to Excise Duty. The yield of sugar was 5.8 per cent cane, which is

about 0.3 per cent higher than that usually obtained by the indigenous process.

This plant has been evolved for the benefit of small-cane growers, who with the help of the members of their families and their own bullocks can easily make sugar by it and get a higher return than by making gur.

(3) *Training and Demonstration.*—3 candidates were trained in the khandhari supervisor's course and 2 in the karigar's course during the season 1944-45 at the Research Station. Demonstration of the working of the sulphitation and cottage industry plants was given to interested visitors at the Research Station.

2. *Scheme for Research on the manufacture of sugarcandy in India.*—

(i) *Experiments on the manufacture of high class confectionery using candy first and second mother liquors.*—Experiments carried out on the manufacture of high class confectionery using candy first and second mother liquors have shown that it is more profitable to manufacture confectionery from mother liquors than to make candy from these. The quality of the various classes and types of confectionery made is quite good. Keeping quality of these in comparison to those made from sugar is being studied.

(ii) *Designing of suitable candy cutter.*—The mechanical candy cutter designed worked fairly satisfactorily. It has, however, been observed that the plate which has the slots through which the teeth pass is rather weak. The design is being improved by making the plate of thicker sheet.

(b) *Training and Demonstration.*—This year 21 candidates have applied for candy chemist's course and 5 for Karigar's course. All these candidates have deposited their fee for training; so far 8 candidates have undergone training and others are likely to join in batches of six at a time.

The manufacture of candy by the new process using steam as developed at the Havalgaon centre was demonstrated to visitors. The manufacture of confectionery from candy mother liquors was also demonstrated.

3. *Scheme of Research into the factors forming the basis for the grading of gur and rab.*—The year 1944-45 being the final year of the scheme, the work was mostly concentrated on the preparation of gur standards on regional basis. Uniform coloured gur standards were suggested for general trade purposes. On the basis of analysis of gur the acceptable limits of some important factors such as colour in solution, sucrose, moisture, ash and insoluble residue of standard gurs were established for fixing the specification of gur.

Packing of gur.—Gur bhis covered with paper and coated with paraffin wax were found to keep well.

4. *Scheme for research on the prevention of deterioration of sugar in storage.*—The work under this scheme has been suspended till the special godown for storage of sugar is constructed by the Central P. W. D.

Technical Assistance and advice.—Final manufacturing reports for the season 1934-44, received from 149 factories were duly scrutinized and necessary suggestions for improving the working were indicated to the factories concerned. Seven sugar factories sent their run and final manufacturing reports for scrutiny and comments. Ten specifications for open-pan factories, one for cane wax plant and one for vacuum-pan factory were drawn up and supplied to the parties concerned. In addition to the above a large number of technical enquiries were received and dealt with through correspondence.

The total number of Indian Sugar Standard Sets supplied during the year was 223 as against 174 in the preceding year. 677 samples of sugar sent to the B.S.S. under orders of the Sugar Controller for India and the Inspectorate of Food Stuffs were tested and the test reports sent to the authorities concerned. 49 samples sent by sugar factories were graded on payment of fees and the grading reports sent to factories concerned.

Indian Sugar Trade Information Services.—The Indian Sugar Trade Information Services (namely the Daily and Weekly Services (giving the spot wholesale and retail prices of crystals and khandhari sugars, stocks, market tendencies, information relating to sugar control etc.), were maintained although the utility of those services has been reduced to some extent by the introduction of sugar control all over India.

Training.—During the year, 1944-45 86 new admissions were made to the various courses of the Institute. 27 students completed their training during the year as against 21 students in the preceding year.

Experimental Sugar Factory.—The factory commenced working on the 5th December 1944, and closed down on the 18th April, 1945. The duration of season was 129 days as against 83 days last year. 95,465 maunds of cane was crushed and 1,420 maunds of sugar was produced. Several semi large-scale experiments were carried out in the factory during the season.

Publications.—The first, second and final notes on the production of sugar direct from cane and the final note on the production of sugar refined from gur, consolidated statements of prices paid for cane (monthly), sugar production and stocks (fortnightly), monthly manufacturing data from central sugar factories, and the review of the quality of sugar manufactured in India during the season 1943-44, have, as usual, been published.

CHAPTER IV.—ANIMAL HUSBANDRY RESEARCH

General.—The sixth meeting of the A. H. Wing of the Board of Agriculture and Animal Husbandry in India met at Hyderabad-Deccan from the 29th Jan. to 1st Feb. 1945. Over 100 delegates from all over India attended the plenary session of the meeting, which was opened by the Nizam Sahib of Chhattari, President of the Executive Council of H. E. H. the Nizam's Government.

Preceding the Plenary Session, the following four committees met simultaneously for two days:—

1. Education Committee.
2. Animal Nutrition Committee.
3. Animal Breeding Committee.
4. Veterinary Committee.

Some of the important recommendations which they made and which were accepted by the wing are referred to under appropriate headings in this report. The recommendations *in toto* are published separately (Appendix).

Animal Breeding.—Dr. Ralph W. Phillips of the Bureau of Animal Husbandry, U.S.A., on his return to America, submitted a report on the impressions he gained during his tour in this country and made certain general recommendations regarding the improvement of cattle. His recommendations which covered a wide field relate to the desirability of determining and rapidly propagating the type of animal best suited to each area of the country, the registration and the recording of the performance of individuals and breeds, range and grassland management and forage production, the encouragement of younger workers, co-operation with scientists abroad, the necessity of having a well defined object for each research scheme financed by the Council and of having these co-ordinated towards the attainment of a general plan. His report was examined and his suggestions accepted by the A. H. Wing, the Committees and the Advisory Board of the Council at the meeting held in February-March 1945.

Under a scheme for investigating the possibilities of artificial insemination on a wide scale for the rapid improvement of livestock in India fundamental studies were made at the Imperial Veterinary Research Institute and the suitability for India of established methods were tested. The prolongation of the period of preservation of semen samples under Indian conditions is under study. It has been recommended that the work should be extended to village cattle maintained under range conditions in India, and that more than one centre be included in the programme of work. At the Government Cattle Farm, Fissar an artificial vagina to suit stud bucks was prepared in the laboratory and semen collected with ease. Work on the preservation and transport of semen and on insemination is continuing. The inter-relationship of 'draught ability', 'milk yield' and such other economic characters are also under study. A related scheme to improve milk producing qualities by selective breeding and feeding

of Kangayam cows without impairing the draught qualities of the male is in progress at Kangayam (Madras).

Under the Central Herd Books scheme already established for the Sahiwal, Sindhi, Haryana and Murrah breeds, about 800 animals were registered. Proposals to open herd books for the Gir and Kankrej breeds and to use selected villages in breeding tracts as subsidiaries to Government breeding farms have been accepted by the Advisory Board. Since April 1943, a scheme to study the correlation of body conformation with the draught ability of work cattle has been in progress. To achieve the object, both single and double yokes were tested in use with a dynamometer cart. The results so far achieved show that yokes of certain types in common use are better than others; yokes which definitely restrict side movement of the bullocks are undesirable; except for the restraint of side movement no very clearly defined reason for the superiority of one yoke over another has yet appeared from these studies.

A special Milk Recording Sub-Committee was appointed to review the working of the existing Milk Recording Schemes and to lay down a uniform programme of work. Its recommendations were communicated to the Provincial and Constituent State Governments, and they were requested to remodel the existing schemes on the new lines suggested. The Advisory Board, has endorsed a recommendation that these schemes should be designated, in future, "Cattle Improvement Schemes", to emphasise their true significance. The five village milk-recording schemes in Bombay, United Provinces, Punjab, Sind and Travancore, continued to function on the existing lines during the year, and the two schemes in Ajmer-Merwara and Baroda were remodelled.

As regards animal breedings, the A. H. Wing made the timely recommendations that while attempting to improve Indian breeds of cattle with regard to their milk production and draught qualities, attention should be paid to the retention of their inherent qualities of thrifty living, disease resistance and ability to exist under conditions of drought. Breeding operation should be confined to and within the specific breeds and as far as possible in their specific home tracts. In areas where pure breeds do not exist the indigenous non-descript stock should be graded up with a selected and well-established Indian breed, and the improvement should be properly assessed from data collected in villages and on farms. Experimental livestock breeding farms should be established by the Central Government, one each in at representative region.

Sheep Breeding—With a view to breeding pedigree sheep with wool of desirable standard suitable for home consumption as well as overseas markets and also to observe the effect of selective breeding and nutrition on wool, body-weight and reproduction, schemes are in progress in different parts of India, viz., Madras, Bombay, Punjab, Bihar, N.-W. F. P., Baluchistan, Mysore and Kashmir. A similar scheme has been sanctioned for Orissa.

The N.-W. F. P. is exploring the possibility of grading up sheep for the production of Karakul pelts. The importation of Karakul bucks for experimentation in connection with this scheme has proved a difficulty.

As regards the use of Merino rams for improving indigenous stock, the opinion of the A. H. Wing was that, as Merino sheep are unable to withstand the Indian climate and condition, except in limited areas, and because their wool is unsuitable for the Indian village industry, their use for cross-breeding should be restricted to the improvement of the finer wool sheep in selected areas where climatic conditions are suitable and the Wing further recommended that as there is great scope for improving the quality and quantity of carpet wool, the quantity should be raised by increasing the density of growth and the area of skin on individuals; improvement could be produced by grading up with selected indigenous breeds of superior type or from selective breeding and drastic culling within the breed; cross-breeding with Merino for such a purpose should not be practised.

Goat Breeding—A goat breeding scheme is in operation at Esah, where Barbari goats are maintained. Pleuro-pneumonia and a disease known as 'Bisi'

which had caused, in Etah, loss and disorganisation, were finally brought under control, the mortality was very low during this year. At Hissar a scheme for the breeding of Beetal goats, with a view to establishing a pure flock with increased milking capacity, is progressing satisfactorily. Efforts are being made to import Angora bucks from South Africa in order to follow up the promising work being done at the Hissar farm under the Angora goat breeding scheme in which attempts are being made to evolve a mohair bearing Indian breed of goat.

A second article in the series of 'the common breed of Indian goats' has been published in Indian Farming (Vol. V. No. 8 Aug. 1944).

Poultry Breeding.—In Bombay, the scheme to investigate the relative performances of exotic breeds of poultry under Indian conditions and to study the miscellaneous problems of poultry husbandry as a rural industry was continued. A cheap poultry house with tick-proof perches to accommodate 8-10 birds and which cost Rs. 20 has been evolved. At the meeting of the A. H. Wing the development of the poultry industry was discussed and recommendations were made as to the lines to be followed. A new scheme for poultry development in the C. P. & Berar has been sanctioned for a period of 5 years with effect from 1st April 1945.

Animal Nutrition.—One of the most important proposals of the A. H. Wing concerned the regionisation of research in animal nutrition. While fundamental research of common interest should be done at the centre that of more local importance should be done at stations established in each of the three regions into which it was suggested the country should be divided. Regional committees composed of nutritionists, livestock experts, Agricultural and Forest officers from each province, falling within the region should be responsible for the work. The Advisory Board of the Council examined the question further at its meeting held in March 1945, and approved the recommendations in principle. It recommended the appointment of a sub-committee to examine the question of the demarcation of the regions further. A programme of work setting out what should be done in the Central Institute and Provincial Stations and what the priority should be, was accepted. The proposal for setting up four sub-stations of the Central Institute is still under consideration. The Council has sponsored several schemes on the rational feeding of animals based upon the nutritive value of feeds.

Investigation on fluorosis in Madras points to the conclusion that bonemeal at 3 oz. per diem may be recommended as an ameliorative. To remove fluorine, treatment of water drawn from wells in separate containers with slaked lime at 500 parts per million is also advocated. In Bengal, the feeding of rice straw, either by itself or in combination with supplements, results in an adverse calcium and phosphorus metabolism whereby large quantity of salts are drawn from the animal system and is responsible for the lack of physique in the local cattle. In Assam, feeding experiments on Sindhi X Assamese pure Assamese and buffalo were carried out for 1½ years; when this food was supplemented by concentrates there was no significant difference in the animals in the straw and the grass groups. With regard to Assamese heifers, the grass ration appeared to be decidedly better than straw.

In the Cattle Feeding Research Scheme, U.P. no difference in the feeding values of Jowar and wheat straw was found when it was fed to either the Hissar Cattle or Murrah buffaloes. Jowar straw is as palatable as wheat straw. The food value of prime jowar was found to be superior to Napier grass for growing bull calves of both Hissar and Murrah breeds. There is always some saving of concentrates if instead of wheat straw, green jowar or Napier grass is fed; the quantity of concentrates required for the same amount of growth being in the ratio of 100:72:78 for Hissar and 100:75:87 for Murrah bulls. Coarse fodder are better digested by the Murrah than by the Hissar breed. In the Punjab tentative results show that a 1,000 lb. bullock working at the plough for 8 hours a day needs 8-9 lb total digestible nutrients containing 0.46-0.58 lb. digestible protein. No ill effects were noticed on the health of cows fed with *Styria* cake or on their milk yield. The ghee produced from the milk

was normal. The analyses of indigenous green fodders carried out in Bihar show that amongst legumes berseem is superior to others; *meth* is richer than *khauri*; *juar* is inferior to maize; both are poorer than grasses. Generally the mineral content is higher in fodders at the flowering stage or at the first cut, but in any case, it varied with the type of soil and its mineral reserves. Rain-fall had a great influence on the quality of the fodder examined, the compositions of which varied from year to year. Manuring tended to increase the mineral content.

The scheme for the artificial drying of grass in Bombay was terminated as the results indicated that the condition which led to the adoption of the process in other countries, not prevail in India. The only essential advantage between sun-drying and machine drying was in the saving of carotene which the Advisory Board considered could be obtained more economically from other sources.

The Advisory Board has recommended schemes in Assam, Orissa and Kashmir for studying the effect of balanced rations on the growth of young calves, milk production in cows and buffaloes and work production of draught animals.

Animal diseases and pests.—Disease control embraces the adoption of both preventive and curative methods. In order to treat the problem adequately the Council has been financing the employment of Disease Investigation Officers in various Provinces and States. Their primary aim was to survey the incidence of various animal diseases in their respective areas, their seasonal occurrence etc., with a view to controlling or eradicating them. The Disease Investigation Officer's schemes have been extended for a period of five years. Similar schemes were put into operation in Kashmir and Rajputana (including Ajmer-Merwara). Assistant Disease Investigation Officers have also been appointed in several provinces and States to devote their time solely to the study and control of diseases in sheep and goats and in poultry. A new scheme for investigating diseases due to anaerobic organisms has also initiated at the Imperial Veterinary Research Institute in February 1944.

An important feature of the year was the appointment of a special sub-committee to review the technical programmes of these officers and to entrust each officer with one or two major research problems. The Sub-Committee accordingly prepared a co-ordinated programme for each Disease Investigation Officer, Assistant Disease Investigation Officer (sheep and Goats) and Assistant Disease Investigation Officer (Poultry), all the problems being arranged in order of priority. The future lines of work of these officers will be guided by these recommendations.

A brief account of the more important results achieved during the year is given below:—

Tuberculosis and Johne's Diseases.—At the I.V.R.I. avian and mammalian tuberculins of high potency were prepared from specially selected strains. The mammalian tuberculin is being successfully employed for the control of tuberculosis at the Government Cattle-Farm, Hissar. From experiments with 11 sheep and 2 hill goats, it appears that natural infection is difficult to transmit, though both goats and sheep succumb readily to artificial inoculation. Tests of the susceptibility of Indian breeds of buffalo calves to artificial inoculation of cultures of six English strains did not indicate that buffaloes possess greater resistance to tuberculosis infection than British cattle. Susceptibility tests on monkeys to vole Bracilli appear to support the view of A. F. Griffith that vole vaccination only delays the development of tuberculosis but does not bring about the destruction of tubercle bacilli which proliferate and cause the death of the vaccinated animal once immunity has waned. Further evidence in this direction is being collected. Tuberculous metritis was diagnosed in a buffalo slaughtered at the Lahore slaughter-house. Survey and control work is in progress in all the Provinces and States.

Contagious abortion.—The final report of the scheme which was conducted at the I.V.R.I. was approved by the Advisory Board. It contains a full account

of the incidence of the disease and will be of very great use to veterinary workers. An account of the research will shortly be published in one of the journals of the Council and the full report itself, as a scientific monograph after the war. Goats in the Government Cattle Farm, Hissar, have been made brucella free by a process of segregation and slaughter. On account of the high incidence of bovine abortion in certain areas of Orissa calf-hood vaccination is being tried there. At Palghar, Ahmedabad and Sholapur in Bombay, calf-hood vaccination is being used to control bovine abortion. The results are encouraging and it is hoped to eradicate the disease in a short period.

Rinderpest.—Investigations in Bengal have specifically shown that exanthematous eruption, whenever it develops forms a part of the rinderpest syndrome, probably as a direct response to the infection and that there is a possibility of the virus persisting in an infective state in the crusts for periods considerably longer than the accepted period of viability of the virus under natural conditions. In field trials, the use of anti-rinderpest desiccated goat spleen tissue vaccine in different parts of U.P. gave satisfactory results. Work on perfecting the technique of preparing pills of the vaccine for subcutaneous inoculation was continued and experiments on the preparation of these pills without any exception were successfully carried out. In view of the fact that rinderpest is of sufficient gravity to warrant special consideration, the Animal Husbandry Wing recommended that a standing committee should be set up at the centre to give technical advice and guidance in a co-ordinated attempt to eradicate the disease from India.

Sterility in cows in Bengal was found to be commonly associated with cervicitis and metritis accompanied by some degree of vaginitis. Seven samples of sera of animals affected in C.P. and Berar with Brucella arthritis, were analysed at the Animal Nutrition Section, Izatnagar. A low inorganic phosphorus content was revealed in four cases. A detailed schedule of feeding experiments designed to study the condition has been prepared in consultation with the Animal Nutrition Section.

Foot and Mouth disease.—The scheme at the Imperial Veterinary Research Institute has completed its first year of work and about 16 strains of foot and mouth virus were typed. It was found that the virus could be preserved for the longest period in glycerine phosphate. In Assam the disease was recorded in an elephant as well as in pigs. The source of infection appeared to be cattle.

In Madras it was confirmed by cultural and biological test that a braxy-like disease observed in sheep was due to a local infection, primarily a corynebacterium infection, followed by that of *vibrio septique*. A disease similar in every respect to braxy was found prevalent in lambs at the Government Sheep Breeding Farm, Monghyr. Anaerobic bacteria indistinguishable from *clostridium septique* were isolated from the liver, kidneys, etc. from naturally affected lambs as well as from the experimental animals such as lambs, rabbit and guinea-pigs.

Anthrax in goats & sheep.—Spore vaccination experiments were conducted in four enzootic areas at Madras. In all, 2776 sheep and 977 goats were vaccinated. The results were encouraging.

Pleuro-pneumonia in goats at the farm at Etah was brought under control by vaccination of the unaffected animals with a flock-specific caprine pasteurised vaccine. The Advisory Board has recommended that the method of inoculating diseased tissue from infected animals into the ear of non-affected ones as a method of protecting them from the disease is worthy of wider trial.

'Wah' (*contagious agalactia*) in sheep has been recorded for the first time in Sind.

A scheme for the study of the etiology of 'circling' disease of sheep in Madras has been sanctioned. The work is to be done in Madras.

The manufacture of *Ranikhet* disease vaccine for poultry has now reached a stage when it is considered that it may be brought into large scale use. Recommendations have been made to certain Provinces about the training of suitable men in the technique of producing the vaccine so that it may be prepared in the provincial centres.

Helminthiasis.—The work in Madras on the life-history of *Moniezia* received the appreciation of the Animal Diseases and Pests Committee. Work on the life history of *Trichocephalus ovis* was taken up in Lucknow and on *Bunostomum phlebotomum*, *Moniezia expansa* and *Parafilaria bovicola* at the I.V.R.I. An investigation at the I.V.R.I. to find out the deficiency, if any, in the diet of grazing sheep and any correlation between such deficiency and helminthiasis and to study the nutritional requirements of lambs has been recommended for sanction.

The regional and seasonal survey of the prevalence of what is known as 'pittoo' or 'gilar' in sheep and goats was attempted under the Bihar scheme. The disease was found to occur amongst bull and buffalo calves also. It further appeared to be seasonal, the peak of the epizootic being from November to February, it declined gradually and disappeared by the end of April. During the year under review investigation of the etiology of the disease has been hampered by lack of material. The Advisory Board has recommended the examination of the possibility of transferring the scheme to some other province where the disease is more prevalent than in Bihar.

Liverfluke disease in goats in Bombay and in sheep in N.W.F.P. was controlled by carbon tetrachloride treatment and change of pasture. A Punjab scheme for investigating this disease which is prevalent in the new areas brought under irrigation has been sanctioned. It will commence with effect from 1st April 1945.

Ways and means by which improvement could be effected in the Provinces and State Veterinary Services for the control of contagious diseases of livestock were suggested by the Animal Husbandry Wing.

(4) *Dairying*.—(i) *General*.—The model draft rules proposed by the Council for the prevention of adulteration of dairy products have been accepted, with certain modifications, by the Food Standardisation Committee of the Central Advisory Board of Health. These rules are receiving further consideration.

The Director of Dairy Research, submitted a scheme for the establishment of a rural creamery at Anand in Kaira District, Bombay with a research laboratory attached to it, to study the supply of milk in bulk by rail to an urban area (Bombay City). In accordance with the recommendation of the Advisory Board it has been passed to the Government of India.

A scheme for investigating the applicability of the Resazurin Test as a means of rapidly assessing the hygienic quality of milk in India, has been started at the Imperial Dairy Research Institute, Bangalore, with effect from the 20th January, 1945 and will run for a period of six months.

The Advisory Board has recommended the following schemes for sanction—

(i) Evolving a suitable method of transporting milk over long distances under warm conditions in India, (I. D. R. I.).

(ii) Ascertaining the utility of the Freezing Point 'test' under Indian conditions, for determining the quantity of milk (I. D. R. I.).

(iii) Survey of the bacteriological quality of the market milk at Delhi, Allahabad, Calcutta and Bangalore (I. D. R. I.).

(iv) Comparing the "Hay-Box" method with the indigenous methods of heaping and storing milk (at the I. D. R. I., the Jhallar Tract, C. P. and the Montgomery Farm of Sir Datar Singh);

- (v) Composition of Milk of cows, buffaloes, goats and sheep (I. D. R. I.);
- (vi) Intensive study of fat, solids-not fat, specific gravity, lactose, ash, protein and freezing point of milk (Punjab);
- (vii) Rapid enquiry into fat, solids-not fat, and specific gravity of milk (N.-W. F. P.).

Among other things the last three schemes are expected to yield enough data for laying down presumptive standards for milk.

The final report of the scheme for detecting adulteration in ghee which has been carried out at the Indian Institute of Science, Bangalore, was considered by the Advisory Board to be worth bringing to the notice of different workers in India.

A small expert committee of dairy scientists and analysts was appointed in February 1945 to review the various methods employed in the analysis of ghee and to suggest improvements therein with a view to the adoption of a standard method. Its recommendations are under consideration.

A scheme for standardising the methods of manufacture of casein in India has been sanctioned for a period of nine months with effect from the 1st April 1945, at the Imperial Dairy Research Institute, Bangalore.

The Advisory Board has recommended a scheme (to be carried out at the new Dairy of the Agricultural Farm, Dacca, Bengal), for developing an efficient method of concentrating whey under the average village conditions in India and evolving cheap equipment for it.

5. *Other Industries.*—(a) *Apiculture.*—A scheme for the establishment of a Central Beekeeping Research Station at Lyallpur with a Sub-Station at Nagrota in the Punjab has been sanctioned.

A subsidy of Rs. 500 was paid to the All-India Beekeepers' Association, Jeolikote, as assistance towards the publication of the Indian Bee Journal.

(b) *Wool.*—In the Bombay University Wool Analysis Laboratory, 289 samples, received from various parts of India were analysed. Valuable information has been collected on the physical quality of the varieties of wool produced in this country. The fibre characteristics of about 20 breeds and of some cross-bred animals have been brought together for the first time. The chemical investigation on the swelling and adsorption properties of pure and hairy wool have given results indicating methods, which could be fruitfully applied to a study of medullation in wool. A special study of Indian wool with a view to lay down laboratory standards which would correspond to the trade standards is under consideration.

Schemes for washing and grading of wool are in operation in Ajmer-Merwara and the N.-W. F. P. The sheep owners have agreed to adopt the improved methods at the time of shearing in N.-W. F. P.

In addition, wool analysis laboratories attached to sheep breeding schemes have been carrying on their work at Poona, Hissar, Baroda and Madras. The analyses conducted at these laboratories are done primarily as a guide to the progress in sheep breeding. Experiments undertaken at the breeding centres concern (a) cross-breeding and selective in-breeding, (b) acclimatisation of foreign breeds, (c) breeding seasons and (d) climatic and food conditions, affecting sheep. Two other laboratories of a similar nature have recently been recommended by the Council for operations in Baluchistan and Orissa.

(c) *Pisciculture*.—The scheme for the improvement of preserved fish in Bengal has terminated. The report will be reviewed next year.

The following schemes are being continued:—

- (1) Study of the life-history, bionomics and development of fresh water fishes, Bengal.
- (2) Preservation of fish by curing, pickling and smoking in Baroda.
- (3) Experimentation on the Barn-type plant for dehydrating fish in Orissa.
- (4) Investigation of fish eggs and larvae (Bombay and Madras).

The Advisory Board has recommended for sanction a scheme for investigating the bionomics of Indian migratory fishes with a view to standardising designs for fish-passes and has also approved the appointment of a special officer to collect data in regard to various factors responsible for river pollution with factory effluents and the effect of such pollution on the fisheries.

Under the Madras Rural Piscicultural scheme, various observations on different kinds of fish, viz., *Barbus-dubius* (Day), *Ospromenus gourami* Lacep, *Cirrhina reba* (Hamilton), *Etiopius suratensis* (Bloch), *Ophicephalus* (Bloch), *O. marulius*, *O. striatus*, *O. punctatus* and *Mugil* Linn. were made during the year under review. It has been found that *Barbus dubius* (Day) is typically fluviatile, easily adaptable to lacustrine conditions and is suitable for pond culture. *Ospromenus gourami* being found to be really prolific, the conservation of natural broods would suffice for pond culture. It is also observed that constant disturbance and fluctuation of water level, overcrowding, turbidity and salinity inhibited breeding. The main causes of mortality during transport are mechanical injury owing to violent oscillations, overcrowding and rise of temperature. Three to five inch fingerlings stand transport best. *Etiopius suratensis* (Bloch) can be exploited for stocking well kept fish tanks as well as pools, uncleared swamps and lakes. Sudden change in salinity was the chief cause of mortality; salinity gradation and slow acclimatization reduced the mortality to zero. *O. marulius* is suitable for uncleared swamp farming and large irrigation wells but it is highly predaceous and cannibalistic. *O. punctatus* breeds easily and thrives in large numbers even in small pieces of water and tolerates foul water; its piscivorous tendencies are negligible. It is found suitable for pools, swamps, paddy fields, ditches, wells and tanks and may be tolerated even in systematic fish ponds excepting nurseries.

(d) *Hides and Skins*.—In the N.-W.F.P. two master flayers and 125 flayers were trained in the art of proper flaying, curing and packing of hides and skins. The present scheme has been extended for a further period of three years and an additional grant has been given for opening a curing and framing centre for hides in the Province.

In Bombay tick infestation has been brought under control among the regularly dipped or sprayed stock; and in a few villages cattle sheds are now practically free from ticks. The scheme for the control of warble fly pest by preventive dressing methods conducted by the Imperial Veterinary Research Institute, has been extended till the 31st March 1947. In Sargodha and Ferozepore districts of the Punjab the percentages of warble infestation has been brought down by 20 to 25 per cent. by singeing and dressing methods. Another scheme for undertaking an enquiry into the defects caused to hides and skins by minor biological factors has been sanctioned for a period of three years under the supervision of the Director, I.V.R.I.

6. *Scientific Monographs*.—The monograph on Rinderpest is under preparation by Mr. J. R. Haddow, Deputy Director, I.V.R.I. Another monograph on Veterinary Entomology has been entrusted to Rai Bahadur S. K. Sen. A monograph on the "Anatomy of Ox" has been completed.

7. *Manuals*.—Work on the preparation of a Manual of Dairying in India by Professor James N. Warner of the Allahabad Agricultural Institute and another

on the 'Maintenance of Farm Animals in Health in India' by Rai Bahadur P. N. Nanda Supdt. Government Cattle Farm, Hissar, is in progress.

B. Miscellaneous.—The establishment of Central Commodity Committees on F-eb. Wool, Milk and Milk Products, Cattle, Poultry and Eggs and Hides and Skins is receiving the attention of the council. It is intended that these committees should be responsible for looking after all the interests of the commodity they represent.

CHAPTER V.—COMBINED AGRICULTURAL AND ANIMAL HUSBANDRY RESEARCH

Village projects.—The village project schemes continued to function in the U. P., Bombay, the C. P., & Berar and Travancore. Attempts were made during the year under report to secure the maximum output by effecting an all round improvement on the lines suggested by the Developmental Research Committee of the Council in 1944. In view of the satisfactory progress of work in the schemes, the Developmental Research Committee recommended in 1945 that the cultivators from the surrounding areas should be brought to see the results achieved in the village project areas.

Mixed farming.—The mixed farming schemes in the U. P., the C. P. and Berar, the N.-W. F. P. and Sind were progressing satisfactorily. The unit holders realised the usefulness of the mixed farming practices as a means of increasing income and at the same time maintaining soil-fertility. The number of cultivators cooperating in the villages increased and this was a vindication of the project system.

Desert farming.—The entire desert tract in Sind is subjected to heavy winds and sand-storms during the hot summer months. It depletes the soil of its finer particles. The effects of various tillage operations made for the conservation of soil moisture were off-set by the erosion menace. Suitable trees for shade and emergency fodder grasses were introduced but they suffered considerably due to short rainy season, white ants and rats. Trials on bajra, inferior millets and other crops like mung, til, ground nuts, were also conducted but with no fruitful results.

Fodder and grazing.—The scheme on kudzu vine (*Pueraria hirsuta*) was started in order to study the conditions under which the plant developed aseed.

The scheme on the improvement of pasture-lands in Baroda was also initiated during the year under report.

Statistical Section.—The Statistician continued his work of examining technical programmes and progress reports of the Council's schemes and of advising research workers in the planning of experiments and interpretation.

Three officers from the Punjab, U. P. and Orissa came on deputation for training and two scholars were admitted for post-graduate research.

Crop-cutting experimental surveys by the random sampling method for determining the total outturn of wheat were carried out in the Punjab and U. P. The results showed that the method evolved was practicable for use by the existing agencies and could be depended upon to furnish reliable estimates of outturn. In view of the encouraging results of these surveys the Government of India gave a further grant of Rs. 1,65,000 for wheat Rabi crop, 1945 and the method has been extended in the current season to cover the whole of India's wheat belt comprising of the Punjab, U. P., C. P., N.-W. F. P. and Sind. The use of the random sampling method was also extended to the paddy crop during the year for which Government of India gave a grant of Rs. 29,426. The work was of an exploratory nature and was carried out in the districts of Kolaba (Bombay), Raipur (C. P.) and Tanjore (Madras). The results showed that the method can be adopted for the paddy crop with only minor changes. The method was also tried on a province-wide scale in Orissa. The analysis of results is in progress.

CHAPTER VI.—AGRICULTURAL MARKETING.

Mr. D. R. Sethi, C.I.E., I.A.S., continued to hold charge of the Department as well as the post of the Agricultural Production Adviser to the Government of India in the Education, Health and Lands, Department. Due to transfers of a number of officers, the Department had to run practically with three-fourths of the original strength of the technical staff. The Government of India continued to give a grant of Rs. 60,000 to be divided amongst the provinces for work on agricultural marketing under certain conditions. In spite of these conditions, the provincial staff continued to be busy with other War activities and could do very little work on surveys.

Surveys and Reports.—Only the reports on coconuts and cashewnuts were issued, though the reports on fish, sheep and goats, bananas, cattle, barley, gram, stone and small fruits were also completed and reached an advanced stage of printing. The report on castor seed was completed and was under final scrutiny. Besides the above, two Assistant Marketing officers, assisted by 19 investigators specially appointed for the purpose, carried out a rapid survey of milk production in Delhi Province and a report was submitted to the Government of India.

Development work.—Despite the difficult conditions created by the War, satisfactory progress was recorded in the grading and standardisation of Agricultural and other produce and the value of the graded produce rose to 8.13 lakhs of rupees during 1944 as against Rs. 5.46 lakhs during 1943 and Rs. 2.41 lakhs in 1942.

A revised ghee grading scheme providing for the employment of Government paid chemists at packers, laboratories as well as augmented and better paid analytical staff at the Central Control laboratory was prepared by this Department. The scheme was sanctioned by the Government of India and almost all the arrangements to enforce the scheme were completed by the end of the year. The Department arranged for the import into Delhi, and sale of Agmark graded ghee at the Government Grocery Shops at Delhi and New Delhi.

Proposals to revise the oil grading scheme similarly were also under the consideration of this Department.

The Sann Hemp Grading Scheme, was also revised so as to achieve greater efficiency. The Vice-President of the London Hemp Association visited India towards the close of the year 1944 and discussed the progress of the scheme with the Agricultural Marketing Adviser and the inspectorate staff. The final decision of the Association regarding the specifications suitable for their requirements is awaited.

The Tobacco Conference convened by this Department in January 1944 at Gunter to consider proposals to revise the Tobacco Grading Scheme decided that the exports on consignment account of all types of tobacco from India should be restricted to AGMARK grades. Revised specifications for AGMARK flue-cured Virginia tobacco, both for internal and export trade, were examined and approved at the Conference. The decisions taken by the Conference were embodied in a scheme which was approved by the Government of India later in the year. Arrangements were being made at the end of the year under review to appoint the Chief Inspector and 8 Inspectors sanctioned under the scheme and the prohibition of the export of ungraded tobacco will come into force as soon as these arrangements are completed. The cost of the scheme will be met from the grant of Rs. 10 lakhs per annum made to the I. C. A. R. by the Government of India from the excise duty on tobacco.

Similar proposals for the compulsory grading under the AGMARK of several kinds of fruit and vegetable products were considered and approved at a representative conference of fruit products manufacturers convened by the I. C. A. R. in May 1944. The scheme providing for the appointment of inspectorate staff, the cost of which is to be recovered from the trade by way of a charge of

Rs. 1-4-0 per 100 AGMARK labels, as well as the Fruit and Vegetable Products Control Order drawn up by this Department continued to be under examination.

Standardisation of Contract Terms.—A conference of the representatives of the various trade and other interests was held in August 1944 at Bombay to discuss the question of enforcing the standard contract for groundnuts, drawn and revised at several previous conferences, through legislation and the contract terms were also examined in detail. The Conference agreed up the various terms but considered that the terms regarding drriage should be altogether omitted from the contract till the Olseeds Committee of the I. C. A. R. examined the question. The Conference did not favour the enforcement of the contract terms through legislation but recommended that the position might be watched and the proposals revived if the trade failed to adopt them voluntarily within a reasonable time.

Market News Service.—The daily market rates of a number of agricultural commodities were continued to be collected and broadcast from Delhi. Weekly reports and monthly reviews on prices, stocks, etc., relating to various commodities were published, as usual.

Publicity and Demonstration.—As usual, publicity intended to popularise the Agmark was continued on a limited scale and demonstrations were given at local exhibitions both by the Central as well as the Provincial staffs. Proposals to amend the Agricultural Produce (Grading and Marking) Act, 1937, suitably so as to enable the establishment and efficient running of Departmental Agmark stalls were submitted to the Government of India and were under consideration.

Export Markets.—Before taking action to improve the quality of goat skins exported from India, Australian importers of goat skins were contacted through the Indian Government Trade Commissioner in that country to obtain precise information regarding their quality requirements. They were generally agreeable to the proposals made by this Department. Similar enquiries have also been sent to the Indian Trade Commissioners at New York and London and their replies are awaited.

The question of dressing Indian goat hair exported to Australia, according to the requirements of Australian buyers has been under the examination of this Department for some time past. A sample of "dressed" hair was under preparation at the close of the year. It is proposed to send this sample, to Australia for evaluation. The question of drawing up suitable standards and specifications for goat hair was also taken up and preliminary discussions were held with merchants at Karachi. Several commercial samples were also collected in this connection.

To ascertain the quality requirements of American buyers, 10 bales of cleaned and washed as well as of ordinary wool were collected by this Department from Ajmer and Jodhpur and sent to the Indian Government Trade Commissioner, New York for evaluation by the Incorporated Carpet Manufacturers Association, New York. Further news regarding the consignment is still awaited.

Conferences and meetings.—Apart from the Sann Hemp, Tobacco, Fruit Products and Groundnut Conferences already mentioned, the Agricultural Marketing Adviser and other senior officers of this Department participated, as usual, in meetings convened by the I. C. A. R. and other Departments and advice was tendered on the marketing of many agricultural commodities.

Miscellaneous.—As usual, this Department continued to deal frequently with inter-Departmental references regarding a large number of agricultural commodities and submitted a lot of information and statistical data.

CHAPTER VII—A. LIBRARY.

The Council's Library is being built up steadily by purchase and by a wide list of exchanges with other official and private organisations engaged

in research on Agricultural and kindred subjects throughout the world. The total collection now amounts to about 50,000 books, pamphlets, translations, etc. During the year under report about 1930 books and publications have been added. Of these only 142 were purchased. Out of a total number of 396 current journals and papers only 111 are subscribed for, all the others being received on an exchange basis.

Details of new books acquired are as follows:—

1. By purchase—142.
2. Through exchange—1,681.
3. Bound Volumes of Journal—107.

Loan Statistics.—The following statistics for 1944-45 would show the extent to which the Library has been used:

1. Loan of books—1,600.
2. Circulation of Periodicals—15,170.

These figures indicate only the number of publications issued out. No record is kept of the books consulted in the Library by members of the staff or visitors.

An analysis of the loan statistics indicates the respective popularity of each subject:—

1. Social and Economic Sciences.	165
2. Pure Science.	123
3. Medicine and Veterinary Medicine.	137
4. Agriculture (General).	732
5. Agriculture (Corps).	125
6. Animal Husbandry and Dairying.	141
7. Technology.	51
8. Miscellaneous.	126

16,00

Cataloguing.—The Dictionary Card Catalogue incorporating author, subject and analytic entries has been kept up-to-date and more than 2,000 typed cards have been added to it during the year.

Reference Service.—In addition to the usual facilities to other Government Departments, the Library has co-operated with research workers working on Agricultural problems and allied topics throughout India by supplying them information contained in Scientific and technical literature. Lists of references are compiled in answer to specific enquiries. The amount of assistance given and the variety of questions answered are on the increase and over 100 such enquiries were answered, and 2,500 references were furnished.

B. Publications.—Indian Farming.—Despite abnormal times and restrictions on the number of copies to be printed as well as continued time lag caused by increased difficulties with regard to paper, press, etc., the circulation of *Indian Farming* did not fall below 2,026 in August (152 copies less than last year's maximum) of which 1,331 represent permanent subscribers, 96 casual sales and 599 free distribution copies. With a view to popularize the magazine and to disseminate the results of research on agricultural and allied subjects 70 newspapers in English and 74 papers in Indian languages continued to be on the free distribution list.

Sons of the Soil.—The third edition of *Sons of the Soil* has been released from the press.

Scientific Journals.—The issues of the *Indian Journal of Agricultural Science* and the *Indian Journal of Veterinary Science and Animal Husbandry* were handicapped owing to preoccupation of the Government Press with urgent military work. After protracted negotiations with the Controller of Printing and Stationery arrangements are now complete for the printing of these journals at a private press.

The new layout adopted for the scientific journals has made it possible to accommodate considerably more material in the same space.

Miscellaneous Bulletins.—Owing to the present paper scarcity the printing of a number of bulletins had to be postponed till the cessation of hostilities. The following bulletins were sent for printing during the year:

(1) Bulletin No. 27, "Definition and Characteristics of seven Breeds of Cattle of all-India Importance" (Reprinted).

(2) Bulletin No. 57 "Stored Grain Pests and their Control" (Second Revised Edition) by Hem Singh Pruthi and Mohan Singh.

(3) "Preparation of Compost Manure from Town Wastes" by Q. N. Acharya. (Second Edition).

(4) "Composition of Milk" by James N. Warner.

(5) "Indian Potato Varieties" by B. P. Pal and Pushkarnath.

Only one Bulletin, viz., "Canning of Tomatoes in Baluchistan" by G. S. Siddappa, and A. M. Mustafa appeared during the year.

Monographs.—One monograph "Dry Farming in India" by N. V. Kanitkar was published during the year and another entitled "Our Knowledge of Insects and Mites of Citrus in India and their Control" by Hem Singh Pruthi and M. S. Mani was sent to press.

Supply of Publications.—Over 600 Institutions in India and abroad continued to receive one or more of the Council's publications either free or on exchange basis.

As recommended by the Editorial Committee a number of Associate Editors have been appointed for different subjects with a view to improve the present system of refereeing. The Committee continued to receive the assistance of a large number of scientists throughout the country and the Council takes the opportunity of thanking them for the valuable help rendered by them.

M. S. RANDEHAWA.

APPENDIX

Annual Account for the year 1944-45 relating to the grant for research purposes

Receipts		Payments						
Head of Account	Receipts during the year	Grants		Serial No.	Head of Account	Expenditure during the year	Excess (-) or savings (+) over net grant	Remarks.
		Original	Net					
1	2	3	4	5	6	7	8	9
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
1. Opening balance	11,40,812 1 2	200	200	1	Rice breeding, Bengal	Nil	Nil	
2. Receipts under the A.P.C. Act.	16,02,320 3 10	2,200	Nil	2	Rice breeding United Provinces	"	"	
		200	Nil	3	Rice breeding Bihar	"	"	
		200	Nil	4	Rice breeding Central Provinces	2 0 0	(-)2 0 0	Inconsiderable.
3. Grants from the Govt. of India:—								
(i) From the groundnut fund.	1,00,000 0 0	4,500	Nil	5	Rice breeding, Assam	Nil	Nil	
		26,400	18,800	6	Rice breeding, Orissa	18,773 10 0	(+)26 6 0	
		4,400	4,100	7	Rice breeding, Baroda	4,100 0 0		
		6,100	6,100	8	Rice breeding, Kashmir	6,002 4 7½	(+)97. 11 4½	
(ii) For Pyrethrum cultivation.	1,870 0 0	4,600	1,600	9	Rice breeding, Travancore	1,600 0 0		
		2,150	450	10	Seed multiplication, U. P.	440 0 0	(+)10 0 0	
(iii) For composting of town refuse into manure	1,01,550 0 0	22,800	Nil	11	Seed multiplication, Orissa	Nil	Nil	
		9,950	8,850	12	Seed multiplication, C. P.	8,850 0 0	Nil	
(iv) For tobacco schemes	10,00,000 0 0	14,300	8,000	13	Nutrition of rice plant, Dacca	8,000 0 0	Nil	
		3,900	4,100	14	Rice diseases, Madras	4,100 0 0	Nil	
		2,000	1,700	15	Rice diseases, Sind	1,700 0 0	Nil	
		3,700	3,400	16	Insect Pests of Paddy, Bengal	3,350 0 0	(+)50 0 0	
(v) For improvement of Agricultural Statistics.	6,600 0 0	Nil	1,100	17	Monograph on Rice Breeding and Genetics	1,097 13 0	(+)12 3 0	
(vi) For crop cutting experiments.	1,19,426 0 0	6,200	7,500	18	Water requirements of rice, Sind	7,500 0 0	Nil	
		5,900	Nil	19	Rice Breeding, Bombay	Nil	Nil	
(vii) For seed Potato scheme.	58,000 0 0	2,100	Nil	20	Rice Breeding, Hyderabad, Deccan.	Nil	Nil	
		7,200	8,000	21	Breeding rust resistant wheat, I.A.R.I.	8,030 0 0	(-)30 0 0	

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4. Grants from Indian States:—

(i) Mysore	5,000 0 0	4,700	5,100	22	Wheat Breeding, C. P.	5,150 0 0	(-)	50 0 0
(ii) Baroda	5,000 0 0	4,700	4,900	23	Cereal technologist, Punjab	4,900 0 0		Nil
(iii) Kashmir	Nil	25,700	5,200	24	Wheat rust research, Madras	5,155 0 0	(+)	45 0 0
(iv) Travancore	5,000 0 0	7,500	7,000	25	Wheat rust research, Bombay	6,940 0 0	(+)	160 0 0
(v) Cochin	5,000 0 0	12,950	15,050	26	Wheat rust research, Agra	15,070 0 0	(-)	20 0 0
(vi) Gwalior	20,000 0 0	750	1,750	27	Breeding rust resistant Barleys, Agra	1,810 0 0	(-)	60 0 0
(vii) Bhopal	2,500 0 0	3,000	Nil	28	Pulse Breeding, Madras	3,940 0 0	(-)	3,940 0 0
5. Interest from investments—	10,972 8 0	5,000	6,000	29	Pulse Breeding, Bombay	5,900 0 0	(+)	100 0 0
(i) 2½ per cent loan 1948-52		2,900	Nil	30	Pulse Breeding, Bengal	2,850 0 0	(-)	2,850 0 0
(ii) 3½ per cent loan 1947-50	19,201 12 0	5,050	5,650	31	Pulse Breeding, U. P.	5,650 0 0		Nil
(iii) 3 per cent loan 1963-65	49,361 4 0	4,250	Nil	32	Pulse Breeding, Bihar	4,200 0 0	(-)	4,200 0 0
(iv) Fixed Deposits, Defence Funds, etc.	21,672 9 0	3,000	2,800	33	Pulse Breeding, C. P.	2,840 0 0	(-)	40 0 0
6. Miscellaneous Receipts—		2,200	1,900	34	Pulse Breeding, N. W. F. P.	1,850 0 0	(+)	150 0 0
(i) Receipts realised by the various Provincial Govts. from schemes financed from the funds of the Council.	36,220 3 5½	4,350	3,150	35	Pulse Breeding, Orissa	3,100 0 0	(+)	150 0 0
(ii) Receipts from unspent balances of grants made by the Council.	4,848 4 9	1,800	2,000	36	Pulse Breeding, Sind.	2,000 0 0		Nil
(iii) Miscellaneous	13,120 13 6	5,400	1,200	37	Pulse Breeding, Hyderabad	1,200 0 0		Nil
		2,200	Nil	38	Pulse Breeding, Mysore	2,200 0 0	(-)	2,200 0 0
		3,200	Nil	39	Pulse and Millet Breeding, Baroda	3,200 0 0	(-)	3,200 0 0
		900	1,400	40	Small millets, Bombay	1,450 0 0	(-)	150 0 0
		1,155	Nil	41	Small Millets, U. P.	1,170 0 0	(-)	1,170 0 0
		4,100		42	Gram wilt research, Punjab	5,800 0 0		Nil
		3,150	5,800	43	Insect Pests of gram, C. P.	3,300 0 0	(+)	150 0 0
		2,900	3,350	44	Striga attack on Jowar, Bombay	2,515 0 0	(+)	184 0 0
			2,600	45				
		3,550	4,050	46	Jowar storage, I. A. R. I.	4,050 0 0		Nil
		70	Nil	47	Jowar storage, Madras	Nil		Nil
		800	Nil	48	Jowar storage, Hyderabad	800 0 0	(-)	800 0 0
		Nil	-70	49	Jowar storage, Punjab	74 15 6	(-)	4 15 6
		2,600	2,500	50	Soyabean, Punjab	2,480 0 0	(+)	120 0 0
		1,550	1,250	51	Small Millets, U. P.	1,230 0 0	(+)	20 0 0
		700	Nil	52	Small Millets, Mysore	Nil		Nil
		14,500	13,900	53	Castor breeding, Hyderabad	13,900 0 0		
		5,150	8,250	54	Groundnut breeding, Madras	4,070 0 0	(+)	4,180 0 0
		4,640	4,540	55	Rape and mustard breeding, Punjab	4,276 1 9	(+)	283 14 3
		5,000	5,700	56	Linseed breeding, C. P.	5,700 0 0		Nil
		3,350	3,950	56	Cocnut, Madras	3,945 0 0	(+)	4 15 0
		7,500	6,800	57	Cocnut-root diseases, Travancore	6,740 0 0	(-)	160 0 0
		4,200	1,900	58	Pests and diseases of groundnuts, Madras.	1,937 14 0	(-)	37 14 0

Receipts

Payments

Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess (—) or Savings (+) over net grant 8	Remarks 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
6a. Sugar Receipts—								
(i) Grant for sugar research from sugarcane Excise Fund.	3,00,000 0 0	3,900 4,000	4,200 Nil	59	Pests and diseases of Tili, U. P.	4,200 0 0	Nil	Inconsiderable
				60	Pests and diseases of Brassicae, Punjab.	3,950 0 0	(—)3,950 0 0	"
(ii) Miscellaneous Receipts—								
Receipts realised by the various Provincial Govts. from schemes financed from the funds of the Council.	2,093 11 9	23,350 3,600	3,750 1,800	61	Pests and diseases of linseed, C. P.	3,750 0 0	Nil	"
		15,000 1,850	16,600 450	62	Pests and diseases of Castor, Hyderabad.	1,780 0 0	(+)20 0 0	"
		6,000	Nil	63	Storage of groundnuts, Madras	16,650 0 0	(—)50 0 0	"
				64	Insect Pests of stored groundnuts, Madras.	440 0 0	(+)10 0 0	"
				65	Multiplication of improved Linseed, Bengal.	Nil	Nil	"
7. Marketing Receipts—								
Grant from the Central Govt. for the Provincial Marketing schemes.	60,000 0 0	5,800	6,200	66	Multiplication of improved Linseed, U. P.	6,190 0 0	(+)10 0 0	"
		3,600	3,400	67	Mantrial experiments with groundnut cakes, Hyderabad.	3,350 0 0	(+)50 0 0	"
		1,600	Nil	68	Groundnut breeding, Mysore	Nil	Nil	"
8. Debts and Remittances—								
(i) Loans and Advances	178 0 0	Nil	1,800	69	Multiplication of improved strains of groundnut, Madras.	1,800 0 0	Nil	"
		Nil	Nil	70	Brassicae and sesamum breeding Calcutta.	1,650 0 0	(—)1,650 0 0	"

(ii) Recoveries from Research Staff on account of income-tax, Provident Fund, etc.	5,669 7 0	22,3000	24,000	71	Tobacco Adviser	25,328 14 9	(-) 1,328 0 0	"
Total Receipts	48,96,416 14 54	10,900	21,300	72	Sub-station, Guntur, I.A.R.I.	21,300 0 0	(-) 0 9 0	"
Repayment of investments and re-investments.	12,00,000 0 0	130	7,130	73	Tobacco seed, Madras	7,130 0 0	N4	"
GRAND TOTAL	58,96,416 14 54	4,690	3,490	74	Training of tobacco curers	3,418 2 0	(+) 71 14 0	"
		1,000	1,700	75	Horticulture, Madras	1,762 12 10	(-) 62 12 10	"
		13,200	3,400	76	Horticulture, U. P.	3,360 0 0	(+) 40 0 0	"
		17,250	N4	77	Horticulture, Punjab	N4	N4	"
		4,200	4,800	78	Horticulture, Bihar	4,800 0 0	N4	"
		7,950	5,350	79	Horticulture, C. P.	5,280 0 0	(+) 70 0 0	"
		5,200	1,900	80	Horticulture, N. W. F. P.	1,820 0 0	(+) 80 0 0	"
		19,000	N4	81	Horticulture, Assam	18,700 0 0	(-) 18,700 0 0	"
		10,500	10,600	82	Horticulture, Orissa	10,679 8 3	(-) 79 8 3	"
		14,980	15,380	83	Horticulture, Hyderabad	15,450 0 0	(-) 70 0 0	"
		41,000	N4	84	Horticulture, Mysore	N4	N4	"
		N4	N4	85	Papaya breeding, Bombay	25 0 0	(-) 25 0 0	"
		7,100	6,300	86	Orange cultivation, Coorg	6,870 0 0	(+) 30 0 0	"
		25,970	10,970	87	Mango necrosis, Lucknow	11,070 0 0	(-) 100 0 0	"
		7,150	11,350	88	San Jose Scale Survey, Kashmir	11,370 0 0	(-) 20 0 0	"
		20,300	15,000	89	Fruit preservation, Baluchistan	17,950 0 0	(+) 50 0 0	"
		22,000	21,300	90	Testing of canned fruits and vegetables, Punjab.	21,078 13 11	(+) 221 2 1	"
		5,300	6,100	91	Cytogenetics of mango and banana, Calcutta.	6,110 0 0	(-) 10 0 0	"
		3,050	1,250	92	Citrus die-back diseases, Bombay	1,240 0 0	(+) 10 0 0	"
		2,900	2,700	93	Citrus die-back diseases, Bombay	2,700 0 0	N4	"
		1,900	N4	94	Citrus grading, Madras	1,900 0 0	(-) 1,900 0 0	"
		1,100	1,500	95	Manual on fruit preservation, Punjab	1,490 0 0	(+) 10 0 0	"
		1,600	1,900	96	Manual on fruit culture, Punjab	1,940 0 0	(-) 40 0 0	"
		2,700	N4	97	Horticulture, Kashmir	N4	N4	"
		2,800	3,400	98	Citrus manurial, Punjab	3,390 0 0	(+) 10 0 0	"
		2,500	N4	99	Survey of Horticulture	N4	N4	"
		450	50	100	Yield data from fruit orchards, C. P.	34 0 0	(+) 18 0 0	"
		380	250	101	Yield data from fruit orchards, N. W. F. P.	220 0 0	(+) 25 0 0	"
		300	N4	102	Yield data from fruit orchards, Kashmir.	N4	N4	"

Receipts				Payments					
Head of Account	Receipts during the year	Grants		Serial No.	Head of Account	Expenditure during the year	Excess (—)		Remarks
		Original	Net				Saving (+) over net grant		
1	2	3	4	5	6	7	8	9	
	Rs. A. P.	Rs. Nil	Rs. Nil			Rs. A. P.	Rs. A. P.		
				103	Yield data from fruit orchards, Punjab.	390 0 0	(—) 390 0 0	Inconsiderable	
				104	Fruit and vegetable preservation, Punjab.	1 12 0	(—) 1 12 0	"	
		40,900	30,100	105	Potato breeding, I. A. R. I.	30,050 0 0	(+) 50 0 0	"	
		36,900	Nil	106	Potato seed certification survey	36,900 0 0	(—) 36,900 0 0	"	
		5,400	5,700	107	Diseases of stored potatoes, Bihar	5,750 0 0	(—) 50 0 0	"	
		13,140	Nil	108	Empire potato scheme	13,120 0 0	(—) 13,120 0 0	"	
		1,650	Nil	109	Vegetable seed production, Kashmir	Nil	Nil	"	
		Nil	10,900	110	Seed potato multiplication, Karnal	10,970 0 0	(—) 70 0 0	"	
		6,500	1,200	111	Utilisation of Linseed fibre, C. P.	1,195 0 0	(+) 5 0 0	"	
		22,400	18,300	112	Medicinal plants, Col. Chopra	18,270 0 0	(+) 30 0 0	"	
		2,550	550	113	Drug plant cultivation	392 10 0	(+) 157 6 0	"	
		3,900	4,100	114	Fan cultivation, C. P.	4,140 0 0	(—) 40 0 0	"	
		7,600	2,700	115	Turmeric, Orissa	2,660 0 0	(+) 500 0 0	"	
		980	430	116	Pyrethrum cultivation, Punjab	430 0 0	Nil	"	
		1,200	Nil	117	Cloves, Travancore	Nil	Nil	"	
		14,300	3,900	118	Cardamoms, Madras	3,900 0 0	Nil	"	
		1,250	1,650	119	Pepper diseases, Madras	1,550 0 0	Nil	"	
		5,900	Nil	120	Coastal soils, Calcutta	5,982 0 0	(—) 5,982 0 0	"	
		13,550	Nil	121	Colloid soil constituents, Calcutta	13,700 0 0	(—) 13,700 0 0	"	
		32,100	26,500	122	All India soil survey	26,490 0 0	(+) 110 0 0	"	
		Nil	4,590	123	Sub-surface investigation, Sind	4,550 0 0	(—) 50 0 0	"	
		14,500	34,200	124	Water requirements of crops, Punjab	34,300 3 9	(—) 109 3 9	"	
		5,400	6,000	125	Sewage farming, Bangalore	5,980 0 0	(—) 120 0 0	"	
		7,300	Nil	126	Demonstration of improved methods of composting.	7,195 0 0	(—) 7,195 0 0	"	
				127	Composting of town refuse into manure, Madras.			"	
				128	Composting of town refuse into manure, Bombay.			"	

		129	Composting of town refuse into manure, Bengal.					
		130	Composting of town refuse into manure, U. P.					
		131	Composting of town refuse into manure, Punjab.					
		132	Composting of town refuse into manure, Bihar.					
1,35,00	1,17,000	133	Composting of town refuse into manure, C. P.	1,19,209	3 6	(-)	2,209	3 6
		134	Composting of town refuse into manure, Sind.					
		135	Composting of town refuse into manure Orissa					
		136	Composting of town refuse into manure, Hyderabad.					
		137	Composting of town refuse into manure, Mysore.					
		138	Composting of town refuse into manure, Baroda.					
		139	Composting of town refuse into manure, Travancore.					
		140	Composting of town refuse into manure, Headquarters.					
4,000	3,000	141	Crop production by catalysis	3,000	0 0		NW	
2,200	1,900	142	Control of erosion, Visva-Bharti	1,850	0 0	(+)	50	0 0
5,800	6,000	143	Trace elements in Indian Soils	6,000	0 0		NW	
	2,100	144	Dry Farming, Madras	2,131	13 10	(-)	31	13 10
	1,400	145	Dry Farming, Bombay	1,431	0 9	(-)	31	0 9
6,500	5,300	146	Dry Farming, Hyderabad-Dn.				NW	
3,160		147	Dry Farming (Developmental Scheme), Madras.	3,200	0 0	(-)	3,300	0 0
		148	Dry Farming (Developmental Scheme), Hyderabad.	5,290	0 0	(-)	5,290	0 0
9,200		149	Monograph on mixed farming practices.	110	0 0	(-)	10	0 0
2,000	100	150	Dry farming monograph, Bombay	17	0 0	(-)	17	0 0
8,700	10,700	151	Plant Physiology, Mr. Boshi Sen	10,760	0 0	(-)	60	0 0
4,400	4,700	152	Insectpest of stored cereal, Punjab	4,750	0 0	(-)	60	0 0
1,700	2,700	153	Control of insect pests of grain, Punjab Univy.	2,780	0 0	(-)	80	0 0
14,200	15,200	154	Survey of Icerya Purchase I. A. R. I.	15,300	0 0		NW	

Annual Account for the year 1944-45 relating to the grant for research purposes—contd.

Receipts				Payments				
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess or Saving (+) over net grant (-) 8	Remarks
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		5,200	3,800	155	Monograph on Locust Research I. C. A.R.	3,768 10 0	(+) 31 5 9	Inconsiderable
			1,500	156	Preservation of grain in storage, Bombay.	1,500 0 0		"
		14,000	15,100	157	Virus diseases, Bombay	15,000 0 0	(+) 100 0 0	"
		1,700	1,400	158	Development of tyre culture fungi, I. A. R. I.	1,380 0 0	(+) 20 0 0	"
		54,300	56,500	159	Expansion at the I. A. R. I.	56,630 0 0	(-) 130 0 0	"
		4,100	4,600	180	Livestock Investigation, Punjab	4,850 0 0	(-) 50 0 0	"
		6,150	5,450	161	Herd books and pedigree registration of cattle, Haryana breed, Punjab.	5,400 0 0	(+) 50 0 0	"
		30,000	4,100	162	Artificial insemination in animals, I. A. R. I.	4,070 0 0	(+) 30 0 0	"
		4,400	4,900	163	Improvement of, Kangeyam breed of cattle, Madras.	4,950 0 0	(-) 50 0 0	"
		20,000		164	Characteristics of grey Breeds of cattle			"
		4,800	4,100	165	Herd Book Registration and milk recording of Sahiwal Breed, Punjab.	4,050 0 0	(+) 50 0 0	"
		4,550		166	Methods of Yoking bullocks, Allahabad.	4,500 0 0	(-) 4,500 0 0	"
		1,700		167	Kankrej Breed Society, Bombay.	1,600 0 0	(-) 1,600 0 0	"
		4,550	5,450	168	Monograph on "Anatomy of the Ox".	5,450 0 0		"
		7,250	8,300	169	Improvement of Cattle in Malabar.	8,300 0 0		"
		4,700		170	Manual on preparation of Animals for Indian Markets.			"

2,480	400	171	Monograph on "Maintenance of farm animals in health"	350	0	0	(+)	50	0	0
3,650		172	Goat Breeding, Bengal				Nil			
4,350	1,900	173	Goat Breeding, Mr. Slater	1,900	0	0				
5,630	2,630	174	Goat Breeding, Punjab	2,648	14	0	(-)	16	14	0
7,250	900	175	Angora goat breeding, Punjab	900	0	0				
3,100	3,400	176	Sheep breeding, Madras	3,442	11	6	(-)	42	11	6
6,800	8,300	177	Sheep breeding—							
350			(i) Bombay	7,673	15	9	(+)	426	0	3
			(ii) Purchase of extra Deccan plateau sheep.	300	0	0	(-)	300	0	0
1,400	1,700		(iii) Development of Scientific research work on sheep breeding.	1,660	14	0	(+)	39	2	0
5,800	6,500	178	Sheep breeding, Punjab	6,568	0	0	(-)	68	0	0
3,100	3,300	179	Sheep breeding, Bihar	3,325	8	0	(-)	35	8	0
4,700	4,300	180	Breeding of lambs with Karakul pelts, N. W. F. P.	4,300	0	0				
14,000	3,400	181	Sheep breeding, Baluchistan	3,400	0	0				
9,100	8,000	182	Sheep breeding, Mysore	8,000	0	0				
6,000		183	Sheep breeding, Kashmir	6,000	0	0	(-)	6,000	0	0
	300	184	Animal Nutrition, Madras	299	0	0	(+)	1	0	0
14,150	12,150	185	Animal Nutrition, Bengal	12,300	0	0	(-)	50	0	0
12,500	10,500	186	Feeding of cattle on departmental farms, U. P.	10,500	0	0				
3,120	5,770	187	Nutritional requirements of milch cows, Punjab.	5,765	2	3	(+)	4	13	9
900	12,600	188	Feeding trials with working bullocks, Punjab.	13,630	2	5	(-)	30	2	5
3,400	2,800	189	Feeding value of indigenous fodders, Bihar.	2,560	0	0				
26,300	11,900	190	Animal Nutrition, Assam	11,650	0	0	(+)	50	0	0
100		191	Drying of grass, Bombay				Nil			
10,950	6,700	192	Feeding of alkali treated cereal straw, I.V.R.I.	8,700	0	0				
5,200	5,000	193	Feeding of oil cakes to milch cattle, Baroda.	4,804	0	0	(+)	196	0	0
300		194	Manual on "Feeding of farm animals in India."				Nil			
5,000	3,600	195	Nutritive value of indigenous grasses.	3,605	0	0				
7,100	7,800	196	Veterinary Investigation Officers—Madras	7,814	4	3	(-)	14	4	3

Receipts

Payments

Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess(-) or Savings (+) over net grant 8	Remarks 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		4,250	4,050	197	Bombay	4,061 8 0	(-) 11 8 0	Inconsiderable
		4,550	4,500	198	Bengal	4,500 0 0	Nil	"
		5,700	4,900	199	United Provinces	4,900 0 0	Nil	"
		4,100	4,900	200	Punjab	4,950 0 0	(-) 50 0 0	"
		7,500	8,000	201	Bihar	8,000 0 0	Nil	"
		3,250	800	202	Central Provinces	800 0 0	Nil	"
		4,750	3,750	203	Assam	3,750 0 0	Nil	"
		13,900	13,200	204	Orissa	13,150 0 0	(+) 50 0 0	"
		7,100	6,100	205	N. W. F. P.	6,100 0 0	Nil	"
		4,950	5,150	206	Sind	5,150 0 0	Nil	"
		4,200		207	Hyderabad	6,100 0 0	(-) 6,100 0 0	"
		2,900		208	Johne's disease among cattle, Mysore.	Nil	Nil	"
		31,650	32,100	209	Tuberculosis and Johne's disease among animals, I.V.R.I.	32,140 0 0	(-) 40 0 0	"
		3,000	9,900	210	Contagious abortion in cattle, goats and sheep, I.V.R.I.	9,950 0 9	(-) 60 0 0	"
		5,200	5,400	211	Etiology of sheep disease, Bihar	5,450 0 0	(-) 50 0 0	"
		4,250	400	212	Veterinary Investigation Officer, Ajmer-Merwara.	400 0 0	Nil	"
		5,500	5,000	213	Veterinary Investigation Officer, Kashmir.	5,000 0 0	Nil	"
		14,200	12,900	214	Control of warble fly pest	12,900 0 0	Nil	"
		14,600	6,400	215	Life history of helminth parasites, I. V. R. I.	6,440 0 0	(-) 40 0 0	"
		18,000	12,000	216	Vaccination against foot and mouth diseases.	11,990 0 0	(+) 10 0 0	"
		9,200	Nil	217	Damage caused by ticks and warble flies.	9,050 0 0	(-) 9,050 0 0	"

3,550	3,050	218	Control of ticks, Bombay	3,650	0 0	NH	
23,700	20,100	219	Indigenous drugs of India	20,100	0 0	NH	
3,000	NH	220	Helminthiasis of cattle, Madras	2,910	0 0	(-)	2,910 0 0
9,800	10,700	221	Helminthiasis, United Provinces	10,638	0 0	(-)	12 0 0
16,690	5,700	222	Diseases caused by anaerobes	5,690	0 0	(-)	10 0 0
1,860	NH	223	I.V.R.I. Monograph on "Rinderpest in India"	NH		NH	
	500	224	Resazurin test of milk	500	0 0	NH	
3,200	3,000	225	Structure of glycerides in ghee	3,000	0 0	NH	
650	NH	226	Milk recording societies, United Provinces.	650	0 0	(-)	650 0 0
1,900	1,700	227	Milk recording societies, Sind	1,650	0 0	(+)	50 0 0
600	NH	228	Milk recording societies, Travancore	620	0 0	(-)	620 0 0
4,300	1,800	229	Detecting adulteration in ghee, Imperial Dairy Institute.	1,728	14 10	(-)	71 1 2
1,860	NH	230	Salvage of dry city cows	NH		NH	
4,200	4,500	231	Manufacture of ghee, Bangalore	4,500	0 0	NH	
2,260	700	232	Manual on "Dairying in India," Allahabad.	700	0 0	NH	
5,100	NH	233	Development of ghee industry in C. P.	5,120	0 0	(-)	5,120 0 0
5,000	4,700	234	Milk transport from villages to towns, U. P.	4,700	0 0	NH	
			Six combined Schemes				
			I. D. R. I.—				
			(i) Manufacture and grading of yellow ghee.				
			(ii) Colouring of Vanaspati				
29,100	21,700	235	(iii) Prevention of high acidity in ghee.	21,660	0 0	(+)	50 0 0
			(iv) Milk transport from villages to towns.				
			(v) Preparation of vegetable rennet.				
			(vi) Substitutes for steel milk containers.				
18,400	11,300	236	Bio-chemical research on Dahi	11,250	0 0	(+)	50 0 0
2,700	2,400	237	Adulteration of milk with skimmed milk powder.	2,320	0 0	(+)	80 0 0
13,800	15,000	238	Nutritive value of Vanaspati	15,000	0 0	NH	
15,050	13,000	239	Nutritive value of vegetable oils	13,000	0 0	NH	
3,400	2,400	240	Milk recording, Ajmer-Merwara	2,400	0 0	NH	
1,500	1,200	241	Milk recording, Baroda	1,150	0 0	(+)	50 0 0

Receipts					Payments				
Head of Account	Receipts during the year	Grants		Serial No.	Head of Account	Expenditure during the year	Excess— or Savings— over net grant		Remarks
		Original	Net						
1	2	3	4	5	6	7	8		9
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.		
		10,000	Nil	242	Nutritive value of milk	Nil	Nil		
		2,200	3,500	243	Poultry Husbandry Bombay	2,687 0 0	(+) 833 0 0		Incon- siderable.
		7,500	2,200	244	Poultry Breeding (Village exten- sion), I. V. R. I.	2,200 0 0	Nil		"
		17,740	1,500	245	Diseases of poultry—	1,412 0 0	(+) 88 0 0		"
		2,150	2,550	246	(i) I. V. R. I.	2,550 0 0	Nil		"
		2,180	1,100	247	(ii) Madras	1,050 0 0	(+) 60 0 0		"
		1,800	1,500	248	(iii) Bombay	1,450 0 0	(+) 50 0 0		"
		2,000	2,200	249	(iv) Bengal	2,200 0 0	Nil		"
		1,700	2,000	250	(v) United Provinces	1,930 0 0	(+) 70 0 0		"
		1,700	1,300	251	(vi) Punjab	1,300 0 0	Nil		"
		2,100	Nil	252	(vii) C. P.	2,100 0 0	(—) 2,100 0 0		"
		5,000	4,800	253	(viii) Bihar	4,550 0 0	(+) 50 0 0		"
		1,950	Nil	254	(ix) Assam	1,850 0 0	(—) 1,850 0 0		"
		5,000	5,800	255	(x) N. W. F. P.	3,850 0 0	(+) 1,950 0 0		"
		16,200	14,000	256	(xi) Hyderabad	14,000 0 0	Nil		"
		3,950	Nil	257	(xii) Mysore	3,850 0 0	(—) 3,850 0 0		"
		700	300	258	(xiii) Baroda	270 0 0	(+) 30 0 0		"
		6,400	4,800	259	Deshi fowls Baroda	4,780 0 0	(+) 20 0 0		"
		5,100	4,300	260	Poultry lice, Aligarh	4,260 0 0	(+) 40 0 0		"
		12,000	11,400	261	Fresh water fishes, Calcutta	11,400 0 0	Nil		"
		1,600	Nil	262	Rural pisciculture, Madras	1,600 0 0	(—) 1,600 0 0		"
		2,300	1,500	263	Fish preservation, Baroda	1,500 0 0	Nil		"
		1,500	Nil	264	Improvement of preserved fish, Bengal.	1,500 0 0	(—) 1,500 0 0		"
					Investigation of fish eggs and larvae, Bombay.				

2,700	2,200	265	Investigation of fish eggs and larvae, Madras.	22,00	0	0	Nil	"
8,500	10,200	266	Wool analysis, Bombay University	10,190	0	0	(+) 10 0 0	"
1,650	Nil	267	Laboratory for wool analysis, Bombay.	1,640	0	0	(-) 1,640 0 0	"
1,500	1,100	268	Laboratory for wool analysis, Punjab.	1,030	0	0	(+) .70 0 0	"
1,100	300	269	Village shearing and grading centres, N. W. F. P.	300	0	0	Nil	"
5,800	3,600	270	Washing and grading of Wool, Ajmer-Merwara.	3,600	0	0	Nil	"
6,500	1,800	271	Village flaying centres, N.W.F.P.	1,800	0	0	Nil	"
4,050	3,400	272	Village flaying centres, Bombay	3,400	0	0	Nil	"
	300	273	Drosophila laboratory	664	13	3	(-) 364 13 3	"
5,750	10,750	274	Animal Husbandry Bureau	14,111	10	9	(-) 3,361 10 9	"
2,800	Nil	275	Monogaphon statistical methods In Animal Husbandry.	Nil			Nil	"
2,950	2,800	276	Village Project of Bombay	2,551	4	0	(+) 48 12 0	"
4,000	3,500	277	United Provinces	3,450	0	0	(+) 50 0 0	"
3,300	Nil	278	Central Provinces	3,900	0	0	(-) 3,900 0 0	"
850	9 0	279	Travancore Mixed Farming	980	0	0	(-) 30 0 0	"
2,750	2,900	280	United Provinces	2,900	0	0	Nil	"
2,750	3,700	281	Central Provinces	3,430	0	0	(+) 270 0 0	"
3,200	Nil	282	N. W. F. P.	3,300	0	0	(-) 3,300 0 0	"
3,000	1,900	283	Sind	1,900	0	0	Nil	"
6,200	Nil	284	Desert Farming, Sind	6,200	0	0	(-) 6,200 0 0	"
1,000	1,200	285	Cultivation of Kudeauvine	1,200	0	0	Nil	"
16,100	19,500	286	Pasture lands improvement, Baroda	19,500	0	0	Nil	"
2,300	2,100	287	Comparison of sample means Statistical.	2,090	3	0	(+) 9 13 0	"
25,000	Nil	288	Statistical Section of the Council	24,335	1	0	(-) 24,335 1 0	"
4,780	5,560	289	Improvement of Agricultural statistics, Dr. V. G. Panse.	5,560	0	0	Nil	"
59,850	104,000	290	Crop cutting experiments Hqrs.	104,009	2	6	(-) 9 2 0	"
Nil	Nil	291	Crop cutting experiments Hqrs. Madras.					"
Nil	Nil	292	Crop cutting experiments, Hqrs., Bombay.					"
Nil	Nil	293	Crop cutting experiments, Hqrs., U. P.					"
Nil	Nil	294	Crop cutting experiments, Hqrs., Punjab.					"
Nil	Nil	295	Crop cutting experiments, Hqrs., C. P.					"

Receipts.				Payments.						
Head of Account	Receipts during the year.		Grants		Serial No.	Head of Account	Expenditure during the year.		Excess (—) or savings (+) over net grant	Remarks
			Original	Net							7	8
1	2		3	4	5	6	7		8	9
	Rs.	A. P.	Rs.	Rs.			Rs.	A. P.	Rs.	A. P.
	Nil		Nil	Nil	286	Imperial Agricultural Bureaux				
	Nil		Nil	Nil	287	Imperial Institute of Mycology				
	59,380		42,080	288	Imperial Institute of Entomology	42,054	2 8	(+)	25 13 4	Incon- siderable.
	Nil		Nil	289	Farnham House Laboratory					
	Nil		Nil	300	Imperial Bureau of Dairy Science					
	660		Nil	301	Fruit Preservation Research Station, Campden.	666	10 8	(—)	666 10 8	"
	250		Nil	302	Tobacco Federation of the British Empire.		Nil		Nil	"
	760		Nil	303	Indian Society of Soil Science	750	0 0	(—)	750 0 0	"
	500			304	Entomological Society of India	500	0 0	(—)	500 0 0	"
	Nil		600	305	Hide improvement fund	600	0 0		Nil	"
	Nil		Nil	306	Indian Bee Keepers' Association	500	0 0	(—)	500 0 0	"
	Nil		Nil	307	Current Science Association	500	0 0	(—)	500 0 0	"
	Nil		Nil	308	Indian Society of Genetics and Plant Breeding.	500	0 0	(—)	500 0 0	"
	7,000		3,500	309	The Council's Library	3,236	2 9	(+)	263 13 3	"
	16,500		14,500	310	Editorial staff for Indian Farming	14,413	10 0	(+)	36 6 0	"
	1,000		300	311	Editorial Committee	240	0 0	(+)	60 0 0	"
	12,800		13,800	312	Accounts and Audit	14,124	4 8	(+)	324 4 6	"
	9,000		8,600	313	Travelling Allowance of non-official members of the Council.	8,558	7 0	(+)	41 9 0	"
	24,000		26,500	314	Travelling allowance of visitors for attending meeting of the Advisory Board and the Committees of the Council.	33,182	7 0	(—)	11,682 7 0	"
	1,000		800	315	T. A. of non-official members of the Board of Agricultural and Animal Husbandry in India.	740	13 0	(+)	59 3 0	"
	3,000		3,400	316	Miscellaneous	2,884	12 9	(+)	515 3 3	"
	30,000		Nil	Nil	Provident Fund contribution					"

12,000	11,400	317	Karnal Station I. A. R. I.	11,392	11 0	(+) 7 5 0
12,500	12,100	318	Anakapalle and Gurdiyattan Station, Madras.	13,477	0 9	(-) 1,377 0 6
3,350	8,600	319	Padegaon Station, Bombay	8,580	0 0	(+) 10 0 0
250		320	Decca Station, Bengal	Nil		Nil
83,000	91,600	321	Muzaffarnagar Station	91,580	0 0	(+) 40 0 0
		322	Shahjehanpur Station			
		323	Central Station, U. P.			
8,500	Nil	324	Lyallpur Station, Punjab	18,500	0 0	(-) 18,500 0 0
65,000	Nil	325	Pusa Station, Bihar	64,992	8 3	(-) 64,992 8 3
		326	Central Station, Bihar			
3,660	Nil	327	Jorhat Station, Assam	3,680	4 0	(-) 3,680 4 0
11,750	Nil	328	Zarhab Station, N.-W. F. P.	11,750	0 0	(-) 11,750 0 0
500	Nil	329	Bakrand Station, Sind	Nil		Nil
770	Nil	330	Hobbal Station, Mysore	Nil		Nil
30	Nil	331	Vyra Station, Baroda	608-11	0	(-) 608-11 0
4,430	5,000	332	Ratoomng experiments, U. P.	4,400	0 0	(+) 600 0 0
800	450	333	Ratoomng experiments, Bihar	442	0 0	(+) 48 0 0
500	450	334	Sugarcane Genetics, I. A. R. I.	492	0 0	(+) 48 0 0
14,000		335	Sugarcane and-gur yields, U. P.			
6,000	6,000	336	Sugarcane Physiology	6,027	3 0	(-) 27 3 0
		337	Entomological work with Sugar-cane, I. A. R. I.			
		338	Entomological work with Sugar-cane, Madras.			
		339	Entomological work with Sugar-cane, Bombay.			
		340	Entomological work with Sugar-cane, Bengal.			
		341	Entomological work with Sugar-cane, U. P.			
1,16,000	1,00,800	342	Entomological work with Sugar-cane, Punjab.	1,00,680	14 0	(+) 119 2 0
		343	Entomological work with Sugar-cane, Bihar.			
		344	Entomological work with Sugar-cane, Orissa.			
		345	Entomological work with Sugar-cane, Bhopal.			
		346	Entomological work with Sugar-cane, Hyderabad.			
		347	Entomological work with Sugar-cane, Indian Statistical Institute.			

Receipts.					Payments.					
Head of Account 1	Receipts during the year. 2		Grants 3		Serial No. 5	Head of Account 6	Expenditure during the year 7		Excess (-) saving (+) over net grant 8	Remarks 9
	Rs.	A. P.	Rs.	Rs.			Rs.	A. P.			Rs.	A. P.
			11,600	10,800	348	Mosaic and other Diseases, I. A. R. I.	10,781	10 0	(+) 18 6 0	Inconsiderable.
			17,550	61,150	349	Dillari Testing Station	61,147	10 0	(+) 2 6 0	"
			2,900	3,600	350	Factors forming the basis of grading gur and rab.	3,584	0 0	(+) 16 0 0	"
			13,600	9,200	351	Manufacture of sugar Candy	9,131	4 0	(+) 68 12 0	"
			7,500	700	352	Sugar Storage	700	0 0	Nil	"
			3,250	Nil	353	Monograph on "Gur making, industry" in India.	Nil	Nil	Nil	"
			3,950	6,150	354	Sugar Survey	7,849	3 0	(-) 1,699 3 0	"
			3,000	Nil	355	Sugar Committee	35	4 9	(-) 35 4 9	"
			75,200	80,200	Nil	Provl. Marketing Schemes	80,250	0 0	(-) 50 0 0	"
			200	500	356	Loans and Advances	486	0 0	(+) 14 0 0	"
			100	Nil	357	Deposits and advances repayable	766	10 0	(-) 766 10 0	"
			2,500	4,800	358	Remittances of income tax, Provident Fund, Etc.	5,975	1 0	(-) 1,175 1 0	"
						Total Expenditure	23,55,883	1 9 1/2		
						Investments and re-investments	25,00,000	0 0		
						By balance	10,40,833	12 8		
						GRAND TOTAL	58,96,416	14 5 1/2		

II.

	Rs.	A.	P.
(i) Permanent advance with the Secretary, I. C. A. R.	250	0	0
(ii) Permanent advance with Dr.-C. N. Acharya, Chief-Biochemist	300	0	0
(iii) Temporary advance for Tobacco Schemes.	100	0	0

III. Particulars of securities etc.—

	Face Value		Purchase Value	
	Rs.	Rs.	A.	P.
1. 3 per cent Stock 1933-35	16,49,500	15,54,334	0	0
2. 3½ per cent Stock 1947-50	5,50,000	5,91,495	1	0
3. 2½ per cent Stock 1948-52	4,00,000	4,02,736	9	0
4. 3 per cent Stock, Defence Bonds, 1946	25,000	25,117	3	0
5. 16 Post Office 10-year cash certificates, dated the 25th September 1935, for Rs. 1,000 face value each	10,000	8,825	0	0
6. 5 Post Office 10-year Defence savings certificates, dated 22nd October, 1940	5,000	5,000	0	0
7. 8 Fixed Deposit receipts Nos. 79872 to A79879, dated the 4th November, 1941 for Rs. 50,000 each repayable at a week's notice	4,00,000	4,00,000	0	0
8. 2 Fixed Deposit receipts Nos. B96263 to B96264 dated the 23rd November, 1944, for Rs. 50,000 each repayable at a week's notice	1,00,000	1,00,000	0	0
9. 14 Fixed Deposit receipts Nos. C 28440 to C28453, dated the 24th November, 1944 for Rs. 1,00,000 each repayable after 12 months	14,00,000	14,00,000	0	0
10. 3 Fixed Deposit receipts Nos. B54680 to 54682, dated the 24th November, 1944 for Rs. 1,00,000 each repayable after 12 months	3,00,000	3,00,000	0	0
11. 8 Fixed Deposit receipts Nos. C28468 to C28475, dated the 13th December 1944 for Rs. 1,00,000 each repayable after 12 months	8,00,000	8,00,000	0	0
IV Particulars of closing balance :—				
1. Cash in hand with the Secretary, I.C.A.R			10	11
2. Incurent Account with the Imperial Bank of India New Delhi and Simla			10,40,823	18
TOTAL		10,40,833	12	8

(Sd.) M. S. RANDHAWA,

Secretary,

Imperial Council of Agricultural Research.

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ANNUAL REPORT
OF THE
IMPERIAL COUNCIL OF AGRICULTURAL
RESEARCH
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FOR
1945-46

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IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH REPORT FOR 1945-46

CHAPTER I.—ADMINISTRATION

1. This is the 16th Annual Report of the Imperial Council of Agricultural Research, covering the period from 1st April 1945 to 31st March 1946, presented by the Governing Body of the Council under Rule 64 of the Rules and Regulations of the Council.

2. **Meetings.**—(i) Advisory Board (Special Meeting) held in July 1945 to consider amendment of Article 2 (a) of the Memorandum of Association of the Council.

(ii) Central Economic (Priority) Committee—July 1945.

(iii) Standing Finance Committee—July 1945.

(iv) Governing Body—August 1945.

(v) Commodity Committees—October-November 1945.

(vi) Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India—December 1945.

(vii) Scientific Committees—February 1946.

(viii) Advisory Board (Regular Meeting) February-March 1946.

(ix) Annual General Meeting held on 1st March 1946—adopted the Annual Report and audited accounts of the Council for 1944-45.

(x) Special General Meeting held on 1st March 1946—agreed to amend Article 2 (a) of the Memorandum of Association of the Council.

3. **Finance and Accounts.**—The following were the receipts from (i) the cess levied under the Agricultural Produce Cess Act, 1940, and (ii) the grants received from the Government of India :—

	Rs.	A. P.
(i) Receipts from the Cess	20,41,182	3 8
(ii) (a) Grant for tobacco schemes	10,00,000	0 0
(b) " " crop cutting experiments	3,30,05	0 0
(c) " " Seed potato scheme	17,000	0 0
(d) " " Cereal rust scheme	12,500	0 0
(e) " " Provincial marketing schemes	60,000	0 0
(f) " " experiments on manufacture of wine	49,000	0 0
(g) " " training in fruit preservation and canning	26,990	0 0
(h) " " additional staff at the Indian Institute of Fruit Technology	2,800	0 0
(i) " " from the Groundnut Fund	17,250	0 0

A statement showing the audited account of the Council for the year 1945-46 is appended (Appendix).

CHAPTER II.—AGRICULTURAL RESEARCH

RICE

The co-ordinated schemes on rice research in various provinces described in the last year's report terminated on the 31st March 1944.

The schemes initiated in Travancore, Baroda and Kashmir in 1940-41 continued to work. In the Kashmir scheme, Russian, Chinese and American varieties have recorded heavier yield and earlier ripening. Varieties from Japan and Australia also fared very well. Vernalization experiments have resulted in inducing flowering and growth in a number of trials. In the Baroda scheme, cultural experiments to study the effect of the number of irrigations, different fertilisers, and green manuring on open cultivated paddies were continued. Rotational experiments in black soil showed that full fallow and fallow with green manure gave the highest yield of grain and straw. In the Travancore Scheme, Kalladasamba strains and Chettivirupu strains were put under rigorous yield test in randomised blocks along with the local mass as control. The result was significant. Cochin III and Pth. 10 were put under trials in different places in Kuttanad on ryots' land. The ryots are in favour of these strains. The Hyderabad rice improvement scheme for late and

very late high yielding rices and their manural requirements also came into operation during the year. In the scheme on the nutrition of the rice plant at Dacca University, last year's experiment on the availability of nitrogen fixed by algae was repeated. The results have again shown that the nitrogen contents of the plants grown in presence of algae are greater than those grown in its absence, and that a part of the nitrogen fixed by algae is available to the immediate crop. Algae growth increases the yield and also improves the nitrogen content of the soil. Under the scheme of research on the Physiology of rice plant at Ravenshaw College, Cuttack, the possibilities of inducing flood, drought and saline resistance in paddy were investigated.

In the rice disease scheme in Madras, investigations are being made on (i) the blast disease of rice caused by the fungus *Piricularia oryzae* and (ii) the foot-rot disease of rice caused by the fungus *Fusarium moniliforme* var *majus*.

Under the paddy insect pests scheme Bengal work was confined to two pests viz. Rice Hispa (*Hispa Armigera*) and Rice stem borer (*Schoenobius incertellus* W.).

In the scheme for the investigation of *Helminthosporium* disease of rice in Sind, it has been definitely proved that the *Curvularia* sp. is equally pathogenic and in some cases even more than *Helminthosporium* sp. The fungus has been identified as *Curvularia lunata*.

As regards the use of chemicals, Agrosan G has apparently given the best result followed by sulphur under dry series, but statistically there was little significant difference and all the chemicals tried under wet series, dry series and pot series were found equally effective.

A scheme for research on vernalisation of rice was initiated at the Calcutta University during the year under report.

WHEAT

Amongst the fungus diseases of wheat, brown, yellow and black rusts constitute the greatest menace. Since 1930 comprehensive research on them has been carried on. The main conclusion reached is that the persistence of rust from year to year is due to the over-summering of the rust spores on volunteer and early-sown wheat crop in the hill areas.

Under the Cereal Rusts Scheme (Agra College) physiologic races which exist in the country are being studied. Single spore cultures of the different physiologic races are being maintained in a laboratory at Simla and tests of wheat varieties, their crosses and progenies in connection with the breeding of rust-resistant varieties for cultivation in the hills are being carried out.

In the scheme for the breeding of rust resistant varieties of wheat at Simla the botanical and agronomic characters of a large number of hill wheats have been examined and the work of hybridisation between the best indigenous wheat and varieties known to be rust-resistant has been completed. Fifty hill varieties which had been found comparatively resistant to yellow rust were subjected to more rigorous tests. In these tests, three varieties were found to have no infection while ten others had only traces. The tests for resistance will be further repeated. Out of the fixed rust-resistant hybrids, 10 brown rust-resistant and 9 yellow rust-resistant one was put in a small-scale yield trial with four improved varieties from the plains, two of the best yielding wheats from the hill wheat collection and a local variety as control. Four of the hybrids stood out best, yielding from 4 per cent to 16 per cent over the control. The work on testing barley varieties for resistance to black and yellow rusts was continued. One hundred varieties, including those found promising in last year's tests, were tested for resistance to black as well as to yellow rust both in the seedling and adult stages. In the seedling tests one variety was found resistance to black rust and three resistant to yellow rust. In the adult stage tests, seven varieties were more or less resistant to both black and yellow rusts while there were forty which had little or no infection of yellow rust.

In the scheme for the control of wheat rust in Decan, black, rust was recorded earlier in the plains than in the hills, brown rust in the hills earlier than in the plains

and yellow rust only in the Nilgiri hills during the year. Heavy infection of black rust on wheat was noticed only in Kadur district in Mysore State and portions in Kurnool and Cuddapah districts in the Madras presidency. Heavy infection of yellow rust of barley was noted in the village of Dambattu in the Nilgiri district. The scheme terminated in 1945.

In the wheat rust scheme, Bombay, 'Kenya Governor', which behaved as highly resistant or almost immune to rust in field trials made in the previous season, developed heavy infection due to prevalence of race 21, to which it is susceptible. Kenya C. 10854 was found to behave better than a moderately susceptible type in field test. H. 44-24, Persian Black, Thatcher and Hope though susceptible at the seedling stage develop only light infection, indicating that they possess mature plant resistance. In replicated trials, the effect of rust on eight improved strains of wheat was tested at Mahabeshwar. These tests showed that there was no significant difference in the rust resisting qualities of Niphad 4, Niphad 5-67-14-26 and baxi 165-6 and that these strains were superior to Bansi 168, Niphad 81, Niphad 31, Banspati 808 and Pusa 4.

Another scheme for breeding improved and rust resistant wheat suited to the black soil areas is in operation in the C. P.

A scheme for testing the milling and baking qualities and bio-chemical properties of Indian wheats with a view to combine good baking and yielding qualities is in operation in the Punjab. Milling and baking tests were carried out on 25 samples, from Gurdaspur, Lyallpur, Cereal Breeding Farm, Gurgaon; Cereal Seeds Breeding Sub-Station, Nagrota (Kangra); Rice Breeding Sub-Station, Farm Kala Shah Kaku, Sheikhpura District and Bombay and C. P. strains grown at Lyallpur. Samples from Gurgaon stood comparatively high in protein content and Nagrota grown samples lowest. Those from Bombay and C. P. declined in protein content when grown in the Punjab. The wheat protein survey for Sind and North-West Frontier Province was taken in hand and completed during the year.

Investigations on the bread-making qualities of wheat *ata* with soyabean flour and groundnut cakes were made. With increasing amount of soyabean flour in the mixture, colour of crust of loaf deepened, becoming intolerably dark. But mixtures of wheat with gram, *mash* and *mung* in addition to soyabean brought about definite improvements. Groundnut did not prove a success for this purpose. Observations in regard to vitamin B content by the different milling processes show that wheat ground with hand *chakki* loses thiamin content the least and that with power-driven *chakki* the most, and that *gharat ata* takes a rank near to hand *chakki*.

MAIZE

During the year under review, a scheme for the improvement of maize crop was initiated in the Punjab.

PULSES

Research on pulses is being financed in Madras, Bombay, Bengal, United Provinces, Bihar, Central Provinces, North-West Frontier Province, Orissa, Sind, Hyderabad, Mysore, Baroda and Gwalior. The object is to evolve high-yielding, disease and drought resistant strains possessing commercially desirable qualities. The pulses dealt with are red gram (*Cajanus cajan* Millsp.), green gram (*Phaseolus Aureus* Roxb.), black gram (*Phaseolus mungo* Linn.), horse gram (*Dolichos biflorus*, Linn.), gram (*Cicer arretinum* Linn.), cowpea (*Vigna unguiculata* Linn. Walp) and *Dolichos lablab* Linn. in Madras; gram, moth bean (*Phaseolus santonifolius* Jacq.), green gram, black gram, horse gram and red gram in Bombay; lentil (*Lens esculenta* Moench. Orient), gram, green gram, red gram and soyabean (*Glycine max.* Linn. Merr.) in Bengal; red gram, black gram, green gram, soyabean, moth bean, gram, pea (*Pisum Sativum* Linn.) and lentil in U. P.; red gram, gram, pea, green gram, horse gram and grass pea (*Lathyrus sativus* Linn.) in Bihar; red gram, green gram, black gram, moth bean, gram and grass pea in C. P.; green gram, moth bean, cowpea, red gram, lentil, and gram in N. W. F. P.; red gram, *birt*, green gram, horse gram and soyabean in Orissa; gram, cluster bean (*Cyamopsis psoraloides* DC.) and pea in Sind; gram, red gram and horse gram in Hyderabad; red gram, *wal* (*Dolichos lablab* Linn.), gram, horse gram and soyabean in Mysore; and green gram, black gram, red

gram and gram in Gwalior. In Baroda, a combined scheme on pulses and millets deals with red gram, cluster bean, moth bean, *kodra* (*Paspalum scrobiculatum* Linn.), and *bajra* (*Pennisetum typhoides* Stapf and Hubbard Trop.). In the Punjab, a separate scheme on soyabean aims at exploring the possibilities of its introduction as an article of human and animal food.

A scheme on gram wilt in the Punjab and another on *Heliothis obsoleta* Fabr. as a pest of gram in C. P. are being continued.

The following schemes were initiated during the year :—

1. Pulse breeding, Gwalior.
2. Insect pests of stored pulses, Imperial Agricultural Research Institute.

MILLETS

The Council is financing schemes on small millets in Bombay, the U. P., the C. P. and Mysore. In the Bombay scheme, in addition to *nagli* (*Eleusine coracana* Gaertn.) and *vari* (*Panicum miliaceum* Linn. Orient.), Kodra has also been taken up.

The U. P. scheme aims at a study of the varieties of *sawan* (*Panicum frumentaceum*) and Kodon grown on the plains and *mandua* (*Eleusine coracana* Gaertn.) grown on the hills. The C. P. scheme is concerned with increasing the yield from *Kodo* and *Kutki* (*Panicum miliare* Lam.). The object of the Mysore scheme is to evolve drought resistant and high yielding strains of *Panicum miliare* Lam., *baragu* (*Panicum miliaceum* Linn. Orient.) and *Codalu* (*Echinochloa frumentaceum* Link). In Baroda, the work on lesser millets is combined with that on pulses.

The scheme on *striga*—a parasitic pest which causes severe damage to the *jowar* crop—is being continued in Bombay. The object of the scheme is to build up homozygous strains of *jowar* resistant to *striga* attack.

The scheme on *jowar storage pest* is being continued at the Imperial Agricultural Research Institute.

FRUITS

Fruit Culture

The various horticultural schemes continued in Madras, the U. P., the Punjab, Bihar, the C. P., Assam, the N.-W. F. P., Orissa, Hyderabad, Mysore and Coorg. In all these schemes, the object has been to determine best varieties, suitable stocks and seeds and quick and cheaper methods of propagation and suitable cultural methods.

As the current sanction of most of these schemes was due to expire on 31-3-46, the Fruit Development Adviser to the Government of India was asked to visit the various horticultural research stations and made a report. His report was considered in October 1945 by the Fruit and Fruit Products Committee which recommended the revision of programmes on the lines proposed therein. The following schemes are also in progress :—

- (1) Citrus grading, Madras.
- (2) Citrus die-back diseases, Bombay and the C. P.
- (3) Cytogenetics of mango and banana, Calcutta University.
- (4) Preparation of manual on fruit culture and fruit preservation.
- (5) Survey of horticultural research in India.
- (6) Manorial trials on citrus in the Punjab.
- (7) Possibility of collecting yield data from individual trees in uniform fruit orchards, the Punjab, the C. P. and Berar, the N.-W. F. P. and Kashmir; and
- (8) Mango Necrosis, Lucknow University.

The following new schemes were initiated during the year under review :—

- (1) Survey of deciduous fruits, Kashmir.
- (2) Citrus physiology, Bihar.

Fruit and vegetable preservation

The Council has been financing two schemes on fruit and vegetable preservation—one at Lyallpur and the other at Quetta. In both these schemes, useful work has been done on-canning, dehydration, concentration and preservation of fruit juices, etc. The Lyallpur scheme terminated on 31st March 1945 and the Indian Institute of Fruit Technology has been established in its place.

VEGETABLES

Potatoes

Breeding better varieties—Since 1935 the Council is financing a scheme at Simla (i) to study the available Indian varieties of potatoes with a view to establish the distinct varieties and utilize them for breeding purposes either by crossing with other desirable cultivated varieties or with South American species; (ii) to maintain and study large collections of wild and cultivated potatoes obtained from South America with a view to determine their breeding value and utilize the best ones for breeding work; (iii) to evolve high-yielding, disease-resistant varieties of potatoes for the hills and the plains of Northern India and (iv) to supply initial seed stocks of superior hybrids to various provinces and States for trial, multiplication and distribution.

Valuable work has been done in this scheme. Classification of potatoes has been completed and a bulletin on the subject is in the press. Some very desirable hybrids since evolved have been tested in Assam and one of them is under large scale cultivation. A new method of tuberless sowing from sprouts yielding 20 to 40 plants per tuber has been developed, which promises to be of inestimable value in the way of rapid multiplication of the desired strains.

Amongst the hybrids, nine have been found superior to Darjeeling Red Round and six to Phulwa. In addition to these, considerable progress has been made in the breeding of late blight-resistant types.

A very interesting feature has been noticed in the dormancy of seed potato. The Simla crop which is harvested in July-August and is not suitable for planting in September in the plains of Northern India was found to be suitable in Southern India. There is a comparatively higher temperature in this part of the country during the months of September-October and there the tubers are cut and the crops irrigated copiously. These factors seem to shorten the period of dormancy.

Intermediate Hill Station, Bhowali.—This station was started in October 1943 with the object of growing the potatoes selected from the Simla Station at a lower altitude and to make the seed available to Government farms, etc. in the plains for multiplication and distribution to the cultivators at the sowing time. During the year under review a fresh batch of 520 newly evolved hybrids was received from the Central Station at Simla and planted with a view to send small seed stocks for observation at Delhi and Pusa during the next *rabi* season.

Fifteen hybrids received last year from Simla and 30 other hybrids selected from fresh stocks received were under multiplication. Suitable ones will be sent for trial to various testing centres in the plains.

Storage pests and diseases, Bihar.—The work under this scheme shows that the potato moth can, in the absence of exposed potatoes, lay eggs on leaves and even on soil. The larvae live as leaf miners or terminal shoot borers. If, however, there are cracks in the soil, the larvae go inside but cannot infest the tubers unless they are at depth of less than one inch. The highest multiplication occurs at a temperature between 86°F. and 102°F. This accounts for the heaviest damage between April and June. Free play of air and light as well as darkness reduce the visibility of eggs. Dusk and diffused day light are more congenial for their maximum activity.

The control under field conditions lies in applying sufficient irrigation to prevent soil from cracking and in harvesting the crop when the plants are more or less green and are about 3½ months old.

Under storage conditions, losses can be appreciably controlled by storing tubers on the floor under sand about half an inch in thickness with some garlic during the months of April, May and June and transferring them to *machans* during the following three months.

Several pre-treatments of tubers have also been tried and treatments with phenyl corrosive sublimate and *simari* leaf extract seem to yield best results. A type of beetle has been found to be an enemy of the eggs and caterpillars of the potato moth. Work on this biological method of control is still in progress.

Ants have also been found to be of great service. If *gur* or brown sugar is sprinkled, ants are attracted and incidentally they perform the job of cleaning the tubers from eggs and larvae without damaging the tubers.

Potato seed certification.—Potatoes suffer from virus diseases which reduce their yield. The disease is transmitted through the tubers.

In order that selection, certification and distribution could be efficiently carried out, Kufri was selected. At this place conditions for masking of adverse symptoms are least favourable, and work of such nature could proceed without the risk of hidden or undetected contamination with the virus.

The station was started in 1944 and the production of virus-free seed has made considerable headway and some promising materials have been selected from Darjeeling Red Round and Majestic.

Seed potato production scheme, Karnal.—This scheme has not shown very satisfactory result. The scheme has now been reorganised.

OILSEEDS

The Council has been financing the following schemes:—Groundnut breeding (Madras), Rape and Mustard breeding (Punjab), Linseed and other oilseeds (C. P. and Berar), Castor breeding (Hyderabad), Groundnut breeding (Mysore), Brassica and sesamum breeding (Calcutta University), Co-ordinated scheme of research on pests and diseases of oilseeds in Madras, the United Provinces, the Punjab, the Central Provinces and Berar and Hyderabad. Storage of groundnuts (Madras), Manurial experiments with groundnut cake (Hyderabad), multiplication and distribution of improved groundnuts (Madras) and multiplication and distribution of improved linseed (United Provinces).

The Groundnut breeding scheme, Madras, came to a close on the 31st March 1945. The work is being continued by the Provincial Government.

The Rape and Mustard scheme (Punjab) expired on the 31st March 1945 and the work has been taken over by the Provincial Government. A number of improved toria and raya strains have been evolved.

The Oilseed research scheme (Central Provinces) terminated on the 31st March 1945 after over eight years. Improved superior strains of linseed, sesamum (Kharif white), sesamum (Rabi), Niger and safflower have been isolated.

The Castor breeding scheme, Hyderabad, continued on approved lines. This scheme is intended for all castor growing regions of India. Trials with three released strains at Kalyanpur in the United Provinces showed that all of them were significantly superior to local strains. Seed rate trials show that 12 lb. seed per acre gave the highest yield.

The Groundnut breeding scheme, Mysore, came into operation from 1st April 1945.

Work on the Brassica and sesamum breeding scheme, Calcutta University, was also started. The co-ordinated schemes of research on the pests and diseases of oilseeds in the various provinces and states continued to work.

Under the scheme for the multiplication and distribution of linseed (U P) and groundnut (Madras) over 4,000 maunds of linseed was produced and distributed to cover 16,000 acres in the U P. In Madras, two high-yielding strains, viz., AH 25 and AH 698 were produced to the extent of 12,250 lb. and 21,650 lb. respectively, out of which 5,340 lb. and 17,500 lb. respectively were distributed.

The scheme for the multiplication of improved linseed in Bengal sanctioned last year could not be put into effect due to lack of improved seed.

The Madras groundnut storage trial shows that the rate of deterioration is more in the summer crop than in the winter one. Well-ventilated room with masonry

walls and pucca flooring duly fumigated, showed marked reduction in insect activity. The incidence and progress of pests on stored groundnuts showed that the caterpillars of *Ephestia* and *Corcyra* appeared in December 1943 immediately after the storage was started and *Tribolium* beetles from February 1944. With the onset of summer in May, the caterpillar pests disappeared completely and the activity of the other pests also decreased and continued to be so till the end of storage in September. All the pests appeared again in January 1945, a month after the commencement of second year's storage; but *Ephestia* and *Corcyra* disappeared from March. The other pests, viz. *Ephestia Cantella* and *Corcyra cephalonica*, increased in numbers and were noted to do considerable damage.

A scheme for work on the storage of groundnuts at the Bharat Vanaspati Products, Ltd., Pachora, East Khandesh, to study the problems under factory conditions and another for research on rust of linseed by Dr K. C. Mehta, Agra College, Agra, were sanctioned during the year.

A scheme for research on insect pests of safflower was initiated during the year under review in Bombay.

With the formation of the Indian Central Coconuts Committee, the Coconut Breeding Scheme (Madras) and the Coconut diseases Scheme (Travancore) financed by the Council have been transferred to that Committee with effect from the 1st January 1946.

TOBACCO

In view of the importance of tobacco as a valuable commercial crop, and in view of the variety and complexity of the problems relating to its production, processing and marketing the Government of India decided to set up a Central Tobacco Committee, as a Society registered under the Registration of Societies Act (XXI of 1880). The first meeting of the Committee was held on the 28th November 1945, and the tobacco schemes which were previously conducted by the Imperial Council of Agricultural Research were taken over by that Committee.

OTHER CROPS

The scheme on pan disease in the C. P. terminated on the 30th April 1945. Foot-rot caused by *Phytophthora parasitica* var. *Piperina* Dast. is the most serious disease of pan. The disease can be recognised by general pallor and drooping of tender shoots and leaves without any external sign of rotting. Later the whole plant turns yellow and dies off. The following measures have been found effective in controlling the disease :—

(i) Only the top-most three cuttings, each 12—18 in. long should be taken from each vine for "seed" purposes. The lower cuttings are highly susceptible to foot-rot organisms and very often carry the disease.

(ii) Just before planting, the cuttings should be immersed in 2 : 2 : 50 strength Bordeaux mixture for one hour.

(iii) At least a week prior to planting, the soil of the garden should be irrigated with 4 : 4 : 50 strength Bordeaux mixture, one gallon for 12 linear feet of the ridges or lines.

(iv) After two months of the plantation, the ridges should be irrigated with 4 : 4 : 50 strength Bordeaux mixture once every alternate month.

(v) Diseased vines should be carefully and systematically removed and destroyed by burning.

(vi) Leaves showing concentric rings of leaf-rot due to the foot-rot organism should be picked and destroyed. They should not be allowed to fall on the soil.

(vii) The vines should always be kept bare of leaves upto a height of one foot from the soil surface.

Anthracnose, caused by *Gloeosporium* sp. and *Colletotrichum* sp., is another important disease which can be identified by round or oval dark-brown lesions on stems. To control the disease the following measures are recommended :—

(i) the infested vines should be destroyed by burning

(ii) the vines in the affected garden should be sprayed with 2 : 2 : 50 strength Bordeaux mixture, one gallon for 75 feet length of vines, once every two months.

General cultural practices suggested are :—

(i) Linseed oil cake should be used as manure and applied only from February to October every year in powder form at the rate of 240 lb. per acre.

(ii) Only three cuttings, each 12—18 in. long from the top downward should be taken from a healthy vine for seed purpose. This practice will not only minimise the incidence of the disease but will yield better and more leaves.

(iii) After a cultivation of 5 years, the pan garden should be dismantled and left fallow for 3 years.

(iv) The garden should be properly shaded at the top and the vines lowered by the second week of March at the latest followed by adequate irrigation during summer months to keep the garden moist and cool. This will serve to eliminate tip-burn disease.

The scheme on medicinal plants and food poisons is being continued in Kashmir.

The scheme on cardamom in Madras aims at finding ways and means of controlling pests and diseases of the crop and improving the yield.

A scheme for the survey of pollu and root diseases of pepper in Madras was financed with the object of assessing the relative importance of various factors responsible for the decline in the cultivation of pepper. It is found that research on the following aspects be undertaken :—

(i) Evolution of high yielding and disease resistant strains.

(ii) Systematic control of the more important insect pests and fungus diseases.

(iii) Improvement of cultural practices, viz. adequate manuring and control of soil erosion.

(iv) Reduction in the cost of maintenance of gardens.

Schemes for research on turmeric in Orissa, cloves in Travancore and corriander disease in Gwalior are in progress.

SOIL SCIENCE

All-India Soil Survey (I.A.R.I.)

This scheme terminated during the year. The collection of soil data from different parts of India has been completed. The information about soil types has been recorded from four angles, viz. geological, land assessment fertility, textural survey of surface samples and genetical study. The collation of existing soil data suggest division of soils of India into eight types, viz. (a) red soils; (b) laterite and lateritic soils; (c) black soils; (d) alluvial soils; (e) desert soils; (f) forest soils including plantation soils; (g) saline and alkaline soils and (h) peaty and marshy soils. Classification of the soil types into sub-types has been discussed. Researches on soil types on mineralogical, biochemical and colloidal aspects, as well as profile studies particularly on genetical lines and the position of the soil types in the world group of classification have been described and discussed.

The data relate to crops grown and area and yield per acre; rotations practised including research work; irrigation, comparison between dry and irrigated methods of agriculture, and irrigation projects; cultivation operations—dry farming; manual data with N, P and K; erosion and soil conservation practices; soil reclamation; and land assessment in relation to crops

Colloid Soil Constituents Scheme and Coastal Soils Scheme (Calcutta University)

Work was continued on approved lines during the year.

Sewage Farming (I.I.Sc., Bangalore)

The scheme has been extended to carry out further investigation.

Minor or Trace Elements (Calcutta University)

The object of the scheme is to ascertain the extent to which deficiency symptoms are associated with the absence or otherwise of minor or trace elements. Only very limited work has so far been done, but even this incomplete information indicates that malnutrition due to deficiencies in trace elements is widespread. It is now proposed to enlarge the scope in order to include the study in relation to human and animal nutrition as affected by these factors.

Crop Production by Catalysis (I.I.Sc., Bangalore)

The object is to standardise the conditions for the application of such chemical compounds to soil as can by their catalytic action lead to increased microbial activity and thus help in the release of more plant food. The results so far obtained suggest the possibilities of using such catalysts in stimulating production.

Control of erosion (Viswabharati, Santiniketan)

The object is to work out suitable and economic methods of plantation and cropping in order to prevent soil erosion and reclaim badly eroded areas. Only preliminary work has so far been done.

Fundamental characteristics of Indian Soils (Punjab University)

This is a new scheme sanctioned during the year and the object is to compare the various methods of soil analysis.

Green Manuring Survey

The Imperial Council of Agricultural Research have sanctioned a scheme to carry out an enquiry into green manuring practices and problems throughout India, as a preliminary to undertaking a campaign to popularise the practice. Mr Surjan Singh Siddhu, Headmaster, Government Agricultural School, Bulandshahr, has been appointed as officer-in-charge of the survey.

ALL-INDIA COMPOST SCHEME

The scheme made further satisfactory progress during the year. Training in the compost process was given at 469 municipal centres of which 317 centres started compost production. 138 1 lakh cubic ft. of compost manure (about 276,000 tons) were prepared upto the 31st July 1945 which is nearly twice the quantity originally planned to be prepared under the scheme. In order to help rapid distribution of the compost, the Government of India offered a special subsidy of twelve annas per 50 cubic ft. of manure actually put on the land. Out of 62.87 lakh cubic ft manure that was ripe for distribution, 52.1 lakh cubic ft. were sold before the 31st July 1945.

Field trials carried out with compost manure gave increases of 1 to 1½ maunds of grain per ton of compost applied. The cost of production amounted to Re. 1 per ton on the average. Most of the municipalities that have adopted the compost system have been satisfied with the special sanitary features of the improved system in respect of freedom from smell and fly nuisance.

Since the scheme had passed the experimental stage and required further development on a large scale, it was decided to entrust the further operation of the scheme in different areas to the Provincial and State Governments concerned with effect from the 1st August 1945, when the Imperial Council of Agricultural Research scheme was to terminate. The developmental side is being attended to by the Government of India directly through the Department of Agriculture but the research side is being worked out by the Council under a subsidiary scheme at the Imperial Agricultural Research Institute. A good beginning of outdoor experiment has been made at the trenching grounds of the Delhi Cantonment Board.

AGRONOMICAL EXPERIMENTS

Of late there has been a feeling that the data available in regard to improved cultural practices generally but more specifically connected with manuring under different conditions of soil and climate is entirely inadequate to place Agricultural Department in a satisfactory position to advise the cultivator under all such conditions. Accordingly, the Council sanctioned the appointment of an officer to review the position. Dr A. B. Stewart, Deputy Director of the Macaulay Institute for Soil Research, Aberdeen, who is an agronomical expert, was appointed for a period of 6 months to undertake the work. He visited various provinces and states and his report is under preparation.

AGRONOMY

Research into improvements in the existing methods of farming in areas of precarious and inadequate rainfall which had been in progress in the Punjab came to an end some time ago and final results are now available. These are summarized below:—

Dry Farming Developmental Research

The schemes for the dry farming developmental research in Madras, and Hyderabad have yielded important results. The schemes were to terminate in 1946 but steps are being taken to extend the scheme in Madras by two years and in Hyderabad by one year with a view to test the improvements achieved and to collate the results.

In Madras it has been found that bunding and wider spacing than what was in practice have given better yields.

In Hyderabad bunding, scooping, manuring, lower seed rate and more frequent interculturing have demonstrated their benefits.

2. Cultivation during *kharif* with *Raja* or *desi* plough for *bajra* crop and with *Meston* and *Hindustani* plough for gram is beneficial.

3. Weeds greatly deprive the soil of its moisture content.

4. Interculture with *Kasola* (a hand implement) conserves more moisture than the Horse hoe

5. By raising bunds and cross bunds across the fields a uniform distribution of rain water is effected which increases the yield.

6. The manure should be applied only to very poor fields and the dose should not be more than 5 tons per acre in any case. The application of manures to fodder *juar* made it more susceptible to the attack of stem borer. Manuring the fields by burying green crops like *guara* and sunn-hemp does not give any advantage but may prove even harmful in dry years by attack of white ants.

7. Generally lower seed-rate give good yields.

8. The time of sowing of *kharif* crop should be immediately after first monsoon shower of more than one inch; and of *rabi* sowing in the second fortnight of October

9. Six plans of rotation and fallow were tried and yields of *bajra* after fallow were most double of those obtained after *guar* and gram. Gram after *bajra* gave twice as much yield as that of gram after wheat. The land should not be kept fallow for more than one rainy season.

10. A number of improved varieties of *bajra*, *juar*, wheat and gram was tried and they recorded higher yield than local varieties. Wheat 9D (a medium ripening variety) grows quicker, sends its roots deeper and matures better than the late variety 8A. The crop of wheat 8A yields more than 50 per cent shrivelled grain.

Desi cotton (M 6 A-2) sown in March with winter rains has been found to grow well and gives good yield.

11. In sandy soil under drought conditions *bajra* and gram are less affected than *juar* and wheat; but drought before sowing is as much harmful to *bajra* as to *juar*. *Bajra* amongst *kharif* and barley amongst *rabi* make more economic use of water than the other.

At Lyallpur, agronomical, physiological and chemical studies are being made of the water requirements of crops under different cultural and manurial treatments. the problems under investigation are:—

(1) The effect of applying varying quantities of irrigation water on different varieties of wheat sown on different dates.

(2) The effect of different quantities of irrigation water, frequencies, dates of irrigation in a factorial design on wheat, toria, cotton and sugarcane.

(3) The effect of different doses of irrigation water and Nitrogen (Sulphate of Ammonia) in a factorial design on wheat and cotton.

(4) The effect of different depths of *Raumi* (irrigation) for sowing on the subsequent irrigations on cotton and toria, and

(5) The effect of economy of water by furrow irrigation system on sugarcane.

Some of the results have been very promising. Thus three irrigations and 40 lb. of nitrogen have given an outturn identical with seven irrigations and no nitrogen thereby suggesting the possibility of water economy through the use of manure. The most important finding, however, is that water at the earlier stage gives the best result.

It has also been found that in normal years wheat and toria can give normal yields even without any irrigation after sowing provided due attention is paid to cultural operations.

PHYSIOLOGY

In the scheme of research in plant physiology and cytology which is being carried out at Vivekananda Laboratory, Almora, U. P. under Mr Boshi Sen, vernalization experiments on wheat, barley, cotton seed and mustard, vegetable and flower seeds were continued.

AGRICULTURAL METEOROLOGY SECTION, POONA

At the Central Agricultural Meteorological Observatory the study of the climates of the air and soil layers near the ground as well as inside different crops experiments on the estimation of plant growth and yield by the methods of random sampling, study of the factors controlling the rate of solar radiation and of moisture from rain and surface and sub-soil irrigation, etc. were in progress. Experiments for studying drought-resistance of plants in relation to meteorological environment were continued. Amongst new instruments developed or designed during the year, special mention may be made of (a) the new apparatus for the rapid estimation of soil moisture and (b) an integrating solarigraph. The electron ray tube apparatus was used for studying the movements of moisture and salts through soil layers. Laboratory investigations on the physics of sub-soil irrigation, capillary ascent of moisture in relation to meteorological factors and to the permeability of the soil, the influence of sodium carbonate on the permeability dispersion and crack-formation of soils, were continued.

The Statistical Branch of the Section was fully engaged in the analysis of the crop and weather data recorded at the Central Agricultural Meteorological Observatory. Investigations on rainfall variability, intensity of cold waves during the winter season and the progress of the monsoon day by day and the study of the surface temperature data collected during the last two years were some of the other aspects which engaged attention during the year.

The following schemes were initiated during the year :-

1. Crop Weather Coordination, Agricultural Meteorological Section, Poona.
2. Water-saving Experiments, Sind.

ENTOMOLOGY

Research on San Jose Scale and Woolly Aphis (Kashmir)

Work was continued during the year. The scheme is due to terminate on the 30 September 1946.

Survey of Icerya purchasi (I.A.R.I.)

The survey of the pest was carried out in Madras, Bombay and Mysore and the pest has been found in Coorg, Travancore, Mysore and Bombay. A study of its host plants and predators was made. Along with this, a survey of the occurrence of San Jose Scale was also carried out and a comparative study was made of the San Jose Scale and other insects resembling it. As a result of the preliminary survey, this Scale has been detected in Bombay, Assam, Bengal, Madras, Mysore and Orissa in addition to places where it was already known to exist, viz. the Punjab, the N. W. F. P., Baluchistan and the U. P.; and the question of making a thorough survey with a view to eradicate it is under consideration. The scheme terminated during the year and further work will be done by the Plant Protection Adviser to the Government of India.

Insect pests of stored cereal grains (Punjab)

Investigations on the biology and ecology of stored cereal grain pests and experiments on control measures were continued.

Control of insect pests by the use of mercury vapour (Punjab University).

The results of investigations under this scheme show that

(i) there is no absorption of mercury vapour by food grains and therefore absolutely no danger to consumers of such grain,

(ii) the air passed through mercury could be used as fumigant for grain storage bins,

(iii) mercury vapour is quite effective when acting upon the eggs through porous pots and

(iv) insect attack can be prevented by plastering the walls of the storage room with mud plaster in which mercury dispersed in calcium carbonate has been added.

Work on the scheme of large-scale experiments on the preservation of stored grain by treatment with mercury dispersion powder, at the Fergusson College, Poona, was continued

A scheme on breeding of *Rodolia cardinalis* was initiated in Madras during the year under review.

MYCOLOGY

Plant Virus Diseases Scheme (Bombay). In addition to work on the various viruses already under study, certain new virus diseases were collected.

Type culture fungi (I. A. R. I.). Sixtyeight species were added to the previous collection bringing the total to 805. The scheme has terminated but the work of maintaining cultures for distribution to provinces and States, etc. has been taken over by the Mycology Division of the I. A. R. I.

Development of certain lines of research at the I. A. R. I.

The various lines of research which are being developed under this scheme are in Agronomy, Chemistry, Entomology, Pathology and Botany. In the Agricultural and Chemistry Sections, methods of sampling important soils and crops are being studied and a comparison is being made in field experiments of the relative value of nitrogen in green manure, farmyard manure, compost, oil-cake and sulphate of ammonia. Investigations on quality in crops are also included. In the Entomology Section, insect population study is being carried out. The study of environmental resistance which is the foundation of biological control is also included. In the Pathology Section, detailed study of potato, tomato and tobacco viruses with a view to evolving control measures is being made. The position with regard to the occurrence of virus diseases in India is also being generally investigated. The various items under study in the Botany Section are cytogenetic investigations on the oleiferous brassicæ, determination of chromosome numbers of the potato varieties and species and study of meiosis in them and collection and registration of varieties of crops from India.

The scheme was financed by the Council up to 31 October 1945 and the work has now been taken over by the I. A. R. I.

Schools of research in different branches of mycology were initiated at various centres in the country during the year under report.

CROPS AND SOILS WING

Several matters of topical interest were discussed at the sixth meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India which was held at New Delhi in December, 1945. Questions related to irrigated farming were examined and detailed recommendations made. The Board also recommended research on the economics of spray irrigation, assessment of the indirect benefits of irrigation and research to ascertain the proportion of irrigation

water which reaches the sub-soil reservoir. The special measures adopted under the 'grow more food' campaign were reviewed and recommendations were made regarding those aspects of it which should be continued in the immediate post-war period and in normal times. These covered various subjects, viz. land utilization, diversion of land, improvement of water supplies, manures and fertilizers, seed multiplication and distribution, vegetable production, agricultural implements, protection of crops, fisheries, agricultural statistics and publicity and propaganda. The present position of the fruit and vegetable growing industries was also another subject discussed and recommendations were made as to the steps necessary to produce the minimum requirements of these protective foods for the diet of the people. The food requirements of milch and other cattle in India under the plans for development of Indian agriculture and animal husbandry were considered and recommendations were made as to how the present agricultural practice can best be adjusted to provide them. Other items on the agenda were the scope for labour-saving machinery in agriculture in the country and recent advances in the technique of plant breeding and seed multiplication. Detailed recommendations with a view to attain the objects in view were made in regard to both the subjects.

CHAPTER III—FRUIT TECHNOLOGY

The Indian Institute of Fruit Technology has been established at Lyallpur with effect from 1 April 1945. The Institute is designed to assist in the development of the fruit industry on an All-India basis with special reference to the following :—

1. Teaching

The Institute provides facilities for imparting training both in theory and practice in fruit and vegetable preservation, with a view to qualify students as teachers, demonstrators, or technical experts for employment in fruit and vegetable preservation factories.

2. Research

Investigations are not confined to fundamental research, but are largely directed to the solution of technical problems confronting the fruit preservers in this country, specially those of chemical and microbiological nature which are beyond the scope or capacity of Regional stations.

3. Control

With a view to improve the quality of fruit and vegetable products, the Institute helps in fixing standards for various products under the 'Agmark' Scheme or such other schemes as may be introduced and also in analysing commercially prepared and marketed products in order to assist the manufactures in effecting improvements.

4. Advisory

The Institute renders advice and guidance to the industry through correspondence or personal visits by the Staff, if necessary, and by issuing necessary literature in the form of leaflets or bulletins dealing with the latest methods of preparing various products.

5. Coordination between Regional Station and the Centre

The Institute will serve as a connecting link between the Regional stations proposed to be started in various parts of India, will assist the stations in the solution of scientific and technical problems and keep them supplied with up-to-date information regarding the latest methods of manufacturing products as devised in India and abroad.

I.—BIOCHEMICAL INVESTIGATIONS

1. Fortification of fruit products with vitamins

All fruit and vegetable products lose, to a varying degree, their vitamin content, particularly vitamin C, according to the methods of manufacture. The recent trend in this industry is to fortify the vitamin C content by adding a suitable vitamin.

C extract or even synthetic ascorbic acid. There are two fruits available in abundance, in this country, viz. Embelic (*Phyllanthus Emblica*) and Rose Hips, which are known to be the most potent sources of vitamin C. Preliminary experiments on the preparation of water extract from Embelic for fortifying fruit products have been conducted.

A sample of Embelic obtained from the local market, on being tested was found to contain 639 mg. ascorbic acid per 100 gm. For the preparation of an extract from this fruit several methods have been used such as crushing in the cold in an apple grater and extraction with water in cold or by heating; crushing in presence of water, after steaming in open or under pressure, or by boiling in water, etc. A satisfactory method of preparing extract of high vitamin content has been evolved. Experiments are in progress to remove tannins and other constituents which impart an astringent taste to the extract.

2. Hydrogen swell formation

In the light of the previous results, plums were canned in lacquered cans under different treatments to find a method to minimize hydrogen swell formation. Results of 15 months' storage tests have revealed that an addition of 0.042 per cent agar, or 2.0 per cent brown sugar to 35° Brix canning syrup considerably reduces the formation of hydrogen swells.

3. Standardization of a sample tamarind seed pectin

A sample of tamarind seed pectin received from Sir Sri Ram for experiment on jelly formation was analysed.

Jelly formation

1.5 to 1.75 gm. of this pectinous material in the form of 1.0 per cent solution yielded with 100 gm. sugar and 0.36 gm. citric acid, a fairly good synthetic jelly, which could be flavoured with any desirable essence. The sample of pectin was not easily soluble in water, but was rendered fairly so, after its purification by a method standardized in these laboratories.

Efforts in this laboratory to estimate pectin in the material by calcium pectate method failed indicating thereby that the material under reference, though possessing jelling properties, may not be a true pectin. This is also confirmed by M. Damodaran and P. N. Rangachari (*Journal of Scientific and Industrial Research*, Vol. IV, No. 5, November, 1945). A report on the work done was submitted to Sir Sri Ram.

4. Experiments of tomato soup, sauces, cocktail and beans in tomato sauce

In order to standardize methods for the preparation of these products, 15 lots of soup, 4 of cocktail, 4 of chilli sauce and 4 each of red and white beans in tomato sauce respectively were prepared and suitable recipes for these were evolved, which yielded products of very good quality in each case. Cut-out tests of these products conducted over a period of 8 months have yielded very encouraging results.

5. Preparation of refined syrup from cane juice

A sample of concentrated (about 80° Brix) neutralized refined syrup was prepared from cane juice to find its suitability for use in fruit products. The sample, however, possessed a characteristic molasses-like taste. Further experiments to explore the possibilities of preparing a suitable refined syrup direct from cane-juice are in progress.

c. Candying of peels and fruits

The aim of these experiments was to find out (a) the amount of sugar required for candying, and (b) the amount of sugar recovered in the form of syrup. Orange and lemon peels and carrots were candied. These experiments revealed that for preparing one pound of the finished candied product a total quantity of about 2½ lb. sugar is used in case of citrus peels and 1¾ lb. in case of carrots for making candying syrups. Out of this 13½ to 14½ oz. sugar is actually absorbed by the fruit in the candying process to yield one pound of the finished product, while the rest of the sugar remains in the form of syrup which can be reused in candying. For rolling the candied product with crystalline sugar, about 4½ to 5½ oz. of sugar is required for one pound of candied peels and about 2 oz. for one pound of candied carrots.

7. Experiments on Coorg oranges

The Chief Commissioner of Coorg sent 400 oranges in two consignments for investigating the quality of citrus products which could be made out of these. These yielded a good quality squash made according to the usual standard formula developed in these laboratories for orange squash. Peel oil emulsion proves suitable for fortification of flavour. In all 13 lots of squash were prepared. These oranges being rather deficient in pectin did not alone yield marmalade of good quality. But when *Khattas* (*Citrus Aurantium*) were mixed with these in the ratio of 2 : 3 by weight, jelly marmalade and jam marmalade of good quality could be obtained. Behaviour of all these products during storage is under examination.

8. Problems offered by the All-India Food Preservers Association

(i) *Utilization of waste pulp left over in the clarification of lime juice required for cordial making*: Experiments carried out with three samples of such pulp supplied for this investigation by Messrs. Indian Mildura Fruit Farms revealed that almost all the constituents of this pulp can be profitably made use of as follows:

(a) Clear juice can be separated from the pulp by decantation after allowing it to stand as such or after dilution with water and used in cordial making.

(b) Pulp left after (a) can be used for recovery of lime oil by steam distillation. The yield of oil from two samples was 56.5 and 85.5 c.c. per gallon of pulp and could be economically distilled from this material which was going to waste in squash factories at present.

(c) The residue left after steam distillation can be easily clarified and filtered. It has been used in cordial making and recovery of citric acid as calcium or sodium citrate.

(ii) *Treatment of an apparently clear sample of lime juice to facilitate filtration through a filter press*: Out of the ten treatments tried to render an apparently clear lime juice fit for filtration through a filter press, addition of fat-free casein (at 3.2 oz. per 100 gallons juice preserved with SO₂) in the form of solution gave desirable results.

The detailed method, as evolved above, was given to Messrs. Indian Mildura Fruit Farms, Ltd., Renala Khurd (District Montgomery), who had sent the sample under reference for investigation.

(iii) *Standardization of pulp in squashes*: As a result of preliminary experiments, a method has been developed for standardization of pulp in squashes, for maintaining uniformity in physical appearance, under one set of working conditions. In this, the quantity and hence column of pulp is regulated and maintained uniform, by determining the pulp content of juice in the form of sediment which settles down on centrifuging the juice in a tube centrifuge for 10 minutes at 2000 v.p.m. A set of uniform conditions of sedimentation in bottled squashes in a particular factory can be standardized by the above method. Fine sieves for the pulping machines have been found to be most suitable. Further work is still in progress.

(iv) *Canning of Malta orange*: Four varieties of Malta orange, viz. Common, Jaffa, Blood Red and Pine Apple and two varieties of *Sangra* (*desi* and *Nagpuri*) have been tested and found quite suitable for canning by the method already standardized, yielding satisfactory product in each case. Addition of 0.5 gm. essence vita crush to one pound of canning syrup was found useful for the fortification of flavour.

A method for canning of Williams' pears and oranges together to form a fruit salad was standardized.

(v) *Packing and storage of essential oils*: It is a common experience that freshly extracted citrus essential oils deteriorate in quality during storage. In order, therefore, to find out the best method for their packing and storage to avoid deterioration, experiments were planned in which lemon oil was packed under nine different treatments. The behaviour of these oils is being studied during storage.

9. Testing and analyses of products and chemicals, etc.

(i) *Samples received on behalf of the Fruit Development Adviser*: One hundred and ninety six samples of squashes, jams, canned fruits, etc. received from manufacturers were tested for sugar content and quality (in some cases) in connection with the allotment of sugar.

(i) *Samples received on behalf of Civil Supplies Department, Punjab* : One hundred and forty six samples of various fruit products were analysed and tested for quality and complete reports submitted to the Civil Supplies Department, Punjab, Lahore

(ii) *Samples received from the trade* : Twenty three samples collectively, of preservatives, juices, squashes, jellies etc., received from the trade were analysed and tested and report in each case submitted to the respective firm. Three samples of dehydrated fruits were received from the Government Factory, Peshawar, for analysis and report on their quality.

II.—MICROBIOLOGICAL INVESTIGATION

1. Yeast and mould cultures

(a) Cultures of 24 different strains of yeast and 5 of mould are being maintained for experimental work and supplying to the trade for alcoholic fermentation

(b) Twenty four cultures of bacteria and mould were obtained from America Type Culture Collection, Georgetown, University Medical School, Washington for comparison and identification of the organisms responsible for spoilage in Indian canned fruits and vegetables. These cultures are also being maintained.

2. Fermentation studies

(a) *Preparation of wine from rejected dried pears and plums* : Rejected dehydrated plums and pears were received from the Progress Officer, Food Department, Peshawar, for investigating the possibility of utilizing these for making alcoholic drinks. Microbiological examination revealed that they were badly infested with insects. These fruits were unfit for human consumption due to insect attack and also could not serve as feed to ducks and chickens due to high content of sulphur dioxide. The extracts of these fruits were obtained after treating with water under different treatments and some sets of wine and cider were prepared with and without addition of any sugar. The wine prepared by the addition of added sugar was of a satisfactory quality, but on the whole the dehydrated material due to insect infestation was not considered suitable for wine or cider production.

(ii) *Different strains of yeast cultures as affecting the quality of grape-wines* : Five promising yeast strains, viz., *Saccharomyces Cerevisiae* var., *ellipsoidous* Burgandy, *Saccharomyces champagne*, *Saccharomyces Frie Bois*, *Saccharomyces Tokay* and *Saccharomyces Marsh* were used in small scale wine making trials on Quetta grapes to determine the quality of wines as affected by different yeast strains. The analysis of different samples of wine gave the following figures :

Alcohol content	16.4 to 16.7 per cent.
Acidity	0.31 to 0.38 per cent.
Ash	0.3 to 0.4 per cent.

The samples of wine are being clarified and it is yet too early to put forth any conclusive results.

(iii) *Preparation of vinegar* : Vinegar from grapes, gur and cane juice was prepared for class work.

(iv) *Preparation of cider* : Cider was prepared from Kashmiri apples (*amri* variety) for class work. The quality of cider was not good due to deficiency of tannins in these apples. For clarification, filter aids, viz *Hyflo-supercel*, standard supercel and filter-cel were tried. Standard supercel appeared to be a good filter aid.

3. Enzymic clarification

Pectin-splitting enzymes have been used for a long time in the industry for clarification of freshly extracted fruit juices. These enzymes are produced by growing moulds of different types on some suitable woody materials.

Due to non-availability of these enzymes in this country, efforts were made to develop a method for the preparation of these enzymes. In this connection cultures of 5 different types of moulds were employed in making enzyme powders. None of these moulds have given any conclusive results.

4. Microbiological analysis of Indian sugars

Sugar may carry spores of all the three groups of thermophilic bacteria, namely flat sour bacteria, thermophilic anaerobes not producing hydrogen sulphide and sulphide spoilage organisms. These bacteria spoil non-acid canned foods.

In order to study the extent of infection of sugar used by the industry in this country by these bacteria 34 samples of sugar were obtained from different factories. Out of these, 20 samples have so far been examined and bacterial counts recorded.

5. Bacterial swell in canned peas

Messrs. B. N. Elias and Co., Calcutta, reported the spoilage in their canned peas pack up to the extent of 60 per cent. The samples of spoiled cans were sent by the firm for examination. The swell was found to be due to *Bacillus lactis acidi*. Pure culture of the causal organism was isolated and the experiments have been conducted to find out the causes of spoilage in canned green peas. Three hundred and twenty five cans of 1 lb. capacity have been canned under different treatments using the pure isolated culture of *Bacillus lactis acidi*, varying concentration of lactic acid to retard the action of these bacteria, etc.

All the treatments are under examination during storage.

6. Microbiological examination of fruit and vegetable products

(a) *Agmark samples*: Twenty-nine samples of canned fruits, tomato products, mango chutney, guava cheese, orange marmalades and guava jelly were analysed microbiologically according to the specifications laid down in the Control Order.

(b) *Samples from trade*: Forty-six spoiled samples of squashes, canned fruits and vegetables and marmalade received from different firms all over India were examined with a view to determine causes of spoilage and suggesting remedial measures.

III. TEACHING

The Diploma Course in Fruit and Vegetable Preservation was started at the Institute from 16 July, 1945. Twenty-three students from different provinces and States as given below were admitted to this course.

Name of provinces and States

1. Assam	9. Orissa
2. Bengal	10. Punjab
3. Coorg	11. Bihar
4. Bombay	12. Sind
5. Kashmir	13. Travancore
6. Madras	14. Kapurthala
7. Mysore	15. United Provinces
8. North-West Frontier Province	16. Hyderabad

During the year under report, 145 lectures in theory of 1½ hours duration and 346 practicals of 2½ hours duration were given to the class. Due to scarcity of laboratory accommodation, practicals were conducted in two batches and the students of the course, besides other laboratory and small scale experimental work, were given training for preparing fruit and vegetable products in semi-commercial pilot plants of the Institute.

The class was taken on an educational tour to half a dozen important factories in the Punjab and United Provinces in December, 1945. In accordance with the prospectus of the course two house examinations were conducted during the year under report.

IV. TECHNICAL ASSISTANCE AND ADVICE

Visitors: Five hundred and seven visitors from all over India visited the laboratories during the year. They were shown round and given all the information and advice sought for by them. A large number of these visitors came for personal discussion about starting and fitting up of factories.

Enquiries: A total number of 707 enquiries from different parts of the country were dealt with through correspondence. A large number of these enquiries related to making of plans for the layout of factories or suggestions for improvement in the existing plans and solving of various problems and difficulties in the manufacture of various products, etc.

V. MISCELLANEOUS

(i) A Chemist of the Agricultural Marketing Department was given three months' training in the analysis of fruit products.

(ii) Final report and the abstracts of the results of work done in the scheme for special work on fruit and vegetable preservation (1941-45) were written up. Annual report of the scheme from 1 July, 1944 to 31 March, 1945 was also written up for inclusion in the Departmental report of the Fruit Specialist, Punjab.

(iii) Reports on the analyses of 33 Agmark samples which had already been completed were compiled, written and submitted to the Agricultural Marketing Department.

(iv) Two notes on the work done on the problems of the All India Food Preservers' Association were written for discussion at the meetings of the Association.

(v) The Biochemist attended meetings of the All India Food Preservers' Association as Honorary Secretary and also convened meetings of the Executive Committee, Publicity Committee and Technical Advisory Committee of the Association during the year.

(vi) Agmark specification for some of the fruit products were prepared and submitted to the Agricultural Marketing Department.

(vii) A good deal of literature on fruit preservation was indexed. Books and journals for the library were ordered.

(viii) Charge of the stores from the Fruit Section, Punjab, was taken over. All the office and stores work were attended to.

(ix) Two scientific papers have been written up for publication in Scientific journals.

CHAPTER IV. ANIMAL HUSBANDRY RESEARCH

A. BREEDING

(a) Cattle breeding

Research on artificial insemination has been taken over as part of the normal duties of the Genetics Section of the I. V. R. I. Special attention has been directed towards defining and overcoming practical difficulties in its application under Indian conditions. Attempts were made to popularize it in the villages around the Institute, and centres have been opened in Calcutta, Patna, Montgomery and Bangalore. Experiments at the Institute were continued on the preservation and transport of semen under tropical conditions. A container of a reasonable size which would keep semen at a low temperature for a long enough time to allow its transportation to any part of India is being constructed with the help of the Calcutta University. A private firm has, under the guidance of the Imperial Institute, produced a satisfactory set of appliances at a reasonable cost.

Only a few dilutors out of the large number tried by foreign workers have given satisfactory results. The following were used for both bull and buffalo semen: (i) egg yolk phosphate, (ii) egg yolk citrate and autoclaved whole milk; and in the case of ram semen (i) egg yolk phosphate and Winter's were tried. The necessary motility rating was preserved at 3 to 5 days, 3 to 5 days, 2 to 3 days respectively and in the undiluted bull semen 1 to 2 days. In the case of ram semen it was 3 to 5 days in all dilutors as well as in the undiluted semen. Pregnancy has been produced in cows with 1/9, in ewes with 1/20, in goats with 1/16 and in buffaloes with 1/11 of a single ejaculate. Fractions from 1/20 to 1/40 have been used in a large number of ewes. Pregnancy has been obtained in cows and buffaloes with up to 6 days and 3 days preserved semen.

respectively, and in ewes with 7 days preserved semen. The percentage pregnancy obtained in cows, ewes, and she-goats has been 79, 100 and 80 respectively, but in the villages the percentages were 71, 75 and 63 and 48 in buffaloes.

The two schemes dealing with general questions relating to animal genetics and their application to the breeding of livestock at the Government Cattle Farm, Hissar, and at the Farm of the Pattagar of Palayakottai, Madras, were continued.

Since April 1943 a scheme to study the correlation of body conformation with the draught ability of work cattle has been in progress at the Allahabad Agricultural Institute. Most of the time has been devoted to the production of testing equipment for longer trials under various loads. A dynamometer treadmill was perfected and a strip chart recorder is being designed. The suggestion for the use of the treadmill method of loading and recording the load is also receiving attention.

The village cattle improvement schemes in Bombay, U. P., Punjab, Sind, Travancore, Baroda, and Ajmer-Merwara have been remodelled on the lines recommended by the Special Milk Recording Committee in 1944.

The expansion of the present Animal Husbandry Bureau into a Central Herd Books Section with enlarged functions on a permanent basis and its transfer to the administration side of the Secretariat of the Council has been recommended. About 789 new entries were registered in the Central Herd Books for the Sahiwal, Sindhi, Haryana and Murrah breeds. Herd Books for Gir and Kankrej cattle have been opened.

(b) Sheep breeding

The sheep breeding schemes enumerated in last year's report continued to operate. It was necessary to change the location of the flock of Bibrak sheep in Baluchistan from Quetta to Gambaz. It was realized that these sheep do not thrive at elevation much above 3,000 feet.

The small surviving flock of the Merino sheep from the Poona Farm was transferred to the Sheep Breeding Research Sub-station, Nagardale, Belgaum, where the climate and grazing conditions are more suitable for them and where they are thriving.

The Mysore Sheep Breeding Scheme terminated as it had served its purpose. The results obtained indicate that (i) the return obtained by special feeding of concentrates does not cover the expenses entailed; (ii) the highest wool yield is obtained at two years old; (iii) it pays to shear young lambs at 3 months of age and every subsequent 12 months rather than to withhold shearing until the lamb is one year old; (iv) it appears better to have one lamb a year than two, both on account of the size of the lambs and on the effect on the health of the ewe; (v) rams should not run with the flock throughout the year; many uneconomic lambs result; (vi) washing in running water before shearing cleans the fleece sufficiently, if the animal is not affected by external parasites.

The N. W. F. P. has been exploring the possibility of grading up sheep for the production of Karakul pelts. Three Karakul rams have recently been imported from the U. S. A. after unsuccessful attempt had been made to obtain them from Afghanistan, the Middle East and Africa.

(c) Goat breeding

The work at Etah and Hissar goat farms continues. In the former place it was shown that the best breeding season was between May and June with kidding between October and November. So far 112 stud bucks have been distributed for grading up and 383 breeding stocks have been supplied to all provinces. A total of 1,039 goats from villages have been bred to the farm bucks.

Three Angora bucks were imported from South Africa and it is hoped that by their use quick progress will be made in the evolving of a mohair-bearing goat.

Wool. There are now 4 Wool Laboratories at work—3 of which are financed by the I. C. A. R. One more has been sanctioned for Baluchistan, and the establishment of two additional ones is under consideration. Besides the routine work, the study of the best methods of sampling is in operation at Poona and Hissar. A quick test for evaluating the wool of rams in the field has been evolved at the Hissar Laboratory.

Washing and grading of wool : The schemes for the washing and grading of wool in Ajmer-Merwara and the N. W. F. P. have been very beneficial to the sheep-owners who now appreciate the uses of grading and cooperative marketing. The wool was graded into skirting, coloured and bodywool. In Ajmer-Merwara, the graded wool was stored and sold in the open market at a profit of 4 pice per sheep in the first season and 5 pice per sheep in the second season.

In the Bombay University Wool Analysis Laboratory, 323 samples received from the U. P., Mysore, Baluchistan, Bihar and Kashmir were analysed to determine the wool quality of sheep in order to classify and assess them. The sulphuric acid method was found to be economical and efficient for removing vegetable matter. Grass content was found to be directly related to quality. Under constant conditions the rate at which a dry sample could regain moisture which usually varies between 10 and 15 per cent depended largely on the amount of medullation and hairness.

(d) *Poultry breeding*

The final report of the Punjab scheme to study the production of table poultry was submitted this year. It was shown that the Asil, Chittagong and improved Punjab were better than the *desi* in regard to growth rate. But that the Asils and the *desi* were poor egg layers and the improved Punjab, because of the irregularity of body conformation, are inferior to the Chittagongs. The expenses involved in feeding fattening rations were not warranted by the return received. Groundnut cake was shown to be a good source of protein up to 24 weeks of age if fed with 1 per cent of common salt.

The most important work of the year was done in the Izatnagar Village Research Scheme. The tentative results obtained showed that improved feeding has more influence on egg production than improved housing and that there is little difference between the pure-bred and the cross-bred in the absence of good feeding and management. Pure-breds and cross-breds, however, give bigger eggs.

When fed, housed and managed well, an average egg production of 132.2 was obtained in the villages, with good housing and with ordinary village feeding the egg production was 47, with ordinary village houses and good feeding the average was 72.6. Under ordinary village conditions with housing and feeding the egg production was 35.2. The biggest single cause of death was Ranikhet disease; the next biggest was from wild animals. It appears that the indigenous hen is just as susceptible to these hazards as the improved breed or their crosses.

B. ANIMAL NUTRITION

Previous observations on the extensive use of alkali-treated straw for feeding livestock at the Imperial Veterinary Research Institute had indicated that alkali treatment considerably improved the nutritive value of coarse fodders. In order to test the practicability and economics of this finding in paddy and wheat straw areas, feeding trials were conducted at the two paddy straw centres, namely Sodepore Pinjrapole (Bengal) and Puri Gowshala (Orissa) and at a wheat straw centre in Montgomery (Sir Datar Singh's Farm), Punjab. The results obtained so far from the Sodepore centre indicate that the young stock consumed 8 per cent more straw than controls showing that the alkali-treated straw was more palatable than the untreated straw. The feeding of alkali-treated straw had no untoward effect on the consumption of other constituents of the ration. The average rate of increase in growth of the control and experimental groups was 0.48 and 0.80 lb. per day respectively. The alkali-treated straw fed animals were thus growing about 67 per cent quicker than those fed on untreated straw. These results are in conformity with those obtained abroad.

At Puri, the cost of 114 lb. of straw was Rs. 2-8-6. The cost of caustic soda required for treatment was Rs. 1-11-3 and the cost of labour was 6 annas. On these three items the cost of 80 lb. of treated straw was Rs. 4-4-0.

In order to study the effect of progressive maturity on the chemical composition of some of the common indigenous grasses 27 samples were analysed in the months of August, September and October 1944. The results showed marked variation in the

composition of the grasses with progressive maturity. The crude protein decreases with the progress of the growth. Phosphate showed almost a similar tendency while calcium may be slightly increasing when the grass grows older. Of the other constituents, soda showed a tendency to increase with maturity while potash decreases in most of the grasses. Sulphur in most cases does not show any marked variation as was also the case with chlorine and magnesium.

In regard to other extract crude fibre and nitrogen-free extract the figures are too variable to warrant any special remarks.

Leafy fodder: Analytical work on leafy fodders has been taken in hand. The results so far obtained indicate that the tree leaves are very rich in crude protein and lime.

The first stage of an important piece of work on the investigation of the nutritive value of vanaspati and the vitamin-A content of ghee was finished at Izatnagar. The butter fat of eight different breeds of cattle and one breed of buffalo was examined and it was found that the vitamin-A value of butter fat of cows of different breeds kept under identical conditions are more or less the same; none of the Indian breeds give milk as rich in carotene as the Jersey breed, some secrete very little indeed. When liberally fed, however, the butter fat of Indian breeds is very rich in vitamin-A, the value being similar to those of European breeds. The vitamin-A content of buffalo ghee is very low. The vitamin-A potency in the same breed varies from place to place: the seasonal variation is not so much. Thirty one samples of bazaar ghee were examined during winter months and 27 during summer from various parts of India. Some of the samples were of very poor vitamin-A quality and there was scarcely any difference in the average value for summer or winter samples. It appears that the vitamin-A content of ghee deteriorates rapidly at first but soon assumes a level which remains constant for a long period. Good packing in air-tight tins may help in protecting vitamin-A content. No vitamin-A could be detected in any of the vanaspati samples, although most of the brands were said to be fortified with vitamins. Experiments were undertaken to find the effect of feeding vanaspati on three generations of rats. In the first generation, there was no significant variation between the controls and the experimental animals, but in the second there was a significant lowering in the vanaspati fed rats. The same effect was found in reproduction and lactation. The first generation is normal, in the second some of the vanaspati fed groups were superior, but others were definitely inferior. There are signs of poor absorption of calcium and vitamin-A from vanaspati diet, poor absorption or increased requirement of vitamin-B complex.

At the Imperial Dairy Research Institute a corresponding experiment was carried through. Various samples of genuine ghee and hydrogenated vegetable oils were analysed for their physical and chemical constants. The nutritive value of cow and buffalo ghee, the body fats of cow, goat, sheep and buffalo and five vegetable oils was determined on the first generation of rats. Here the results correspond with those obtained in other parts of the world, i.e. there was no significant difference shown.

In a scheme for the improvement of stunted cattle in Malabar and South Canara it was demonstrated that the most important factor in their failure to grow was deficiency in food not only absence of minerals or presence of parasites.

In the Lyallpur cattle feeding experiments, the nutritive requirement of a 1,000 lb. bullock in medium work was determined that is 0.5 to 0.55 lb. of digestible protein in 8.5 to 9 lb. of total digestible nutrients per day. The feeding value of barley, wheat, mammi, guara grain and gram kara for working bullocks was determined. Barley proved better than toria cake for working bullocks when fed with 30 lb. berseem green and wheat, bhusa *ad lib*. Guara grain when fed with green chari gave better results than when fed with green maize. Gram kara or gram chuni can be fed with green maize and berseem green with equally good results. Wheat mammi was not relished by the animals. There appeared to be a marked associative effect of feeds when fed in combination.

Under another digestibility experiment in the Punjab on milch cows with oil seed and oil-cakes to investigate the nutritional requirements for milk production it was found that the milch cows relished sarson cake better than toria cake and 4 lb

per head per day were taken without producing any ill-effect whatsoever on the health of the animals; milk and ghee produced was normal in every respect except that the iodine value was rather high which indicated that the fat contained more unsaturated fatty acids.

The results obtained during the last 4 years with 6 milch cows (Sahiwal breed) indicated that the nutritional requirements of a cow are 0.048 lb. digestible protein and 0.357 lb. T. D. N for producing one lb. of milk containing 5 per cent fat.

The final report on Animal Nutrition Scheme which was in operation in Madras from 1935 to 1943 was submitted. Mineral metabolism experiments were conducted on Kangayam and cross-bred animals and the daily requirements of calcium and phosphorus for all type of animals have been worked out. The cattle of Kurnool district were found to have low blood inorganic phosphorus in keeping with the pasture content of the area. In the biochemical study of fluorine intoxication which occurred at Nellore, it was found that aphosphorosis also played a part in producing the syndrome in combination with the fluorine present in the water.

A survey of pastures indicated that the pastures were in general quite normal excepting those in Guntur, Anantapur, Cuddapah and Kurnool in the Ceded districts and it was found that organic manures even in large doses did not upset the normal nitrogen and carbohydrate metabolism of crops as happened in the case of ammonium sulphate. It was found that white ragi had superior biological values than brown ragi and that white starchy rice was better than glutinous rice, as a result of the experiments carried out on rats. Experiments carried out on Bellary breed of sheep to determine the nutritional factors involved in wool production showed that a portion of elemental sulphur fed was retained but had no effect on the quality or the yield of the wool. Similar experiments, in which protein from groundnut cake and fish meal were fed to poultry, showed that these had no effect on the composition of the flesh of poultry.

Under the scheme in U. P. for studying the comparative feeding values of the important cereal grains and main straws of the country, it was observed that in the case of the Harijana breed of cattle barley, maize, jowar and bajra are replaceable weight for weight for the same feeding value though there are indications of superiority of barley. Bajra and barley were found to be of higher feeding value for the Murrah breed of buffaloes.

A scheme to ascertain the alleged bad effects or presumed good effect of feeding groundnut oil cake and cotton seed alone or in mixtures to milch cattle on their production and reproduction and to study the comparative economics of feeding these stuffs is being carried out in certain villages of the Baroda State with Kankrej cows and Mehsana buffaloes. Some of the animals were fed continuously on the feed selected while in the case of others a change was given generally after every two months. Tentative results are as follows:—

- (1) A change in feed from time to time reacts favourably on the production level of cows.
- (2) Groundnut cake and groundnut oil-cake, cotton seed (50.50) when fed to buffaloes increased milk production the former more than the latter.
- (3) The animals whose feed was changed from time to time grew more quickly than those fed continually on one diet. Those fed on groundnut-cake plus cotton seed grew more quickly than those fed on cotton seed alone or on groundnut alone. The same effects were noticed in the length of lactation and in the milk yield.

In Assam, a survey of the pasture and soil analysis has been carried out. The composition of various species of grasses varied for pre-monsoon and post-monsoon periods. Calcium and phosphorus are higher in pre-monsoon period. In some cases, some of the seasonal grasses became extinct and are entirely replaced by other grasses in a different season thus suggesting that grazing areas can be improved by better cultural and manurial treatments. Existence of three new species of grasses, viz 'Kahi', 'Tatus', 'Patipata' has been observed. They are well relished by cattle. Nutritional experiments carried out on (i) Sindhi (ii) Assamese Buffalo and (iii) Assamese heifers showed that diet of straw proved as good as grass provided the former was supplemented adequately with concentrates except in the case of Assamese heifers where grass appeared to be better than straw.

ANIMAL DISEASES AND PESTS

Disease Investigation Schemes for large animals, sheep and goats and poultry continued to function in the Provinces and States. A new scheme from Baroda for the appointment of a Disease Investigation Officer and another from Bengal for the appointment of an Assistant Disease Investigation Officer (Sheep and Goats) have been recommended for sanction by the Advisory Board. A special conference of the Disease Investigation Officers was held at Izatnagar during this year. The conference made various recommendations dealing with the utilization of their services, provision of field emergency unit, poultry mortality, writing of reports etc. which were accepted by the Advisory Board. The technical programmes of these officers were minutely gone into and every officer has been entrusted to carry out research on one or more major problems which are of particular importance in his area. A brief account of the important results achieved during the year is given below.

Tuberculosis and Johne's Disease

Some experiments were carried out to study the immunizing effect of Volo Bacillus against T. B. but inconclusive results were obtained and the experiments have been postponed for lack of experimental animals. Johnin prepared from overseas strains proved unsatisfactory for tests in India. It is now proposed to prepare it from Indian strains. More tuberculin tests have been carried out in the provinces by the Disease Investigation Officers but from now onward this work is to be entrusted to the provincial staff. In Madras, out of the 90 and 67 animals (both cows and bullocks) tested for T. B. and Johne's Disease respectively 17 and 5 gave positive reaction; out of 322 cattle and buffaloes tested in the United Provinces 23 reacted. In the Punjab, tests for T. B. showed 4 per cent reactors in mixed breeds in Shekhpura and 1.8 per cent in hill breeds. Fairly high incidence of T. B. infection was found in the cattle population of Cuttaek and Puri Districts. Out of the 9 buffaloes tested for T. B. in Hyderabad, 3 were found positive. Out of 231 animals tested in Kashmir 5 per cent were found positive.

Contagious Abortion

In Bengal, out of 65 cattle tested 10 proved positive. In the United Provinces, tests showed 1.6 per cent positive, out of 152 animals tested for contagious abortion in the Central Provinces 23 reacted. In Assam the disease was confirmed. In Orissa, out of 38 cows and 1 bullock tested, 5 cows and 1 bullock proved positive. The brucella positive herd of goat was kept under observation at Hissar. During the year 23.5 per cent were sterile; 17.6 per cent had still births, 59 per cent kidded normally. Mortality in kids was 23 per cent as compared to 17 per cent in the negative flock, 23 per cent of twins were born as compared to 63 per cent twins in the negative flock. The weight of kids at birth compared favourably with that of kids in the negative flock.

Rinderpest

Two thousand vaccinations with Powder Vaccine were carried out in Rinderpest outbreaks on the same lines as goat tissue vaccine in the U. P. with very satisfactory results. Rinderpest vaccine prepared in pill form with glucose as excipient and syrup glucose as binding agent has given the best and the most promising results for immunization against Rinderpest, the serum goat tissue vaccine method was found successful in almost all goat breeds and in Lohi sheep in the Punjab while goat tissues vaccine alone was successful in the case of different breeds of sheep but each breed showed a dissimilarity in the mode of reaction. The liver of goats injected with rinderpest goat virus was found to be infective in Bihar. It was found that the virus remained potent in the liver and spleen for 16 to 24 days respectively when kept in a frigidare. In Kashmir the reaction to goat tissue vaccine on one herd of Sindhi cattle was found to be very mild indicating the vaccine alone to be quite safe for use.

Foot and Mouth

At the I. V. R. I. a total of 37 Indian strains were isolated and 29 of these have been typed. It was demonstrated that a mixture of blood and crystal violet incubated for 10 days protected cattle against contact infection. Acute cases of foot and mouth were recorded in lambs at Hissar showing typical cardiac lesions and gastro-enteritis.

Contagious Caprine Pleuro-pneumonia

In Madras, the disease was recorded from Nellore and Chittoor Districts. Carbolic vaccine made from lung tissue used after keeping it at room temperature for nearly 7 hours and carbolic vaccine made from spleen tissue gave very good results in sheep and goats. In Sind, trial of vaccination with formalised-disease lung emulsion was made which was reported to have reduced the mortality in sheep and goat considerably.

Hump-sore

Use of preparations containing sulphonamides and codliver-oil following surgical operations greatly accelerated recovery.

Anaerobes

At the I. V. R. I. various media used in the cultivation and isolation of anaerobes of the *Clostridium* group were prepared and tried. Sheep brain and moist media were found to be very suitable.

Helminthiasis

Results of examination at the I. V. R. I. showed that aged plain cattle and buffaloes are markedly refractory to hookworm infection. Work on the life-histories of the *Dicrocoelium dendriticum* and *Gastrothylax crumenifer* of ruminant was continued. A survey of local sheep and goats pastures was made for free living grass-mites with a view to studying the infection and life history of *Monezia* and a species of oribatid mites was found to be very common at Bareilly. Work on the life-histories of *A. vitulorum*, *G. crumenifer*, *P. cervi* and *Monizia* was continued in Madras. At the Lucknow University, a large number of helminths were examined from the U. P., Bihar, Bengal and Orissa. Work on the life-histories of *Trichocephalus ovis* and *G. crumenifer* was continued. In the C. P., helminthic infection was brought under control by regular helminthic drench with copper sulphate and administration of special coccidiosis powder. In Orissa in Fascioliasis infestation carbon tetrachloride therapy in 6 to 7 c.c. dose per animal was found quite satisfactory. In Haemonchosis infestation phenothiazine therapy was tried with good results. In Hyderabad treatment with copper sulphate, carbon tetrachloride and igitol was found satisfactory against *Haemonchus contortus* and immature paramphistomes.

Mastitis

Out of the 30 samples of milk tested, three proved to be positive for *Streptococcus* infections. A scheme to investigate mastitis in important tracts has been recommended for sanction.

Pittoo and Gillar—Valuable information in respect of the causation of the condition its mode of spread and the problems of the intermediate hosts and treatment has been made available under a scheme in Bihar. Copper sulphate carbon tetrachloride treatment has been recommended for trial. The Scheme has been terminated with effect from 1st April 1946.

Indigenous Drugs

In Madras, analysis of various toxic plants was continued. As recommended by the Council in 1945, the Government of India have agreed to take over this scheme from 1st April 1947 and work it at the Animal Nutrition Section of the I. V. R. I.

Miscellaneous

In the Punjab sulphur ointment was found to be the most useful treatment for actinomycotic dermatitis in Hissar Dale lambs which were the most affected.

A review of the work of the A. D. I. Os. (Poultry) is given below.

Ranikhet

It was estimated that the Punjab sustains an annual loss of 5 lakhs due to this disease. As a result of preventive methods the incidence has been reduced from 16 per cent in 1942-43 to 6 per cent in 1944-45 at the farms. In the North West Frontier Province, losses have been estimated at about Rs. 22½ lakhs. This disease is more common in early spring and winter, while the reverse is the case in hilly tracts. A vaccine production centre has been opened at Peshawar.

Fowl Pox

This disease comes second to Ranikhet in importance and is fairly common in all provinces, causing about 17 to 50 per cent mortality in the affected lot, more so in chicks. Its seasonal incidence in Madras is from December to March, and in the Central Provinces from March to May. Results of vaccination have been reported as useful in Baroda, Bengal, the C. P. and the Punjab and of a doubtful nature in other provinces.

Avian Leucosis has been recorded in a Government Farm at Madras, in the C. P., Hyderabad, Bombay and the Punjab amounting to a few cases in all.

The presence of *B. W. D.* has not been confirmed in any province.

Fowl Cholera has been confirmed only bacteriologically in Hyderabad and Madras (4 outbreaks only).

Tuberculosis.—A few cases have been recorded in Madras, Baroda, U. P., C. P. and Hyderabad. Almost all these are isolated instances. A large number of birds have been tested in the U. P. where the incidence in farm birds has been found to be 2 per cent while no case has been recorded in village birds.

Coccidiosis is common in Madras, Baroda, Bengal, C. P. and Punjab, while in other places it is rare, or the incidence is not mentioned. Sulphaguanidine has been found useful in Bihar and Hyderabad.

Spirochaetosis appears to be third in importance as regards mortality and losses to the poultry industry. It is common in Baroda, C. P. and Berar, Bombay and Punjab, but it is rare in Hyderabad. It is restricted to some localities in Madras while a few outbreaks have been reported in the U. P., in Bengal it has been mostly seen in imported birds. In the Frontier Province a few sporadic cases have been seen in colder regions. Soamin and sulpharsenol have been found useful in its prevention and treatment. Kerosene oil has been successfully tried for the eradication of ticks, and methylated spirit for seed ticks. Sulpharsenol followed by an injection of virulent blood gives immunity.

Nutritional Discodera in a few places (Bengal, N. W. F. P. and C. P.), possibly A-avitaminoria has been reported, but quite a few deaths are caused by non-specific and unknown nutritional causes.

At the Muslim University, Aligarh, a scheme of research on the classification of the various species of lice infesting Indian poultry and domesticated animals is in progress.

DAIRYING

With the object of determining the conditions and methods which can be adopted for the production of clean milk in the centralised and individual systems of milking under village conditions, work has been in progress at Bangalore and Lucknow, since 1943. The laboratory part is being carried out at the Imperial Dairy Research Institute, Bangalore, and practical problems at Lucknow in co-operation with the Lucknow Milk Union. Hot rehs (alkaline earth found in the U. P.) and hot soda solutions reduced the bacterial counts of milk cans by 97 per cent. When milk cans were exposed to steam and hot air for 45 minutes in specially constructed apparatus the maximum destruction of organisms was obtained. The most satisfactory material for straining of milk in villages was found to be a double-fold piece of muslin. Ghee prepared directly from cream gave the highest yield with the minimum manufacturing cost and possessed a better flavour when compared with creamery butter or *Desi* butter ghee. Haulage by cycle from the village societies to the milk collecting depots and transport thence by motor to the Union dairy gave the most satisfactory results as far as the ultimate bacterial count of the milk was concerned. The scheme has been recommended for extension for one more year.

Investigations on the 'resazurin' reduction test with a view to find out its applicability under Indian conditions were carried out at the Imperial Dairy Research Institute for a period of six months. On a comparison with the standard 'methylene blue reduction test' and 'plate count' this test has been found to be satisfactory. Tentative standards for grading milk have also been attained. Those tests have been

found to be generally useful in picking out milk produced under insanitary conditions in drawing attention to serious cases of mastitis in herds and for detection of admixture of colostrum, late lactation and mastitis milk in the supplies. The test should for the present be used for advisory purposes. Further investigations are necessary to explain certain anomalies observed and also for verifying the 'resazurin' standards for grading under all climatic and other conditions.

From several methods tried at the Imperial Dairy Research Institute to evolve suitable tests for detecting the presence of milk powder in milk, the simplest and the most reliable test is found to be the odour of samples after incubation for four hours. Incubation is carried out after adding a drop of formalin to suppress the development of lactic acid. A rennet test depending on the time taken for a sample of milk diluted with distilled water provides another simple and quick test. Estimation of dry residue provides yet another useful test. Fresh milk gives a residue below 1 per cent whereas toned milk gives an average varying from 0.3 to 0.5 per cent. The results of this test are further confirmed by the xanthoprotein reaction with the dry residue. Pure milk gives a yellowish colour while toned samples give an orange one.

In order to help (i) to fix presumptive standards for controlling the quality of milk and (ii) to provide the necessary knowledge regarding milk which is essential for its successful processing in the dairy industry in India, a model scheme prepared by Prof. J. N. Warner of Allahabad Agricultural Institute was circulated to all Provinces to study the physical and chemical composition of zebu's and buffalo's milk. It was considered necessary to fix these standards on a provincial basis, in view of the separate provincial legislations that may come into force. Accordingly, schemes have been sanctioned or recommended in Bengal, U. P., Punjab, N. W. F. P., Bihar and at the Imperial Dairy Research Institute.

Under the scheme for the Bio-chemical Research in Indian Dahi in progress at the Imperial Dairy Research Institute, the preliminary examination of the samples obtained from tracts representing the different climatic and other conditions and which are famous for dahi production showed that the majority of them had a pronounced acidic smell with a sour taste while a good number of them were very sour. Only a few possessed the typical dahi aroma and a mildly sour taste. The average variation in the bacterial count, titratable acidity and chemical composition for the dahi samples were calculated. The different type of organisms found in the samples are being isolated and maintained as pure cultures for further study.

In order to prepare vegetable rennet from *Withania coagulans*, for use in cheese making, steps have been taken to concentrate the enzyme under a scheme at the Imperial Dairy Research Institute. It has been found that most of the enzyme activity is found to be confined to the gummy pulp. The outer husk also contains some milk clotting properties. Preliminary use of extract obtained through a medium of 1 per cent salt solution in soft cheese making has given encouraging results.

Methods of manufacture of ghee were studied at the Indian Institute of Science, Bangalore. It was found that milk treated by the boiling process soon after collection (within 2 to 3 hours) and seeded with a good inoculum produced curd of firm texture and satisfactory flavour. The texture of the ghee produced therefrom was uniformly firm and granular. Vitamin A content and carotene were not affected and the storage property was found to be uniformly good. A survey of the process of ghee manufacture in Indian villages revealed a number of defects in collection, processing, storage, transport, etc. It has also been found that ghee of very high quality can be prepared from milk without souring. The milk is separated into 35 to 40 per cent cream, rediluted with water to half the volume of the milk, re-separated, 0.1 per cent by weight of citric acid added to the cream and boiled into ghee. Ghee so prepared has a keeping quality two to four times that of ghee prepared by the souring process. A cheap and simple device of washing, suited to the small-scale village manufacturer is to siphon off or tap away the butter milk from the bottom of the churn after the butter granules are well-formed and then gently re churn the grains with added water. This process helps in improving the flavour and texture of the country butter as also the keeping quality of the ghee made from it.

A study of the *fatty acid and glyceride structure of buffalo ghee* was carried out at the Indian Institute of Science, Bangalore, to help distinguishing a ghee of low R. M. value due to natural causes from one due to adulteration with foreign fats. The most useful feature is the percentage of linoleic acid which though it is not constant, is very small in all the ghees tested and amounts to about 1 per cent. All oils which are used for feeding animals and for direct adulteration of ghee except coconut and hydrogenated oils have very large quantities of this acid. Even 10 per cent adulteration with these oils will raise the linoleic content of the ghee in a very marked degree. Coconut oil can be detected by the R. M.—P. M. relationship. The ghee which result from feeding these oilseeds or cakes do not contain large quantities of this acid since this is saturated by the body of the animal, but direct detection can be made by the above method.

A further study to find out the linoleic acid contents of various types of ghee which cover the limits of natural variation due to breed, feed, season, etc. has been recommended by the Advisory Board.

For the purpose of *refining and grading of 'yellow-ghee'*, control ghee samples and market samples obtained from various parts of the country were analysed at the Imperial Dairy Research Institute for their physical and chemical properties. Studies on refining will be taken up with larger samples next year.

A simple process for the *removal of free fatty acids in ghee* has been worked out at the Imperial Dairy Research Institute, Bangalore, with the use of finely produced good quality lime, raising rapidly the temperature to 108°C. and filtering it through filter cloth or flannel when the temperature has cooled down to 60°C. This treatment is effective against deterioration due to high acidity only; but when acidity is due to other causes, this treatment will not be of much use.

In order to provide a useful visual check against misuse of *vanaspati for adulteration with ghee*, it is proposed to colour vanaspati with Ratanjot (*Onasma Echioides*) as a result of the work carried out at the Imperial Dairy Research Institute. Colouring principles obtained from *Ratanjot* are non-toxic even when used in large doses. Addition of sesame oil provides a double check. The Advisory Board of the Council has recommended that instead of specifying the quantity of sesame oil to be added, a condition should be laid down that the finished product should give a colour reaction of a specified intensity when tested by Furfural reaction. This intensity of colour will enable the detection of adulteration up to 5 per cent of vanaspati in ghee.

With a view to assisting the Provinces and States to undertake *legislation for the prevention of adulteration of dairy products*, a set of model rules has been framed in consultation with the Chief Controller for Food Standards of the Central Advisory Board of Health. The rules as finally approved by the Advisory Board are to be circulated to Provincial Governments and constituent States of the Council.

Standard methods for the analysis of ghee were framed by a special Committee in 1945 and forwarded to all Provincial Governments and constituent States of the Council for guidance. A similar Committee was formed in 1946 with a view to standardising the methods employed in the analysis of milk and milk products other than ghee. The recommendations of the Committee as accepted by the Dairy Science Committee and the Advisory Board will be communicated to the provincial Governments and constituent States of the Council shortly. The details of these methods will be published in the form of bulletins.

With a view to finding out suitable substitute for steel milk containers, the following metals were tried, *viz.*—

1. Tinned steel
2. Brass.
3. Tinned brass.
4. Galvanised plate, and
5. Bronze.

From chemical studies with whole milk, separated milk, and curds, tinned steel and tinned bronze are found to be the best materials for storing milk and milk products.

Ghee Industry Development in the C. P. and Berar.—The scheme for the development of Ghee industry in the Jhallar tract aims at enhancement of production of ghee and securing better returns to primary producers through co-operative organisations and unions. It is being run satisfactorily. Cream separators were introduced in a few villages and it was realised that the Ghee obtained direct from cream possessed better aroma.

Manuals

A Manual of Dairying by Prof. James N. Warner of the Allahabad Agricultural Institute was completed under the year and arrangements are being made for its publication.

BEE KEEPING

An *ad hoc* Bee Keeping Committee met in November 1945 and reviewed the work done in India on Bee Keeping and made various important recommendations for the encouragement of apiculture in the Provinces and States through the help of the Forest Departments, schools, military farms, by establishing research stations, by offering subsidies, etc.

A Central Bee Keeping Research Station at Lyallpur with a sub-station at Nagrota in the Punjab was initiated in May 1945.

FISH

The Scheme for investigation on the life-history, bionomics and development of fresh water fishes at the University of Calcutta which has been in progress since December 1936 was terminated on 31st March 1946. During the year under review identification of fry of *Cirrhina reba*, *Labeo bata* and *Barbus chola* were made and the fry of *Clavus batrachus*, *Wallagonia attu*, *Labeo rohita* and *Catla catla* were being further studied. Experiments for determining the artificial and natural foods for *Jeol machh* and other fishes of economic importance show that the principal types take protozoan, crustaceans, small fishes fry, bottom debris, insect larvae, algae and also higher phanerogamic plants in general. *Jeol machh* have a greater liking towards animal food, viz. crustaceans, insect larvae and flies, small fishes and fry, bottom debris etc. Of the artificial foods *chuno* fish and shrimp gave the best results in case of *C. batrachus* and *H fossilis*. As regards zonation, it was observed that *C. catla* generally favours the surface of the water and *L. rohita* the mid-water as well as the surface and the bottom. *L. Calbasu* and *C. mrigala* live in the bottom. The average health of the carp showed marked regression in water of 6.8 pH. It has been ascertained that the pH in which fishes thrive is from 7.4 to 7.8. It has been observed that in winter the growth of carp is generally retarded while they markedly increase during summer and rainy season. The breeding habits of *Colea fasciata* and *Oryzias melastigma* have been studied both under natural and laboratory conditions.

The life history of *Barbus conchannus* was fully studied and those of *O. puniatus*, *C. batrachus*, *L. gonius* and *W. attu* are in progress. Life history of *O. melastigma* has been completed. Further observation on *Catla catla* has now been finalised while that of *L. rohita* is still under progress. During field study, it was found that the fishes grow more in the sewage feeding *Bheris* than in the ordinary fresh water ponds due to abundance of natural food in the *Bheris*.

Under the Rural Piscicultural Scheme, Madras, systematic observations were made on the following species of fish viz. *Labeo Cuv*, *Chanos chanos* (Forsk.), *Cyprinus carpio* Linn.: *Wallagonia attu* (Bl. Schn.), *Lates calkarifer* (Bloch) and *Plymemus* Linn. Detailed studies were carried out on the qualitative and quantitative analyses of the biota of the typical ponds and their correlation with the food of fishes, physico-chemical factors and their variations in typical ponds and wells and of the effect of meteorological variations on fish life. The upper Indian carps Rohiu and Mrigal have been successfully transported from Bengal and introduced in Madras. Transport of live fish and fish diseases and mortality were also investigated.

Since 1944, the Council has subsidised two schemes on the Investigation of Fish Eggs and Larvae in Madras and Bombay. During the first year of the scheme at Madras, a successful attempt was made to establish the identity of two common types of *Leptocephali* of the Madras Plankton *Muraenesox* of the Family Congridae and *Muraena* of the Family Muraenidae by allowing them to metamorphose into the adult eels. Plankton collections made during the year contained post larval stages of 10 genera belonging to 9 families. Fish eggs from these collections were removed and kept alive under observation for studying the developmental stages.

Under the scheme at Bombay, 638 eggs and 3394 fish larvae and post larvae were obtained from 222 plankton samples collected during the year under review. It was found that the temperature of sea-water is one of the important factors that control the breeding period and the rate of development of many marine organisms. Slight changes in salinity affect considerably the movement of marine animals. January, February and part of March were the most favourable months of the year for the occurrence of plankton. During the rainy season, plankton samples were rather poor both in quality and quantity. Both schemes have been recommended by the Advisory Board for further extension.

Under the scheme for the "Preservation of fish as food by curing, pickling and smoking" in Baroda State, 73 experiments were conducted mostly on Bombay Duck, Tura, Hilsa and Prawns. Periodical examination was made and it was found that almost all the products kept good for periods ranging from one to eight months. The Prawn in particular, were successfully preserved for over six months and their attractive colour was also preserved. Samples of cured fish were examined by the Imperial Council of Agricultural Research and Food Department. Results were satisfactory in general. The scheme has been taken over by the State Government with effect from the 1st April 1945.

The following schemes have been initiated during the year.

(1) Scheme for an Investigation into the Bionomics of Indian Migratory Fishes with a view to Standardise Design for Fish Passes. Headquarters are at Calcutta under the guidance of Dr S. L. Hora, Director of Fisheries, Bengal.

(2) Scheme for the Experimentation on the 'Barn' type of Dehydrated plant for the Preservation of Fish in Orissa. An Assistant has been trained at Baroda preliminary to taking up the work at Cuttack.

The Advisory Board has recommended for sanction a scheme of Research submitted by the University of Madras with the object of elucidating the biology of marine prawns belonging to the Penaeidae family occurring on the Coromondal Coast.

HIDRS AND SKINS

Control of Warble fly (I.V.R.I.)

It was observed from the experiments carried out on a field scale to assess the comparative insecticidal values of derris root (derris powder 1 lb., water 10 lb.) and tobacco-lime mixture (tobacco dust 4 lb., lime 1 lb. and water 1 gallon) applied against warble infestations in Sargodha and Ferozepore districts of the Punjab that though the tobacco lime wash is quicker in its action, yet the total number of larvae destroyed by derris root is more. During the year, there was a further drop of 8 to 10% in infestation, the reduction in the previous year being 20-25%. In the singeing experiments there was 20 p.c. reduction in the warble fly infestation of cattle in the first year but in the 2nd year the results showed only a reduction of 3 to 5 p.c.

Goat Warble Fly.—It has been confirmed that the duration of larval stage of *H. crossi* is for a period of seven months under the subcutaneous tissues of the back of the goat.

Control of Ticks.—Under the Imperial Veterinary Research Institute scheme for the control of ticks it has been established that the ticks of *Hyalomma aegypticum* species are capable of infesting goats as an alternative host. *Rhipicephalus haemaphysaloides* has been found in Madras in addition to Bombay reported last year. It has also been confirmed that it is the nymphal stage of the tick which is parasitised by *H. Hookeri* and that ticks in larval and adult stages have been found to

be free. A strength of 0·2 per cent sodium arsenite and 1·0 per cent Deris powder have been found to be efficacious against *Boophilis australis* (cattle tick) and *H. bispinosa* (goat ticks). Experiments with D.D.T. showed that an emulsion in turpentine upto 0·2 and 0·5 per cent concentration and 0·2, 0·5 and 1% concentrations with kerosene oil when used as spray on cattle is effective as a tickicide against *B. australis*.

In Bombay a scheme with a view to demonstrate the control of ticks has been terminated and is being taken over by the Provincial Government. In Orissa arsenic solution in 0·1 per cent strength proved useful for the control of ticks in sheep.

Village Flaying.—The Village Flaying Parties Scheme in Bombay which was started on 1st December 1943 has not been a success and has been closed down on 31st March 1946.

In the North-West Frontier Province 4 Master Flayers and 140 flayers have been trained in the art of flaying. Percentage of cuts in hides has been gradually brought down through propaganda use of approved types of knives and adequate lighting arrangements.

CHAPTER V—COMBINED AGRICULTURAL AND ANIMAL HUSBANDRY RESEARCH: VILLAGE PROJECTS

Village project schemes continued to function in Bombay, the Central Provinces and Berar and Travancore. These Schemes are being worked with the object of producing better economic conditions by the use of improved agricultural implements and by proper marketing. The results so far have been encouraging.

VILLAGE REHABILITATION

A scheme for village rehabilitation was sanctioned for Baroda, for trying out five different systems of farming in five villages with a view to ascertain their comparative economics and feasibility. Agricultural improvement is to be attempted by the introduction of improved implements, and provision of rotational grazing, better seeds and better grass lands. Improved methods for preservation of cattle manure and introduction of subsidiary industries are also to be attempted.

MIXED FARMING

The idea underlying the mixed farming experiments was to ascertain the best combination of crops and animals on a holding so that fertility of the land could be maintained by the return of manure to the soil, enabling economic production of crop and animal. The mixed farming schemes in the United Provinces, the Central Provinces and Berar and North-West Frontier Province, continued to function satisfactorily. In Sind, however, the scheme was closed down prematurely. With this system of farming an increase in income in fodder crops as well as in cash is expected.

Statistical Section.—The notable events of the year under review were the starting of the Diploma Course for training in Agricultural and Animal Husbandry Statistics and the extension of sample surveys on wheat to the whole of India's wheat belt and those on paddy to the Provinces of U. P., C. P., Bihar, Orissa, Bombay and Madras.

The Branch was re-organised during the year. The Statistician of the Council was appointed its Statistical Adviser and two Statisticians were appointed under him to attend to the normal advisory work pertaining to the Agricultural and Animal Husbandry Schemes of the Council. In addition, a large staff consisting of five Statisticians, and several subordinate officers, was added to deal with the cropping experimental surveys on wheat and paddy.

The work of examining technical programmes and progress reports and advising research workers in the planning of experiments and their interpretation was continued. In addition to the students of the Diploma Course, four officers from the provinces and States came on deputation for short periods of training. Post-graduate students continued their research.

The repetition of the crop surveys have brought in further evidence to show that random sampling is a practicable proposition for measuring the yield of agricultural crops in a scientific manner. On the scientific side the successful organisation of

these surveys over a tract of India's size is in itself a definite advance in the application of statistical methods to agricultural problems. In regard to the actual technique of the surveys, certain far-reaching and striking results were obtained, the most outstanding being the one pertaining to the size of the sampled area. The results have shown that in the unevenly sown crops in India the use of small size plots such as are marked by a rigid or semi-rigid sampling frame, in the hands of the departmental staff, cannot be relied upon to give correct results, owing to the very serious risk involved in getting biased estimates.

CHAPTER VI.—AGRICULTURAL MARKETING

Mr D. R. Sethi, C.I.E., I.A.S., held charge of the office of the Agricultural Marketing Adviser till the 10th August 1945, when he was relieved by Khan Bahadur A. R. Malik, Deputy Agricultural Marketing Adviser. Dr T. G. Shirname, Additional Director of Civil Supplies, Bombay, was appointed as Deputy Agricultural Marketing Adviser.

Owing to frequent transfers of officers in the grades of Senior Marketing Officer, Marketing Officer, Assistant Marketing Officer, etc., the Department had to carry on with about half its strength of technical staff for a major portion of the year. This shortage naturally affected the progress of survey and report writing work. The Government of India have provisionally placed a grant of Rs. 60,000 at the disposal of the Imperial Council of Agricultural Research to be divided amongst the Provinces for work in agricultural marketing under certain conditions. In spite of these conditions, the Provincial staff continued to be busy with other war activities and could do very little work in surveys.

SURVEYS AND REPORTS

Reports on gram, bananas, cashewnuts, barley and sheep and goats were issued during the period under review. Reports on fish, cattle, wool and hair, castor seeds, ghee, butter and other dairy products and stone and small fruits were finished during this year and are all in press now. Reports on mustard, rapeseed and toria, and a bulletin on sunn-hemp are under preparation. The following commodities are under surveys :—

1. Maize and millets. 2. Mangoes. 3. Pulses. 4. Chillies. 5. Fibres.
6. Sesamum and nigerseed. 7. Cottonseed and other oilseeds. 8. Turmeric, pepper and ginger. 9. Poultry. 10. Meat. 11. Animal fats and other by-products.

At the instance of the Agriculture Department, a rapid survey on cardamoms was conducted during the year and a report submitted to Government. A similar survey on arecanuts is in progress. This survey has been undertaken at the instance of the Central Board of Revenue.

DEVELOPMENT WORK

Despite the difficult conditions created by the war, satisfactory progress was recorded in the grading and standardisation of Agricultural and other produce and the value of the graded produce was 731 lakhs of rupees during 1945 (up till December) as against Rs. 813 lakhs during 1944 and Rs. 646 lakhs during 1943.

Ghee.—The grading of ghee showed a remarkable progress during the year. This was due to the fact that the Military authorities purchased Agmark ghee in the Kathiawar area without subjecting it to further tests. This naturally enhanced the prestige of Agmark ghee and many parties were anxious to join the Ghee Grading Scheme as packers. The Scheme received an impetus also when the U. P. Government banned all exports of ghee outside the province except for a fixed quota of Agmark ghee to Bengal and other provinces for civilian consumption.

Special measures were taken to stiffen the quality control arrangements during the year. They are the following —

1. The Ghee Grading and Marking Rules were amended so as to permit the grading of only quality ghee which came up to the 'Special' grade standards except in the case of acidity and it was decided that all samples were to be subjected to the Phytosteryl Acetate test.

2. The Ghee Grading Scheme was re-organised in the United Provinces, making the chemists at the packers' laboratories Government servants. The scheme is on no cost basis to Government as the entire cost was offset by receipts from the packers concerned. A further development in this connection was the appointment of a Chief Chemist (a gazetted class II officer) at the Central Control Laboratory to assist the Officer-in-Charge. The scheme has been extended to Bihar also.

3. It was also decided to divide the ghee grading centres into three important zones, each zone being placed under the charge of an Inspector. Three posts of Inspectors (gazetted class II) have been sanctioned and suitable persons have been appointed. Owing to the fact that the Kathiawar and Baroda States contributed a large proportion to the ghee graded in the country and purchased by the Military authorities it was found necessary to establish a Subsidiary Ghee Laboratory in Kathiawar. The exact place where this should be located is under consideration. The laboratory will serve the needs of Baroda and Junagadh and other States of Kathiawar.

Sunn Hemp.—The sunn-hemp grading work expanded considerably. All the sunn-hemp exported out of the country is now Agmark and as the work at Shiupur was particularly on the increase, the Government of India sanctioned an additional post of Inspector in the beginning of the year. The London Hemp Association made certain suggestions for improving the grade specifications for the commodity in order to suit the buyers' demand, and the specifications are accordingly under revision and the interests concerned were consulted at an informal conference held in the beginning of the year. The revised specifications have been further examined in the light of trade practices and it is proposed to have another conference with the trade in the near future.

Tobacco.—As a result of the decisions reached at the Tobacco Conference held in 1944, the grades and grade specifications for Agmark Virginia, flue-cured tobacco were revised and proposals were made for the compulsory grading of this commodity. Since several complaints about poor quality of tobacco were received from Middle East countries, official control over all exports was considered necessary. The Central Government banned under Section 19 of the Sea Customs Act, the export of flue-cured Virginia sun-cured Virginia, sun-cured Natu and Motihari tobaccos to a foreign country other than the United Kingdom unless it was graded under the Tobacco Grading and Marking Rules, and certified as such by the Inspectorate staff appointed for the purpose. The Government of India sanctioned the posts of one Chief Inspector (class I officer) and 8 Inspectors (class II officers) to be stationed at Guntur and other centres for purposes of quality control. Subsequently it was decided to extend the scheme to exports to the United Kingdom as well and to exempt from inspection such tobacco as was exported to the United Kingdom against firm orders. The Commission also revised the grade specifications for flue-cured Virginia tobacco. The Indian Central Tobacco Committee sanctioned a further staff of 1 Senior Inspector and 10 Inspectors. All the posts except that of the Senior Inspector have been filled now and the scheme is working very satisfactorily.

FRUIT PRODUCTS

In exercise of the powers conferred on them by the Defence of India Rules the Government of India promulgated the Fruit Products Control Order. According to this order no manufacturer can produce any kind of fruit or vegetable products in British India without holding a licence under the Order from the Agricultural Marketing Adviser to the Government of India, the licence being granted on the fulfilment of certain conditions with regard to hygienic, sanitation, grade specifications, etc., laid down in the Order. A number of applications for the grant of the

license have been received and are under scrutiny. Arrangements for the recruitment of the required analytical and inspectorate staff (one Chief Inspector and ten Inspectors) are being made. The Order will be enforced with effect from the 1st May 1946.

STANDARDISATION OF CONTRACT TERMS

No progress has been achieved in this matter during this year. The standard contract terms drawn up by this Department for wheat, linseed and groundnuts have been adopted only by a few trade associations in the country at Karachi, Bombay and Madras. The question of enforcing legislation was discussed at the Marketing Officers' Conference, 1945, which recommended that the Central Agricultural Marketing Department should prepare a draft bill for the compulsory adoption of the standard contract terms, which should be circulated to the Provincial/State Government for an expression of their opinion. It was also recommended that standard contract terms for other important Agricultural products should be included in the draft bill.

MARKET NEWS SERVICE

The daily market rates of a number of agricultural commodities were continued to be collected and broadcast from Delhi. Weekly reports and monthly reviews on prices, stocks, etc. relating to various commodities were published as usual.

PUBLICITY AND DEMONSTRATIONS

The Department assisted the provincial marketing staff in the organisation of Agmark stalls at various exhibitions and shows. A comprehensive scheme for publicity for Agmark ghee has been submitted to the Information and Broadcasting Department and is at present under their consideration.

EXPORT MARKETS

Samples of graded wool sent from Ajmer and Jodhpur to the India Government Trade Commissioner, New York, last year received a favourable reception. Correspondence is also in progress regarding the despatch of samples of wool, goat-hair, nuts and certain other agricultural commodities graded under standard grades, to the United States of America, Canada and Australia according to their demands. The matter was discussed at the Marketing Officers' Conference, 1945, and it was decided that an Agricultural Produce (Exports) Bill restricting the exports to Agmark products only should be passed into law. A draft bill has been prepared and is under the consideration of the Government of India.

A few samples of cashewnuts, almonds and walnuts have been sent to the India Government Trade Commissioner, Toronto, Canada, for exhibition purposes.

CONFERENCES AND MEETINGS

As a result of the recommendations of the Marketing Officers' Conference, a Standing Committee consisting of the Agricultural Marketing Adviser and five Provincial/State Marketing Officers has been formed in order to examine various marketing questions and advise Government on them.

MARKETING SUB-COMMITTEE OF THE POLICY COMMITTEE No. 5 ON AGRICULTURE, FORESTRY AND FISHERIES

One important feature of the year was the constitution of a Marketing Sub-Committee by the Government of India with Dewan Bahadur Sir T. Vijayaraghavacharya, K.B.E., Dewan, Udaipur, as Chairman, with certain officials and non-officials as members and Khan Bahadur A. R. Malik, Agricultural Marketing Adviser as Member-Secretary. The Committee has been set up to examine the entire question of agricultural marketing in India. The Sub-Committee held two meetings—one in July 1945 and the other in March 1946. The future policy with regard to agricultural marketing will depend largely on the report of the Committee. The report is expected to be completed by the end of May 1946.

MISCELLANEOUS

As usual, this Department continued to deal with inter-departmental references regarding a large number of agricultural commodities and submitted information and statistical data.

CHAPTER VII.—GENERAL

A. LIBRARY

Since its inception the Council has paid special attention towards the organization and equipment of its Central Reference Library, and has succeeded in building up a collection of 60,000 publications of scientific, technical and statistical character. This stock is increasing at the rate of 3 to 4 thousand publications every year, chiefly by exchange of publications, which now extends to important scientific institutions all over the world. The library receives publications issued by the provincial departments of agriculture and veterinary services. It has now a large collection of literature on the "Grow More Food" campaign in India and abroad, and has procured posters, charts, and similar material on extension and propaganda work. The expenditure on the Library is shared equally by the Government and the Council; the former meets the cost of the staff, furniture and accommodation, and the latter provides funds amounting to Rs. 7,000 per annum for the purchase of books and publications.

Books and Publications.—The total number of books in the Library on the 31st March 1946 was 60,610 as per details given below.—

Books and bound volumes of Journals	24,887
Memors, Bulletins and other Serials	26,736
Pamphlets and Reprints	4,704
Imperial Agricultural Bureaux Translations of foreign papers	1,170
"Grow More Food" publications	2,563
Posters, Charts, Maps etc.	550

The new additions for the year comprise 259 books purchased from the Council's funds, 4,270 exchange publications, and 336 bound volumes of Journals, a total of 4,865 books and publications. The number of current journals has increased to 476 against 396 last year. Of this number only 109 journals were purchased and the rest were received on exchange basis. This number excludes year books, annuals, reports and serial publications issued at irregular intervals, of which a very large number is received.

CIRCULATION STATISTICS

The loan of books and periodicals reached a total of 17,934, an increase of 1,164 over last year's figure. The details are as follows :—

Daily and weekly papers	10,477
Monthly, quarterly and other papers	5,082
Books and publications	2,375

These figures do not include the books and papers used in the Reading Room, of which greatly increased use was made by the officers and staff of the Imperial Council of Agricultural Research and Imperial Agricultural Research Institute, as well as students and research workers.

The following details of the loan statistics will show the demand for books on various subjects :—

1. Social Science	244
2. Pure Science	87
3. Applied Science (including medicine and Veterinary Science)]	330
4. General agronomy	1,022
5. Field and Garden crops	285
7. Animal Husbandry	195
8. Technology	56
10. Miscellaneous	156
Total	2,375

Classification and Cataloguing.—The Library maintains a printed as well as a card catalogue. A catalogue was printed in 1935 and its first supplement in 1937. Thereafter half-yearly lists of additions (1-12) appeared till the end of 1941, when their publication was suspended for the duration of war. A supplementary catalogue for the period 1st January 1942 to 31st March 1946 has now been compiled and sent to the press. The card catalogue comprising the Dictionary Catalogue and a classified shelf-list based on the Decimal Classification is being kept up-to-date, and 3,500 typed cards have been added to during the year.

Imperial Agricultural Bureaux Translations.—The Imperial Agriculture Bureaux started a special service for the translation of foreign scientific papers and selected the Imperial Council of Agricultural Research Library as the Central Reference Library for India for the circulation of these papers. This service was continued during the year and the total number of the translations now available for the use of the research workers in India comes to 1,170. A list of the translations is being compiled and will be printed as soon as ready.

List of Scientific Workers.—A card index of the Scientific workers in India, incorporating information about the qualifications, address and subjects specialised by each research worker, has also been prepared.

Information Service.—The work of rendering reference and bibliographical aid to research workers has been set on proper footing and a special service for indexing and abstracting of the scientific journals started from this year to meet the increased demand for general and technical information. At present this service is limited to the most important Agricultural and Animal Husbandry Journals but with the establishment of the proposed Publicity Directorate, it is hoped to expand it suitably. Eighty-three lists of reference to literature on specific topics were supplied in response to enquiries from scientists in India, and a comprehensive bibliography on tobacco has been compiled at the request of the Indian Central Tobacco Committee. The revision of the Bibliography on Soil Erosion (Indian Section) is also in hand.

B. PUBLICATIONS

Indian Farming.—The circulation of *Indian Farming* during the year remained as before. Seventy-one newspapers in English and seventy-four in Indian languages were on the free distribution list. The get-up of *Indian Farming* was improved by changing the cover design and by inserting new illustrations. An Artist was appointed by the Council to look after the illustrations of the Journals and their proper layout, and he has brightened *Indian Farming* by his visual charts, maps, and diagrammatic sketches.

Scientific Journals.—The publication of the *Indian Journal of Veterinary Science and Animal Husbandry* and *Indian Journal of Agricultural Science* fell into arrears and arrangements were made by the Controller of Printing and Stationery for the printing of the Journals at a private press. As the press did not possess the necessary equipment to do the work, the manuscripts were withdrawn. These have since been printed. Due to press difficulties, the publication of the Journals

is still in arrears. It is hoped that the Government of India Presses will soon be free to attend to this work.

In order to cope with the increase in work and to look after the Scientific Journals, an Assistant Editor was appointed by the Council.

The following bulletins were published during the year :—

(1) Miscellaneous Bulletin No. 27 "Definition and Characteristics of Seven Breeds of Cattle of All-India Importance" (Second Revised Edition).

(2) Miscellaneous Bulletin No. 57 "Stored Grain Pests and their Control" (Third Revised Edition).

(3) Miscellaneous Bulletin No. 60 "Preparation of Compost Manure from Town Wastes" (Second Revised Edition).

(4) Miscellaneous Bulletin No. 63 "Preparation and Preservation of Fruit and Vegetable Products".

Scientific Monographs.—Only one monograph "Our Knowledge of the Insect and Mite Pests of Citrus in India and their Control" by Hem Singh Pruthi and M. S. Mani appeared during the year.

Supply of Publications.—Over 600 institutions in India and abroad continued to receive one or more of the Council's publications either free or on exchange basis.

EDITORIAL COMMITTEE

Dr J. N. Mukherjee, C.B.E., D.Sc., Director, Imperial Agricultural Research Institute, replaced Dr H. S. Pruthi and Dr A. C. Joshi, D.Sc., F.N.I., Professor of Botany, Government College, Lahore, was appointed as a member. Professor J. N. Warner was replaced by Dr T. W. Millen, M.Sc., D.V.M., Head of the Department of Animal Husbandry and Dairying, Allahabad Agricultural Institute.

GENERAL

With a view to increase the circulation of *Indian Farming* the Committee recommended that a publicity campaign be launched, and that Hindi and Urdu editions of *Indian Farming* be brought out. Steps are being taken to implement the recommendations. The Committee continued to receive valuable assistance from a large number of specialist referees in the examination of papers received for publications.

6th July 1946

M. S. RANDHAWA

APPENDIX

Annual Account of Income and Expenditure of the Imperial Council of Agricultural Research for the year 1945-46

Receipts			Payments					
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess (-) or Saving (+) over net grant 8	Remarks 9
		Original 3	Net 4					
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
1. Opening balance	10,40,833 12 8	...	...			
2. Receipts under the A.P.C. Act. 20,41,182-3-8 Deduct—amount transferred to Reserve Fund 2,02,320-3-10	18,38,861 15 10	6,000 8,860	...					
				1	Rice Breeding, Bombay	2,795 0 0	(+ 65 0 0	Inconsid- erable
				2	Rice Breeding, Orissa			
3. (i) From Groundnut Fund	17,250 0 0	2,300	...	3	Rice Breeding, Hyderabad . . . . .	...	...
(ii) For Tobacco Scheme	10,00,000 0 0	3,300	5,600	4	Rice Breeding, Baroda	5,648 11 0	(-) 46 11 0	"
(iii) For Crop Cutting Experiment- ment	3,30,050 0 0	3,000	2,700	5	Rice Breeding, Kashmir	2,695 3 3	(-) 4 12 9	"
(iv) For Seed Potato Scheme	17,000 0 0	5,000	10,100	6	Rice Breeding, Travancore	10,158 10 2	(-) 58 10 2	"
(v) For Cereal Rust Scheme	12,500 0 0	22,800	...	7	Seed Multiplication, Orissa . . . . .	...	...
		250	...	8	Seed Multiplication, C. P. . . . .	...	...
		6,370	10,370	9	Nutrition of Rice Plant, Dacca University	10,420 0 0	(-) 50 0 0	"
(vi) For Indian Institute of Fruit Technology	69,790 0 0	...	...			
4. Grant from Indian Leaf Tobacco Co. for Studentships abroad	13,356 8 0	4,150	4,650	10	Rice Disease, Madras	4,650 0 0	...	"

Receipts				Payments				
Head of Account	Receipts during the year	Grants		Serial No.	Head of Account	Expenditure during the year	Excess (—) or Savings (+) over the net grant	Remarks
		Original	Net						3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
	Rs. A. P.	Rs.	Rs.			Rs. A. P.	Rs. A. P.	
5. Grants from the Indian States :	...	2,150	1,300	11	Rice Disease, Sind	1,280 0 0	(+) 40 0 0	Inconsid-
(i) Mysore	10,000 0 0	...	3,700	12	Rice Research, Assam	3,684 11	(+) 15 4 6	erable
(ii) Baroda	5,000 0 0	400	...	13	Inspect Pest of Paddy, Bengal			
(iii) Kashmir	10,000 0 0	7,000	...	14	Water Requirements of Rice Sind			
(iv) Travancore	10,000 0 0	13,900	...	15	Water Requirements of Rice Assam.			
(v) Cochin	5,000 0 0	3,100	3,100	16	Rice Vernalization, Calcutta	3,100 0 0		
(vi) Gwalior	...	...	...	17	Rice Monograph	3 8 0	(—) 3 8 0	"
(vii) Bhopal	5,000 0 0	...	100	18	Rice Research, Bihar	101 0 0	(—) 1 0 0	"
(viii) Patiala	50,000 0 0	1,500	6,300	19	Breeding Rust Resistant Wheat I.A.R.I.	6,350 0 0	(—) 50 0 0	"
		5,430	5,430	20	Wheat Breeding, C. P.	5,737 5 3	(—) 7 5 3	"
6. Interest from Investments :	10,972 8 0	4,000	4,000	21	Cereal Technologist, Punjab	3,746 9 0	(+) 253 7 0	"
(i) 2 3/4% Loan 1948-52	...	...	...			15,550 0 0		
(ii) 3 1/2% Loan 1947-50	19,201 12 0	18,850	15,550	22	Wheat Rust Research, Madras	7,473 0 0	(+) 430 0 0	"
(iii) 3% Loan 1963-65	49,361 4 0	7,900	7,900	23	Wheat Rust Research, Bombay	16,650 0 0	(+) 10 0 0	"
(iv) Fixed Deposit, Defence Bonds etc.	33,257 2 0	3,400	16,660	24	Wheat Rust Research, Agra			
(v) Victory Loan 1959-61	5,273 7 0	...	...			
7. Miscellaneous Receipts :	...	...	1,200					
(i) Receipts realized by the various Provincial Govts. from schemes financed from the funds of the Council	24,453 12 4	4,000	2,000	25	Breeding Rust Resistant Barley, Agra.	1,260 0 0	(—) 60 0 0	"
(ii) Receipts from unspent balances of grants made by the Council	13,476 9 8	3,940	3,940	26	Maiz Breeding, Punjab	1,970 0 0	(+) 30 0 0	"
				27	Pulse Breeding, Madras	4,096 11 0	(—) 156 11 0	"

(iii) Miscellaneous (General)	31,449 9 11	3,460	3,460	28	Pulse Breeding, Bombay	3,400 0 0	(+)	80 0 0	"
(iv) Miscellaneous (Tobacco)	2,349 15 6	2,900	400	29	Pulse Breeding, Bengal	350 0 0	(+)	50 0 0	"
8. Marketing Receipts :		5,700	6,200	30	Pulse Breeding, U P.	6,250 0 0	(-)	50 0 0	"
(a) Grant from the Central Govt. for the Provincial Marketing Schemes	60,000 0 0	4,500	3,700	31	Pulse Breeding, Bihar	3,650 0 0	(-)	50 0 0	"
		3,170	3,170	32	Pulse Breeding, C.P.	3,500, 0 0	(-)	330 0 0	"
(v) Miscellaneous Receipts	3 5 0	2,380	2,380	33	Pulse Breeding, N.W.F.P.	2,350 0 0	(+)	30 0 0	"
9. Sugar Receipts :		3,300	3,300	34	Pulse Breeding, Orissa	3,270 0 0	(+)	30 0 0	"
(i) Receipts from unspent Balances of grants	195 14 0	1,650	2,450	35	Pulse Breeding, Sind	2,452 12 9	(-)	2 12 9	"
(ii) Receipts realized from schemes	(-)-7,762 12 0	4,500	..	36	Pulse Breeding, Hyderabad	..	..	..	"
10. Debts and Remittances		2,300	..	37	Pulse Breeding, Mysore	..	..	..	"
(t) Loans and Advances	294 0 0	..	..	38	Pulse and Millet Breeding, Batoda	..	..	..	"
(ii) Deposits and Advances repayable	1,087 3 0	3,640	..	39	Small Millet, Bombay	1,000 0 0	..	..	"
(iii) Recoveries from Research Staff on account of Income-tax Provident Fund, etc.	..	1,000	1,000	40	Small Millet, C.P.	1,300 0 0	..	..	"
	11,149 2 0	1,300	1,300	41	Small Millet, U P.	1,895 0 0	(-)	95 0 0	"
Total Receipts	46,94,405 1 9	1,800	1,800	42	Small Millet, Mysore	..	(+)	700 0 0	"
		700	700	43	Gram Wilt Research, Punjab	7,000 0 0	(+)	250 0 0	"
Receipts of the I C.A.R. Reserve Fund	2,02,320 3 10	7,250	7,250	44	Insect Pest of Gram, C.P.	3,600 0 0	..	..	"
Repayment of Investments and Reinvestments	3,00,000 0 0	3,600	3,600	45	Striga Attack on Jowar, Bombay	3,302 1 0	(-)	252 1 0	"
Grand Total	51,96,725 5 7	3,050	3,050	46	Jowar Storage, I.A.R.I.	4,349 3 6	(-)	49 3 6	"
		300	4,300	47	Soyabans, Punjab	3,627 8 0	(-)	657 8 0	"
		2,970	2,970	48	Pulse Breeding, Gwalior	1,700 0 0	..	..	"
		2,300	1,700	49	Insect Pest of Stored Pulses, I.A.R.I.	4,660 0 0	(+)	40 0 0	"
		5,600	4,700	50	Caster Breeding, Hyderabad	8,322 4 4	(-)	4,122 4 4	"
		4,700	4,200	51	Groundnut Breeding, Madras	1,824 10 3	(+)	3,025 5 9	"
		4,350	4,350	52	Rape and Mustard Breeding, Punjab	1,965 10 3	(+)	794 5 9	"
		360	2,760	53	Linseed Breeding, C.P.	..	(+)	60 0 0	"
		860	60	54	Coconut, Madras	3,823 11 1	(-)	23 11 1	"
		3,500	3,800	55	Coconut Root Disease Travancore	5,130 0 0	(+)	70 0 0	"
		7,200	5,200						

Receipts			Payments							
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7			Excess(—) or Savings(+) over net grant 8	Remarks 9
		Original 3	Net 4			Rs. A. P.	Rs. A. P.			
		Rs.	Rs.			Rs.	A. P.	Rs.	A. P.	
		2,250	2,550	56	Pests and Disease of Ground-nuts, Madras	2,630	0 0	(—)	80 0 0	Incon- siderable
		1,110	6,410	57	Pests and Disease of Tli, U.P.	6,400	0 0	(+)	10 0 0	"
		1,960	6,260	58	Pests and Disease of Brassicae, Punjab	6,300	0 0	(—)	40 0 0	"
		1,310	4,410	59	Pests and Disease of Linseed, C. P.	4,450	0 0	(—)	40 0 0	"
		2,990	.	60	Pests and Disease of Castor, Hyderabad.	.		..		
		15,850	..	61	Storage of Groundnut, Madras			..		
		6,000	..	62	Multiplication of Improved Linseed, Bengal			..		
		6,280	6,080	63	Multiplication of Improved Linseed, U.P.	6,160	0 0	(—)	80 0 0	"
		6,000	..	64	Manurial Experiments with Groundnut Cake, Hyderabad			..		
		900	900	65	Multiplication of Improved Strains of Groundnuts, Madras	880	0 0	(+)	20 0 0	"
		1,800	..	66	Brassicae and Sesamum Breeding, Calcutta			..		
		3,400	..	67	Groundnut Breeding, Mysore			..		
		2,860	1,660	68	Pests of Safflowers, Bombay	1,680	0 0	(—)	20 0 0	"
		1,550	1,050	69	Multiplication of Improved Linseed, Bombay	970	0 0	(+)	80 0 0	"
		3,000	..	70	Storage of Groundnut, Bombay			..		
		3,000	..	71	Linseed Research, Bengal	4	0 0	(—)	4 0 0	"

3,000	...	72	Rust of Linseed, Agra	1,000	0	0	(-)	1,000	0	0	"	
16,18,000	1,65,000	73	All India Research on Tobacco	1,67,460	14	1	(-)	2,450	14	1	"	
8,500	400	74	Virginia Tobacco Seed, Madras	436	14	0	(-)	36	14	0	"	
12,000	24,000	75	Sub-Station Guntur I.A.R.I.	24,300	0	0	(-)	300	0	0	"	
1,270	270	76	Training of Tobacco, Curers	(-)	491	10	6	(+)	761	10	6	"
790	7,190	77	Horticulture, Madras	7,272	0	0	(-)	82	0	0	"	
15,840	18,740	78	Horticulture, U.P.	18,800	0	0	(-)	60	0	0	"	
32,520	2,920	79	Horticulture, Punjab	2,847	13	0	(-)	72	3	0	"	
1,290	4,390	80	Horticulture, Bihar	4,400	0	0	(-)	10	0	0	"	
9,350	10,350	81	Horticulture, C.P.	10,400	0	0	(-)	50	0	0	"	
1,000	2,600	82	Horticulture N.W.F.P.	2,675	0	0	(-)	75	0	0	"	
6,970	15,970	83	Horticulture, Assam	15,995	4	3	(-)	25	4	3	"	
1,070	5,570	84	Horticulture, Orissa	5,600	0	0	(-)	30	0	0	"	
11,000	...	85	Horticulture, Hyderabad	...	...	...	...	...	...	...	"
38,000	36,000	86	Horticulture, Mysore	35,715	0	0	(+)	285	0	0	"	
5,700	2,900	87	Horticulture, Kashmir	2,850	0	0	(+)	50	0	0	"	
7,430	5,730	88	Orange cultivation, Coorg	5,668	0	0	(+)	62	0	0	"	
2,500	12,000	89	Mango Necrosis, Lucknow	12,016	11	6	(-)	16	11	6	"	
9,250	6,350	90	San Jose Scale Survey, Kashmir	6,390	0	0	(-)	40	0	0	"	
7,000	...	91	Fruit Preservation, Baluchistan	(-)	5,735	10	3	(-)	5,735	10	3	"
2,000	200	92	Testing of canned Fruits and Vegetables, Punjab	6,482	3	0	(-)	6,282	3	0	"	
6,000	7,500	93	Cytogenetics of Mango and Bananas, Calcutta	1,450	0	0	(+)	6,050	0	0	"	
3,200	2,000	94	Citrus Die-back disease, Bombay	1,950	0	0	(+)	50	0	0	"	
3,030	2,730	95	Citrus Die-back disease, C.P.	2,650	0	0	(+)	80	0	0	"	
490	490	96	Citrus Grading, Madras	600	0	0	(-)	110	0	0	"	
500	400	97	Yield data from Fruit Orchards, Punjab	330	0	0	(+)	70	0	0	"	
300	200	98	Yield data from Fruit Orchards, N.W.F.P.	190	0	0	(+)	10	0	0	"	
300	300	99	Yield data from Fruit Orchards, C.P.	230	0	0	(+)	70	0	0	"	
550	...	100	Yield data from Fruit Orchards, Kashmir	...	...	...	...	...	...	...	"
4,200	5,500	101	Citrus Manurial Trials, Punjab	5,570	0	0	(-)	70	0	0	"	
2,500	...	102	Survey of Horticultural Research I.C.A.R.	...	...	...	...	...	...	...	"
900	900	103	Citrus Physiology, Bihar	990	0	0	(-)	90	0	0	"	
...	...	104	Fumigation of Imported fruits, I.A.R.I.	1,570	0	0	(-)	1,570	0	0	"	

Receipts		Payments						
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess(—) or Savings(+) over net grant 8	Remarks 9
		Original 3	Net 4					
		Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		65,800	65,800	105	Indian Institute of Fruit Technology	68,913 15 9	(—) 3,113 15 9	Inconsiderable
		21,540	37,340	106	Potato Breeding, I.A.R.I. (Intermediate Hill Station for Potatoes)	37,586 0 0	(—) 246 0 0	"
		33,400	10,900	107	Potato to Seed certification Survey, I.A.R.I.	21,870 0 0	(—) 1,970 0 0	"
		4,400	5,300	108	Diseases of stored Potatoes, Bihar	5,380 0 0	(—) 80 0 0	"
		1,550	1,550	109	Vegetable Seed Production, Kashmir.	1,522 1 7	(+) 27 14 5	"
		27,800	66,600	110	Multiplication of Seed Potatoes, Karnal	63,320 6 0	(+) 3,279 10 0	"
		5,640	..	111	Utilization of Lunseed Fibre, Bihar	..	..	"
		11,820	520	112	Ditto C.P.	4 8 0	(—) 4 8 0	"
		113	Medicinal Plants (Col. Chopra), Kashmir	450 0 0	(+) 70 0 0	"
		1,000	100	114	Dry Plant Cultivation	202 3 0	(—) 102 3 0	"
		500	..	115	Fan Cultivation, C.P.	..	..	"
		3,400	4,100	116	Turmeric, Orissa	4,150 0 0	(—) 50 0 0	"
		550	100	117	Pyrethrum Cultivation, Punjab	100 0 0	..	"
		8,480	8,460	118	Cardamum, Madras	8,475 0 0	(—) 15 0 0	"
		1,300	1,300	119	Cloves, Travancore	1,270 0 0	(+) 30 0 0	"
		1,600	..	120	Ditto Orissa	..	..	"
		2,400	..	121	Coriander Disease, Gwalior	..	..	"

12

4,640	4,640	122	Water requirements of crops, Punjab	4,675	0	0	(-)	35	0	0	"
500	14,000	123	Sevage Farming, Bangalore	14,052	8	11	(-)	52	8	11	"
2,900	2,900	124	Control of Erosion, Viswa Bharti	3,500	0	0	(-)	600	0	0	"
6,700	6,700	125	Trace Elements in Indian Soils	6,200	0	0	(+)	500	0	0	"
4,900	5,800	126	Crop Production by Catalysts, Bangalore	5,834	14	0	(-)	34	14	0	"
			Composting of town Refuse into Manure								
		127	Madras								
		128	Bombay								
		129	Bengal								
		130	U. P.								
68,800	40,880	131	Punjab	34,220	15	3	(+)	6,659	0	9	"
		132	Bihar								
		133	C. P.								
		134	Sind								
		135	Orissa								
		136	Hyderabad								
		137	Mysore								
		138	Baroda								
		139	Travancore								
		140	Headquarters								
1,090	590	141	Coastal Soil, Calcutta	524	0	0	(+)	68	0	0	"
14,390	15,890	142	Colloid Soil Constituents, Calcutta	16,130	0	0	(-)	240	0	0	"
3,010	19,710	143	All India Soil Survey	19,750	0	0	(-)	40	0	0	"
8,590	..	144	Dry Farming Hyderabad	..							"
3,160	3,160	145	Dry Farming (developmental) Madras	3,154	6	5	(+)	5	9	11	"
9,500	..	146	Do. Hyderabad	..							"
1,890	690	147	Monograph on Mixed Cropping Practices	697	12	0	(-)	7	12	0	"
41,800	..	148	Green Manuring, Survey, I.C.A.R.	..							"
10,000	8,200	149	Crop weather coordination, Poona	8,140	0	0	(+)	60	0	0	"
3,900	..	150	Water saving Experiments, Sind	..							"
7,800	7,800	151	Designing of Agronomic Experiments, I.C.A.R.	11,359	3	0	(-)	3,659	3	0	"
12,100	18,100	152	Plant Physiology, Boahi Sen	18,100	0	0	..				"

Receipts				Payments					
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess (—) or Savings (+) over net grant 8		Remarks 9
		Original 3	Net 4				Rs.	A. P.	
		Rs.	Rs.			Rs. A. P.	Rs.	A. P.	
		...	1,400	153	Physiology of cane and wheat, Benares Hindu University	1,440 0 0	(—)40 0 0		Inconsp. derable
		2,620	2,620	154	Insect Pest of Stored Cereal grains, Punjab	2,620 0 0	..		"
		610	16,310	155	Survey of Icerya Purchasi, I.A.R.I.	16,350 0 0	(—)40 0 0		"
		1,430	630	156	Monograph on Locust Research, I. C. A. R.	520 8 0	(+)109 8 0		"
		1,500	1,500	157	Preservation of Grain in Storage, Bombay	1,500 0 0	.		"
		3,800	1,600	158	Breeding of Rodolia Cordinalis, Madras	1,600 0 0	..		"
		15,440	15,440	159	Virus Diseases, Bombay	16,400 0 0	(—)960 0 0		"
		100	100	160	Development of type culture Fungi, I.A.R.I.	160 0 0	(—)60 0 0		"
		22,800	8,000	161	Schools of Research in Mycology	8,773 2 0	(—)773 2 0		"
		39,030	39,030	162	Expansion at the I.A.R.I.	39,300 0 0	(—)270 0 0		"
			...	163	Kans Eradication, Bhopal . . .	2 13 0	(—)2 13 0		"
		4,750	...	164	Live stock Investigation, Punjab	.			
		680	...	165	Herdbook and Pedigree Registra- tion of Cattle, Haryana Breed, Punjab	.			
		10,600	35,300	166	Artificial insemination in I.V.R.I.	31,365 0 0	(+)3,935 0 0		"
		4,900	5,700	167	Improvement of Kangayam Breed, Madras	5,710 0 0	(—)10 0 0		"

20,000	...	168	Characteristics of Dry Breed	...	...	
5,420	.	169	Herdbook Registration and Milk Recording of Sahwal Breed, Punjab	...	...	
80	3,480	170	Method of Yoking Bullocks, Allahabad	3,534	2 9	(-)	54	2 9
1,850	2,250	171	Kankrej Breed Society, Bombay	2,250	0 0			
4,150	1,050	172	Improvement of Cattle in South Kanara, Madras	1,000	0 0	(+)	50	0 0
2,130	.	173	Monograph on maintenance of Farm animals in Health I. C. A. R.	.	.			
4,700	.	174	Manual on Preparation of Animals for Indian Markets	.	.			
2,500	.	175	Manual on Breeding of Farm Animals in India	.	.			
3,650	2,550	176	Goat, Breeding, Bengal	2,530	0 0	(+)	20	0 0
4,400	6,400	177	Do Dr. Sator	6,385	7 3	(+)	14	8 9
2,750	.	178	Do Punjab	...	..	
1,400	1,400	179	Angora Goat Breeding, Punjab	1,199	10 0	(+)	200	6 0
3,150	3,850	180	Sheep Breeding, Madras	3,886	0 0	(-)	36	0 0
7,200	8,300	181	(1) Sheep Breeding Bombay	8,392	12 0	(-)	92	12 0
1,400	1,400		(2) Purchase of Extra Deccan Plateau Sheep	1,500	0 0	(-)	100	0 0
1,570	1,970	..	(3) Development of Scientific Research Work in Sheep Breeding	2,060	6 0	(-)	90	6 0
5,580	..	182	Sheep Breeding, Punjab	..	..	
3,500	3,800	183	Do Bihar	3,850	0 0	(-)	50	0 0
4,720	5,720	184	Breeding of Lands with Karakul Pelts, N. W. F. P.	5,757	3 0	(-)	37	3 0
5,200	11,000	185	Sheep Breeding, Baluchistan	11,075	10 3	(-)	75	10 3
1,100	..	186	Do Mysore	..	..	
4,570	..	187	Do Kashmir	..	..	
1,200	..	188	Improved Farm Breed, Bikaner Sheep, Punjab	..	..	
7,950	2,750	189	Sheep Breeding, Orissa	2,700	0 0	(+)	50	0 0
3,880	4,980	190	Do Bengal	5,000	0 0	(-)	20	0 0
13,350	1,450	191	Feeding of Cattle on Departmental Farms, U. P.	1,350	0 0	(+)	100	0 0
1,800	2,200	192	Nutritional requirements of milch Cows, Punjab	2,200	0 0			

Receipts		Payments						
Head of Account	Receipts during the year	Grants		Serial No.	Head of Account	Expenditure during the year	Excess (-) or Savings (+) over net grant	Remarks
		Original	Net						3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
		Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		12,000	12,000	193	Feeding trials with working bullocks, Punjab	11,277 0 9	(+)772 15 3	Incon-
		500	500	194	Feeding value of indigenous fodder, Bihar	175 0 0	(+)324 0 0	derable.
		26,000	42,300	195	Animal Nutrition, Assam	42,375 0 0	(-)75 0 0	"
		3,350	1,350	196	Drying of Grass, Bombay	1,252 0 0	(-)98 0 0	"
		2,250	2,250	197	Feeding of Alkali Treated Cereal straw, I. V. R. I.	2,550 0 0	(-)300 0 0	"
		400	400	198	Feeding of oil cakes to milch cattle, Baroda	3,504 1 2	(+)3,904 1 2	"
		13,000	9,000	199	Nutrition value of leafy fodder, I. V. R. I.	8,600 0 0	(+)400 0 0	"
		12,000		200	Improvement of Gir Board Baroda	..	...	"
					Veterinary Investigation Officer			
		8,100	8,100	201	Madras	8,099 0 0	(+)1 0 0	"
		5,100	5,100	202	Bombay	4,870 0 0	(+)230 0 0	"
		5,300	4,100	203	Bengal.	4,030 0 0	(+)70 0 0	"
		6,450	5,350	204	U. P.	5,300 0 0	(+)50 0 0	"
		4,250	..	205	Punjab	...	...	"
		5,250	650	206	Bihar	630 0 0	(+)20 0 0	"
		3,250	1,650	207	C. P.	1,650 0 0	...	"

5,250	..	208	Assam . . . . .	..	..			
4,900	4,900	209	Orissa	4,887	12	0	(+)	12	4	0
4,950	4,950	210	N.W.F.P.	4,600	0	0	(+)	350	0	0
6,100	..	211	Sind . . . . .	..	..	..	..	..	..	..
5,200	4,100	212	Hyderabad	4,024	0	0	(+)	76	0	0
4,400	3,900	213	Ajmer Merwara	3,800	0	0	(+)	100	0	0
4,500	..	214	Kashmir . . . . .	..	..	..	..	..	..	..
2,530	..	215	Johne's disease among cattle, Mysore	..	..	..	..	..	..	..
40,200	35,300	216	Tuberculosis and Johne's diseases among cattle I. V. R. I.	35,250	0	0	(+)	50	0	0
500	3,800	217	Etiology of sheep disease, Bihar.	3,800	0	0	..	..	..	..
15,000	16,900	218	Control of Varble fly pest	16,850	0	0	(+)	50	0	0
8,100	11,100	219	Life History of Helminth parasites I. V. R. I.	15,463	4	0	(-)	4,363	4	0
16,400	11,800	220	Vaccination against foot and mouth diseases	11,700	0	0	(+)	100	0	0
10,200	11,200	221	Damage caused by Ticks and Varble flies	11,200	0	0	..	..	..	..
1,000	1,000	222	Control of Ticks, Bombay	19	0	0	(+)	981	0	0
12,200	11,500	223	Indigenous drugs of India	11,530	0	0	(-)	30	0	0
3,250	2,750	224	Helminthiasis of cattle, Madras	2,012	0	0	(+)	738	0	0
10,400	10,400	225	Helminthiasis, U. P.	10,400	0	0	..	..	..	..
15,200	7,300	226	Diseases caused by anaerobes, I. V. R. I.	7,300	0	0	..	..	..	..
6,900	..	227	Control of liver fluke and lung-worm, Punjab	..	..	..	..	..	..	..
2,300	1,500	228	Etiology of sheep disease, Madras	1,420	0	0	(+)	80	0	0
1,000	..	229	Monograph, on Veterinary Entomology, I. C. A. R.	..	..	..	..	..	..	..
1,500	1,500	230	Preparation of Rinderpest Vaccine, U. P.	1,550	0	0	(-)	50	0	0
54,900	..	231	Tuberculin testing, I. V. R. I. . . . .	..	..	..	..	..	..	..
3,250	2,400	232	Veterinary Investigation Officer (Sheep and Goats), Bombay	2,400	0	0	..	..	..	..
2,750	..	233	Do. Punjab . . . . .	..	..	..	..	..	..	..

Receipts		Payments						
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess (-) or Savings (+) over net grant 8	Remarks 9
		Original 3	Net 4					
		Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		2,400	2,400	234	Veterinary Investigation Officer (Sheep and Goat), Bihar	2,400 0 0	..	Inconsid- erable
		2,350	..	235	Do. N W F.P.	..	..
		2,630	830	236	Do. Orissa	850 0 0	(-) 20 0 0	"
		2,600	3,100	237	Do. Baroda	3,100 0 0	..	"
		2,600	..	238	Do. Kashmir	..	..
		2,750	2,150	239	Do. Mysore	2,150 0 0	..	
		700	200	240	Milk Recording Societies, U. P.	120 0 0	(+) 80 0 0	"
		2,050	1,850	241	Do. Sind	1,850 0 0	..	"
		660	660	242	Do. Travancore	640 0 0	(+) 20 0 0	"
		5,480	4,280	243	Do. Ajmer Merwara	..	4,280 0 0	"
		1,860	..	244	Salvage of dry city cows	..	..
		6,220	6,220	245	Manufacture of Glue, Banagalore	6,220 0 0	..	"
		1,000	..	246	Manual on Dairying in India, Allahabad	(-) 2840 2 9	(-) 284 2 9	"
		..	4,400	247	Development of Glue Industry, C. P.	4,450 0 0	(-) 50 0 0	"
		5,400	5,400	248	Milk Transport from village to town, U. P.	5,200 0 0	(+) 200 0 0	"
		1,400	1,000	249	Risazuria test of milk, I. A. R. I.	907 0 0	(+) 93 0 0	"
		5,800	6,300	250	Nutritive Value of vanaspathi, I. V. R. I.	5,800 0 0	(+) 500 0 0	"
		8,600	8,600	251	Nutritive qualities of Vegetable oil, I. D. R. I.	8,600 0 0	..	"

200	600	252	Structure of Glycerides in Glue, I. D. R. I.	680	9	(-)	80	3	0	
10,000	..	253	Nutritive value of milk, I. D. R. I.	..	..	..	..	..	..
16,370	10,770	254	Biochemical Research on Dahi, I. D. R. I.	10,800	0	0	(-)	30	0	0
-	..	255	Six combined schemes, I. D. R. I. :-							
			(i) Colouring of Vanaspati							
			(ii) Manufacture and grad- ing of yellow Ghee							
			(iii) Prevention of high aci- dity in Ghee							
31,300	26,900	..	(iv) Milk transport from village to towns	26,900	0	0				
			(v) Preparation of Vegeta- ble rennet							
			(vi) Substitute for steel milk containers							
1,430	..	256	Improvement of Milk by Scienti- fic Feeding Punjab	..	..	..	..	..	..
8,400	6,000	257	Methods of making Casein, I. D. R. I.	5,920	0	0	(+)	80	0	0
..	..	258	Ghee Adulteration, I. I. Sc., Bangalore	9	6	0	(-)	9	6	0
2,700	900	259	Poultry Husbandry, Bombay	840	10	0	(+)	59	6	0
4,200	5,600	260	Poultry Breeding (Village Ex- tension), I. V. R. I.	5,605	0	0	(-)	5	0	0
2,400	700	261	Disease of Poultry, Madras	680	0	0	(+)	20	0	0
2,500	2,500	262	Do. Bombay	2,420	0	0	(+)	80	0	0
1,800	2,100	263	Do. Bengal	2,120	0	0	(-)	20	0	0
2,700	2,700	264	Do. United Provinces	2,400	0	0	(+)	300	0	0
2,100	..	265	Do. Punjab	..	..	..	..	..	..
1,700	1,700	266	Do. Central Provinces	1,750	0	0	(-)	50	0	0
2,250	2,250	267	Do. Bihar	2,150	0	0	(+)	100	0	0
2,200	..	268	Do. Assam	..	..	..	..	..	..
2,050	2,050	269	Do. North West Frontier Province	2,200	0	0	(-)	150	0	0

Receipts				Payments				
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess (-) or Savings (+) over net grant 8	Remarks 9
		Original 3	Net 4					
		Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		2,100	2,100	270	Diseases of Poultry, Hyderabad .	1,775 0 0	(+) 325 0 0	Incon-
		7,000	500	271	Do. Mysore .	480 0 0	(+) 20 0 0	derable
		2,100		272	Do. Baroda .		..	
			700	273	Do. Sind .	700 0 0	..	
		6,750	5,450	274	Cattle and Poultry Luce, Aligarh.	5,450 0 0	..	
		800	400	275	Deshi Fowls, Baroda .	410 0 0	(-) 10 0 0	..
		2,250	2,250	276	Poultry Diseases, Orissa	2,380 0 0	(-) 130 0 0	..
		5,200	2,700	277	Poultry Research, Central Provinces.	2,700 0 0	..	
		500	500	278	Indian Poultry Gazette, I. V. R. I.	500 0 0	..	
			8,600	279	Poultry Diseases, I. V. R. I. .	8,659 0 0	(-) 59 0 0	..
		4,580	5,380	280	Fresh Water Fishes, Calcutta .	5,380 0 0	..	
		10,400	11,000	281	Rural Pisciculture, Madras .	11,000 0 0	..	
		990		282	Fish Preservation, Baroda .	..	..
		800	800	283	Improvement of Preserved fish, Bengal.	800 0 0	..	
		2,840	1,640	284	Fish, Eggs and Larvae, Madras .	1,630 0 0	(+) 10 0 0	..
		1,300	1,300	285	Fish, Eggs and Larvae, Bombay .	1,300 0 0	..	
		7,000	7,000	286	Semi dried Prawn, Madras .	6,650 0 0	(+) 350 0 0	..
		3,300	3,300	287	Fish Preservation, Orissa .	3,000 0 0	(+) 300 0 0	..
		8,000	10,300	288	Wool Analysis, Bombay University	10,480 0 0	(-) 180 0 0	..

2,300	2,300	289	Laboratory for Wool Analysis, Bombay	2,200	0	0	(+)	100	0	0	..
1,500	..	290	Laboratory for Wool Analysis, Punjab								
800	400	291	Village Shearing and Grading Centres, N.W.F.P.	360	0	0	(+)	40	0	0	..
3,600	...	292	Laboratory for Wool Analysis, Baroda								
2,200	2,200	293	Washing and Grading of—Wool, Ajmer-Merwara	2,200	0	0					
7,400	4,200	294	Village Flaying Centres, N.-W. F. P.	4,180	0	0	(+)	20	0	0	..
4,650	8,350	295	Village Flaying Centres, Bombay	2,340	0	0	(+)	10	0	0	
3,750	3,750	296	Defects Caused by Minor Biological Factors, I.V.R.I.	3,170	0	0	(+)	580	0	0	..
6,700	5,800	297	Bee Keeping, Punjab	5,760	0	0	(+)	40	0	0	..
2,500	..	298	Monograph on Statistical Methods in Animal Husbandry, I.C.A.R.								
..	..	299	Inheritance of Quantitative Characteristics and Laying Qualities of Eggs, I. C. A. R.	96	10	0	(-)	96	10	0	..
...	11,500	300	Animal Husbandry Bureau, I. C. A. R.	8,899	10	6	(+)	2,600	5	6	..
2,550	2,250	301	Village Project, Bombay	2,250	0	0					
3,500	4,400	302	Village Project, United Provinces	4,471	14	6	(-)	71	14	6	..
3,600	4,600	303	Village Project, Central Provinces	4,600	0	0					
850	850	304	Village Project, Travancore	540	0	0	(+)	310	0	0	..
2,130	3,330	305	Mixed Farming, United Provinces	3,400	0	0	(-)	79	0	0	..
1,970	1,970	306	Mixed Farming, Central Provinces	1,969	15	9	(+)	0	0	3	..
3,330	3,330	307	Mixed Farming, N.-W. F. P.	3,550	0	0	(-)	220	0	0	..
250	...	308	Mixed Farming, Sind								
10,600	10,600	309	Desert Farming, Sind	10,778	12	4	(-)	178	12	4	
22,000	12,000	310	Village Project, Baroda	12,000	0	0					
180,240	190,040	311	Crop Cutting Experiments	2,49,350	7	9	(-)	58,810	7	0	..
17,000	5,600	312	Pasture Land Improvement, Baroda	5,600	0	0					

Receipts		Payments						
Head of Account 1	Receipts during the year 2	Grants		Serial No. 5	Head of Account 6	Expenditure during the year 7	Excess (—) or Savings (+) over net grant 8	Remarks 9
		Original 3	Net 4					
		Rs.	Rs.			Rs. A. P.	Rs. A. P.	
		1,370	1,370	313	Cultivation of Kudzu vine, Bombay	1,100 0 0	(+) 270 0 0	Inconsi- derable
		39,960	39,960	314	Statistical Section of the Council	46,962 5 4	(-) 7,002 5 4	"
				315	Imperial Agricultural Bureaux			"
				316	Imperial Institute of Science			"
		59,380	42,180	317	Do. Entomology.	42,054 2 8	(+) 125 13 4	"
				318	Farnham House Laboratory			"
				319	Imperial Bureau of Dairy Science			"
		650	650	320	Fruit Preservation Research Station, Campden	666 10 8	16 10 8	"
		420	...	321	Tobacco Federation of the British Empire	...	...	"
		750	...	322	Indian Society of Soil Science	...	...	"
		500	500	323	Entomological Society of India	500 0 0	...	"
		500	500	324	Indian Bee Keepers' Association	500 0 0	...	"
		500	500	325	Current Science Association	500 0 0	...	"
		500	500	326	Indian Society of Genetics and Plant Breeding	500 0 0	...	"
		7,000	5,000	327	The Council's Library	6,066 8 6	(-) 1,066 8 6	"
		16,000	16,000	328	Editorial Staff for Indian Farming	16,666 10 6	(-) 666 10 6	"
		1,000	700	329	Editorial Committee	122 0 0	(+) 578 0 0	"
		16,000	16,000	330	Audit & Accounts	20,562 9 6	(-) 5,562 9 6	"

9,000	5,400	331	T. A. of non-official members of the Council	4,885	2	0	(+)	514	14	0	"
24,000	26,000	332	T. A. of visitors for attending meetings of the Advisory Board and Committees of the Council	31,011	11	0	(-)	5,011	11	0	"
1,000	1,000	333	T. A. of non-official members of the Board of Agriculture and Animal Husbandry in India	938	14	0	(+)	61	2	0	"
3,600	4,300	334	Miscellaneous	5,836	0	0	(-)	1,536	0	0	"
6,000	6,000	335	Provident Fund Contribution	6,003	0	0	(-)	3	0	0	"
65,500	45,000	336	Provincial Marketing Scheme	42,406	5	0	(+)	2,593	11	0	"
..	123,000	337	Sugar Schemes	121,913	12	0	(+)	1,086	4	0	"
..	500	338	Cold Storage Scheme	528	9	0	(-)	28	9	0	"
500	500	339	Loans and advances	290	0	0	(+)	210	0	0	"
500	500	340	Deposits and advances repayable	354	12	9	(+)	145	3	3	"
7,000	10,400	341	Remittances of Income Tax Provident Fund, etc.	11,802	6	0	(-)	902	6	0	"
Total Expenditure				21,99,751	15	11					
Investments and re-investments.				8,00,000	0	0					
By balance				21,96,973	5	8					
GRAND TOTAL				51,96,725	5	7					

		Rs.	A.	P.
(i) Permanent advance with the Director, I.I.F.T.		500	0	0
(ii) Permanent advance with the Secretary, I.C.A.R.		250	0	0
(iii) Temporary advance for Tobacco Schemes		100	0	0
III. Particulars of securities, etc.—	Total	850	0	0
	Face value	Purchase value		
	Rs	Rs.	A.	P.
1. 3 % Stock 1963-65	16,49,500	15,54,334	0	0
2. 3½ % Stock 1947-50	5,50,000	5,91,495	1	0
3. 2½ % Stock 1948-52	4,00,000	4,02,736	9	0
4. 3 % Stock, Defence Bonds, 1946	25,000	25,117	3	0
5. 10 Post Office 10 year Cash Certificates, dated the 25th September 1935, for Rs. 1,000 face value each	10,000	8,825	0	0
6. 5 Post Office 10 year Defence Saving Certificates, dated 22nd October, 1940	5,000	5,000	0	0
7. 8 Fixed Deposit receipts Nos. A 79872 to A 79879, dated the 4th November 1941 for Rs. 50,000 each repayable at a week's notice	4,00,000	4,00,000	0	0
8. 3 Fixed Deposit receipts Nos. B76314 to B76316, dated the 7th December 1945 for Rs. 1,00,000 each repayable after 12 months	3,00,000	3,00,000	0	0
9. 9 Fixed Deposit receipts Nos. C70582 to C70590, dated the 8th December 1945 for Rs. 1,00,000 each repayable after 12 months	9,00,000	9,00,000	0	0
10. 16 Fixed Deposit receipts Nos. C70596 to 70600 and C03001 to C03007, dated the 11th December 1945, for Rs. 50,000 each repayable at a week's notice	6,00,000	6,00,000	0	0
11. 16 Fixed Deposit receipts Nos. C03014 to C03029, dated the 13th December 1945 for Rs. 50,000 each repayable at a week's notice	8,00,000	8,00,000	0	0
(a) Total Securities	56,39,500			
IV. Particulars of closing balance :—				
1. Cash in hand with the Secretary, I.C.A.R.		7	10	0
2. In Current Account with the Imperial Bank of India, New Delhi and Sumla		21,96,965	11	8
Total		21,96,973	5	8

(Sd.) S. C. SARKAR,
Under Secretary,
Imperial Council of Agricultural Research.

The accounts have been examined and according to the best of my information and in consideration of the explanations given as a result of test audit of the books of the Imperial Council of Agricultural Research the accounts are correct subject to remarks made in my report.

DAYA SHANKAR,
For Examiner,
Outside Audit Deptt.

A sum of Rs. 5 lacs invested into 3% victory loan of 1959-61 has not been included vide para. 8 (b) of the report,

Annual Account of the Receipts and expenditure of the Tobacco Grant given by the Government of India for 1945-46

No.	Particulars	Amount			S. No.	Particulars	Amount		
		Rs.	A.	P.			Rs.	A.	P.
	Opening Balance	1,938,134	10	5	1	Expenditure on Tobacco Adviser and Staff	57,612	13	1
1	Grant from the Government of India	1,000,000	0	0	2	Tobacco Grading Scheme	36,300	0	0
2	Grant from Indian Leaf Tobacco Co.	13,356	8	0	3	Virginia Tobacco Seed Scheme, Madras	436	14	0
3	Sale proceeds of tobacco, Guntur	631	8	10	4	Substation Guntur, I. A. R. I.	24,300	0	0
4	Do.	635	10	3	5	T. A. of members of Tobacco Committee	12,666	7	0
5	Do.	126	12	9	6	Expenditure on training of Tobacco Curers	491	10	6
6	Do.	43	5	0	7	Commission for collection of cheque from Indian Leaf Tobacco Co.	12	9	0
7	Do.	202	13	10	8	Exploratory Station for Cigarette Tobacco	14,265	3	0
8	Do.	150	12	1	9	Tobacco Grading Scheme	4,978	14	0
9	Sale proceeds of articles	30	12	0	10	Central Tobacco station	41,595	0	0
10	Sale of Tobacco seedlings, Guntur	489	6	7		By balance	2,762,145	0	4
11	Sale of Tobacco, etc., Guntur	38	14	2					
	Total	2,953,841	1	11		Total	2,953,841	1	11

(Sd.) S. C. SANKAR,
 Upper Secretary,
 Imperial Council of Agricultural Research.

The accounts have been examined and according to the best of my information and in consideration of the explanations given as a result of audit of the books of the Imperial Council of Agricultural Research the accounts are correct subject to remarks made in my report.

DAYA SHANKAR,
 for Examiner,
 Outside Audit Department.