

## SELECTED ARTICLE

# Agricultural Progress in India During the Decade 1929—1939

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Ever since I undertook to deliver this lecture I have marvelled at my temerity and, indeed, it is impossible to do justice to my subject. Not only is one dealing with the varied agriculture of a sub-continent peopled by 400 million people of several races, but also with several distinct systems of agriculture based on widely differing soil and climatic conditions. Progress has been marked and general, but it has taken many forms. My choice of this period for review was largely governed by the fact that, speaking broadly, it coincides with the decade following the report of the Linlithgow Commission.

The decade under review was a notable one for other reasons, for Indian agriculture, like that of many other countries, had to adapt itself to the conditions arising from the world economic depression. Equally important was the effect on agriculture of industrial progress within India, leading to a demand for increased quantities and better qualities of the natural products which form the raw materials of industry. Above all, the increase in population afforded larger outlets for agricultural products, the demand being intensified by a distinct increase in the general standard of living. Indeed, India almost ceased to be an exporter of wheat and other cereals, despite a considerable expansion of production. To-day, however, I propose to confine myself in the main to a brief account of the steps which were taken to implement the recommendations of the Royal Commission and the results which have been achieved. My task has been lightened by the reports made to the Government of India in 1937 by Sir John Russell, and by Dr. Norman Wright.

**Report of the Royal Commission.** The report of the Royal Commission was more than an authoritative review. It was a clarion call to action for which India was ready. The Commission stated categorically that the application of the scientific method to the problems of Indian agriculture had borne fruit, but that only the fringe of the problem had been touched, and that a great combined effort was needed. Indian Agricultural Ministers had already reached much the same conclusion, and one of the most encouraging features of Indian administration has been the growing support of all political bodies and parties for sound measures designed to improve Indian agriculture.

There has been a striking increase in the staff and funds devoted to agricultural and veterinary problems. The total funds available annually for agricultural and veterinary research and development in India have now passed the £ 2 million mark—a substantial sum, though still less than 1½d. per head of the population. The increase in man-power is as striking, but, owing to changes in the form of annual provincial returns, strictly comparable figures cannot be presented.

**Research Organisations.** The organisation of the Imperial Council of Agricultural Research has been so admirably described by its first Vice-chairman, Sir T. Vijayaraghavacharia, in a paper read before the Society some years ago, and more recently by Sir John Russell, that it is not necessary for me to describe it.

The Royal Commission had stated in considerable detail in what directions further research was required, and the Council at once proceeded to the discussion of tentative projects for research on problems of obvious importance. The Advisory Board considered these in the light of work already in progress in India, and the facilities available for such research in existing institutions, and eventually recommended modified projects, or groups of projects, for grants. In this manner full advantage was taken of the experience of senior research workers and of their land, buildings and equipment, and grants were given, in the main for staff and apparatus.

The Council was fortunate in two important respects. Following the lead of the Nizam's Dominions the larger Indian States decided to contribute to the Council's funds and share in its activities, and in 1939 Hyderabad, Mysore, Baroda, Travancore, Cochin, Bhopal and Kashmir were all represented on it. Many other States co-operated with the Council in particular activities. Secondly, it was found possible to obtain an important measure of assistance from the Science Colleges of the Indian Universities, who undertook special investigations with the aid of grants.

By common consent the Council became responsible for liaison with overseas agricultural research organisations, especially the Imperial Agricultural Bureau. In increasing degree it obtained valuable assistance from British research institutes, not the least important of which was the training of research workers in special methods. It was also able to obtain valuable information, literature and material for Indian investigators and to put them in touch with research workers in other parts of the world.

The funds placed at the disposal of the Council by the Government of India during the nine years ending March, 1939, including the cost of expert staff, secretariat and publications, amounted in all to about a million sterling. The policy of the Council has always been to supplement, and never to supplant, local effort. Thus, in 1939 it was aiding, in greater or lesser degree, nearly a hundred research projects, with grants of varying magnitude, and met the salaries of nearly three hundred research officers and scientific assistants. Of the total funds allocated by the Council in nine years, about £600,000 was devoted to twenty-six major projects.

Special arrangements exist for research on cotton and jute. The Royal Commission on Agriculture commended the work of the Indian Central Cotton Committee, and that body, which derives its funds from the cotton cess, has continued to promote and aid research for the improvement of cotton-growing and to provide for technological research. Its operations have been expanded and developed, the Committee's expenditure in 1938-39 being approximately £72,000, compared with £57,000 ten years earlier.

Usually the Committee provides part only of the expenditure on a project, the Province or State concerned contributing also, usually in increasing degree when grants are renewed. The Committee paid increasing attention to means for translating the results of research into practice, its unique technological research laboratory was expanded and operations to improve the marketing and handling of Indian cotton and to stop malpractices were continued.

The Royal Commission on Agriculture recommended that a Central Jute Committee should also be set up to deal with all problems connected with the growing and marketing of jute, and provided with an annual grant from central revenues of five lakhs of rupees. For various reasons this recommendation was not acted upon until 1936. The Committee first met in February, 1937, and no time has since been lost. Arrangements for agricultural research were made at Dacca. A technological research laboratory for work on the quality of the jute

fibre was built and equipped and opened by H. E. Lord Linlithgow in January, 1939; work in temporary accommodation had been proceeding for some time previously. The co-operation of the Indian Jute Mills Association, which maintains its own research department for the improvement of manufacturing processes, was readily forthcoming, and arrangements were made for the mutual interchange of information and for consultation on research programmes. The difficult question of improving the statistics of jute production was tackled, and the problems of jute marketing were brought under survey.

Brief reference should be made to the loss to Indian agriculture which resulted from the destruction of the Pusa Research Institute by the great Bihar earthquake in 1934. After careful consideration the Government of India decided not to rebuild at Pusa, but to provide a new institute at the capital, and a suitable site was found about three miles from New Delhi. The transfer was completed towards the end of 1936 and a considerable measure of reorganisation effected simultaneously. In its new home the Imperial Agricultural Research Institute has far better contacts with agricultural and other scientific workers, and has immeasurably greater opportunities of co-operating with provincial research organisations than hitherto. This is important, since the first duty of an agricultural experiment station, especially when maintained by the State, is to apply scientific knowledge and methods to definite field problems.

**Local Activities for Agricultural Improvement.** From this brief and necessarily imperfect description of research organisations we may now turn to the agencies for translating the results into agricultural practice and eventually into increased income to the Indian cultivator.

As one indication of the progress made we may note that the number of organised demonstrations carried out in 1937-38 was 113,000, compared with 37,000 ten years earlier. Moreover, such demonstrations have improved in character. To a marked extent "better farming" campaigns embodying a number of improvements have taken the place of piecemeal efforts, and the demonstrations have been backed by a "service" organisation.

Perhaps more important still is the increasing degree in which extra-departmental agencies are assisting in agricultural development. For example, the better conservation of natural manures and improved sanitation are now being dealt with as one job in many villages, which is as it should be. Co-operative societies are doing more, though still not nearly enough, to assist the cultivator to obtain the seeds and implements that he needs, and the increase in the number of better farming and better living societies is most encouraging.

It is dangerous to prophesy, but the time may not be far distant when the "nation building" departments of Government concerned with the improvement of the conditions of village life will make a combined approach to this great task.

**Practical Achievements.** To turn very briefly to some of the results which have been achieved. There is no room for doubt that the average yield per acre of several crops in India has been raised by means which enhance the monetary reward to the grower and provide him with more and better food for his family and his cattle. This is a sweeping statement, but is made deliberately. It can best be tested in the case of cotton, as practically the whole of the crop is baled and used in mills or exported, and the acreage figures are substantially accurate. The Central Cotton Committee's examination of the trade returns showed that the average yield in the quinquennium 1932-37 was 108 lb. per acre as compared with 96 and 95 in the two previous quinquennial periods. The Government forecast for 1938-39, based largely on the standard yields, was over a million bales, or 20 per cent below the actual commercial crop, whereas for the quinquennium

1922-27 it was only 9 per cent short. In 1939 the question of raising the standard yields was under active consideration.

In the case of wheat special crop-cutting experiments and the evidence collected in the course of marketing surveys, indicate that where improved varieties and methods have spread, production per acre has increased substantially. Turning to sugarcane, the estimated production per acre expressed as *gur* (raw sugar) was 1.4 tons in 1937-38, despite the fact that it was a bad season, as compared with 1.1 tons per acre in 1927-28, which was a favourable year. Such examples could be multiplied. It should, of course, be added that the increase in the all-India average yields is partly due to improved irrigation facilities. On the other hand, when one examines local figures, one finds that it is precisely in the irrigated tracts that the increase due to improved methods is greatest. There have also been important improvements in the quality of several crops. I shall mention a few examples later.

Varietal improvement, including the provision of good seed, has been one of the most important activities of the Indian Agricultural Departments since their inception, and is as important as ever. In 1937-38 it was reported that the area under improved varieties had reached 23 million acres, as compared with 10 million in 1936-37.

As the net area cropped annually in British India alone is some 230 million acres, the ascertained area under improved crops is still less than 10 per cent. of the total, but even so it represents an additional annual income to Indian agriculture of the order of £ 20 million.

Agricultural improvement, however, does not stop at the supply of good seed, and the present attitude of the majority of agricultural workers in India to crop improvement can fairly be stated as follows: Varietal improvement is both an important immediate objective and a necessary preliminary to further developments. Of all improved methods, it is the one which the cultivator most easily understands, and can most easily adopt provided that the "service" organisation is good. Moreover, the success achieved has given him confidence and has provided the contacts necessary for other extension work. Usually the improved variety brings an immediate reward for enterprise, even if there is no improvement in methods of cultivation. But the full advantage of an improved variety is rarely, if ever, realised unless its introduction is accompanied by better soil management. Consequently, the Agricultural Departments, in increasing degree, are organising demonstrations which combine the use of an improved variety with improvements in cultivation and manuring—and with increasing success.

**Various crops. Cotton.** To turn to some individual crops, cotton should, perhaps, come first, because, as the result of nearly 20 years' co-operative effort by the Indian Central Cotton Committee and the Provincial and State Agricultural Departments, the character of the Indian cotton crop has been radically altered. The total area under improved varieties in 1938-39 was 5,663,000 acres out of a total of 23½ million, nearly one-quarter of the whole. The change in the quality of the crop is important. In the three years 1927-28 to 1931-32, short staple cottons, i. e., below  $\frac{3}{8}$ ", formed 75 per cent of the whole, and medium staples 25 per cent. In 1938-39 the figures were: short staple 63 per cent, medium staple 32½ per cent, long staple 4½ per cent. Moreover many of the short and medium cottons had been materially improved in spinning value. It is fortunate that a long view was taken, that the importance of quality was never lost sight of, that adequate technological tests preceded the introduction of new cottons into general cultivation, and that marketing organisation accompanied seed distribution schemes. The Indian textile industry provides a constant and

growing market for the longer-stapled cottons which are also assured of a market in Great Britain. On the other hand, the export demand for the shortest Indian cottons has contracted severely, though it will probably never disappear, and the consumption of these by Indian mills, though large, is unlikely to expand much.

*Jute.* In the case of India's other great export, jute, in 1937-38 the area under Departmental varieties was reported to be 1,763,000 acres out of a total of 2,889,000 acres. These varieties were, in the main, chosen for their high yield, but were reported on by the trade to be of satisfactory quality before they were put into general cultivation.

*Oilseeds.* Some valuable fundamental work was done in earlier years, but until recently the amount of agricultural work on this group of crops was disproportionately small in view of their value as cash crops and their importance for Indian industries and export alike. The remarkable expansion of the groundnut crop has continued until India is the world's largest producer and its second exporter, despite the enormous internal consumption. For an "introduced" crop to spread from 300,000 acres in 1900 to nearly 9 million acres in 1937-38 is in itself a striking proof that the Indian cultivator knows a good thing when he sees it. From 1934 to 1938 production averaged 2,800,000 tons, and of this 39 per cent was exported, the remainder being retained in the country, and about 1,200,000 tons, or 43 per cent, used for the production of oil. The reported area under improved varieties is only some 417,000 acres, but these figures relate mainly to recent work and exclude the earlier distribution of seed by the Agricultural Departments. As a result of the action taken by the Research Council, well-planned experimental work is now in progress, including the production of better varieties, improved methods of cultivation and manuring, and better methods of harvesting and handling. The objective is high yield and disease resistance, coupled with a high oil percentage and low fatty acid content. Correctly used in a rotation, the groundnut crop is a valuable aid to the maintenance of soil fertility, especially in some of the important cotton areas. Co-ordinated research schemes are also in operation for the improvement of the linseed, rape, castor and other oil seeds.

*Sugar-cane.* The sugar-cane crop forms a natural link between the commercial crops and the food crops, and is of particular interest, since, speaking broadly, no other crop gives the Indian cultivator so large a cash reward for his labour and that of his family. Sugar-cane production in India has been revolutionised since 1929, and India now has a modern white sugar industry which is capable of supplying all her requirements, and, on the whole, is technically efficient. Of the total area under cane in 1939 approximately 80 per cent was under improved varieties, mainly Coimbatore canes. Very much has been done in recent years to improve the efficiency of the Indian sugar industry, both by factory improvements and in the organisation of the cane supply, though several control problems have yet to be solved, but the more efficient production of cane is still the first requisite. To that end intensive cane improvement schemes, many of them aided by the factories concerned, are in progress in several important areas—notably in the United Provinces—where an effort is being made to secure better cultivation and manuring, combined with the systematic supply of healthy seedling canes of the varieties best suited to the area. In the Bombay Deccan important work has been done on the problems of sugar-cane cultivation in that area, of which alkali formation and a fall in fertility were outstanding. As a result, systems of soil management and cane cultivation have been worked out which are now being put into practice.

*Rice and Wheat.* In 1928 the amount of attention devoted to rice was disproportionately small for a food crop occupying annually some 72 million acres. In

Madras good work was in progress, in Bengal a sound foundation for future work had been laid, but elsewhere there was less to record. The Research Council made a point of remedying this defect at the earliest opportunity by a series of co-ordinated research schemes. In 1937-38 the area under improved varieties had reached 3,759,000 acres, compared with 634,000 in 1927-28. In Madras one-sixth of the total area was growing departmental strains. Work has by no means been limited to plant breeding, and the whole chain of experiment stations is co-operating in cultivation and manurial trials.

Wheat was one of the first crops to occupy the attention of agricultural departments. Progress in the improvement of wheat production has been steady, and the total area under improved varieties only just fell short of the seven-million-acre mark in 1937-38, this being nearly one-fifth of the total area. Progress has been most rapid in the Punjab, where half the total area is under improved kinds, and important progress has been made elsewhere. Both yield and quality have been improved and the gain to the cultivator is substantial. Of later years work on the rust problem has been of outstanding importance, and the work done by Dr. K. C. Mehta has enabled the breeding of resistant varieties to be undertaken with precision. More important still is the knowledge which has been gained of the ways in which the black and brown rusts are disseminated annually and of the foci of infection.

*Tobacco.* Tobacco presents features of special interest. In 1929 the production of cigarette tobacco of the Virginia type in India was in its infancy. Now it is an important established industry employing about 2,500 flue-curing barns. Some 85 per cent of the total requirements of the Indian cigarette factories were provided by Indian grown leaf in 1938, and an important export trade had been developed. The centre of the industry is Guntur, in the Madras Presidency, and the Research Council finances a research sub-station in that district for the study of rotations, fertilisers and other factors influencing yield and quality. A set of co-operative experiments on the production of cigarette tobacco in other provinces from two standard varieties is also in operation. It is of interest to note that the value of the exports of Indian tobacco has risen from about £637,000 to approximately £1½ million during recent years.

Considerable progress has also been made in the development of fruit growing, both in the hills and the plains, and in the cold storage of fruit.

**Plant Protection.** The reduction of the loss of crops caused by insect pests and plant diseases received the attention of the agricultural departments from the outset, but progress since 1929 has been marked, both in the application of knowledge and in investigation. Rarely can much be done by the use of insecticides or fungicides except with plantation, orchard and garden crops, and pest control must be secured by more radical measures, often involving substantial changes in agricultural practice. We have, however, one dramatic example of war on insect predators in the measures taken to deal with the locust invasion which became so important in 1929-30, though actually it had started some three years earlier. To the Research Council fell the task of co-ordinating effort, providing intelligence of the progress of locust invasion, of advising on control measures and of maintaining contact with locust control organisations in other countries. The Council was fortunate in securing the co-operation of the considerable number of Indian States affected both in the provision of information and intelligence and in control measures. The cost of the locust visitation to India, including control measures and the remissions of land revenue in affected areas and loss of crops, ran into crores of rupees, and it was resolved that India should not again be caught unprepared. A survey was made of the permanent and semi-permanent breeding grounds of the desert locust in

India, and the course of this and previous visitations studied. Certain areas on the Mekran coast of Baluchistan were quickly found to be important, and desert laboratories were set up to study the locust in this breeding ground. The conditions which cause the locust populations in these tracts to increase suddenly, thus leading to swarming and migration, are now fairly well understood and control measures have been worked out. A permanent locust warning service has been set up in order that prompt action may be taken if a visitation threatens in future. It is possible that it may soon be tested, in view of recent reports of locust activity in Baluchistan.

One other group of entomological undertakings may be mentioned, viz. the campaign against the pink boll worm of cotton in the United Provinces and the clean-up campaigns against the spotted boll worm in Bombay and the Punjab. The field work followed on successful scientific investigations, and both were financed by the Indian Central Cotton Committee. The effect on both the yield and commercial quality of the cottons of the tracts concerned is now apparent. Similar work is in progress in Hyderabad and Baroda States with satisfactory results. Important work is also in progress on the other insect pests of cotton and those of sugar-cane, rice, fruit trees and tobacco, and promising results have been obtained.

In combating plant diseases, the principal weapon has been the production of resistant varieties and their substitution for susceptible kinds. Much more attention has also been paid in recent years to the effect of cultural methods on the incidence of plant diseases. Much useful work has been done which cannot here be described.

**Livestock.** The fundamental importance of the improvement of Indian livestock to the development of agriculture was emphasised by the Royal Commission who made a number of far-reaching recommendations. In India cattle form almost the sole motive power for cultivation, and a better milk supply is now the first requirement for the better nutrition of the population. If any real and permanent advance is to be made there must be better protection against epidemic disease and other pests, better breeding and better feeding. Much has been done in these directions during the past few years, though the results are only now becoming apparent. The grants made by the Research Council have enabled a number of important investigations on disease control to be undertaken, some at central institutes and some in provinces and states. Disease investigation officers, who act as a reconnaissance and intelligence service for the Imperial Veterinary Research Institute, have been provided in each province and in several Indian States.

The Central and Provincial Governments have expanded their operations in the production and use of protective sera. The great value of the more important breeds of Indian cattle has been recognised, and cattle improvement placed on sounder basis. The improvement of Indian milk production and dairying was the subject of a special enquiry by Dr. Wright (Director of the Hannah Dairy Research Institute), and as a result the Government of India decided to appoint a Director of Dairy Research and to establish a central dairy research institute. In the meantime, some important surveys of milk production were carried out.

The arable area in India has steadily expanded at the expense of grazing grounds, and with an increasing population this process is unlikely to be reversed even if checked. Consequently, a balance can only be maintained if a real increase in the production of fodder crops, the greater use for cattle food of such industrial by-products as the oilcakes and much more thorough measures to conserve and improve the larger grazing areas can be secured.

Though there are exceptions, most parts of India are ill-suited to the production of good grazings. Consequently, on the average holding the production of fodder crops must take the place occupied by temporary leys in England. Fortunately, India is rich in such crops, and it is known that in most provinces and states there has of recent years been a growing response to departmental propaganda. An important feature has been the steady, though gradual, expansion of the cultivation of *Berscem* (Egyptian Clover—*Trifolium Alexandrinum*) in Northern India, especially in the North West Frontier Province and the Punjab.

Grazing and fodder problems are essentially provincial, and often local, and call for the co-operation of several departments. Provincial fodder and grazing committees have been set up in all provinces and several Indian States, and a central committee of the Research Council secures liaison. The Council has made grants to meet part of the cost of some experimental and development work. The Forest Departments have supported these efforts, and in several provinces have undertaken important work themselves. Work on the improvement of grazing by better management and controlled rotations has been started, and several provinces have in progress grazing surveys, which include a study of the grasses.

Careful experiments have shown that by the substitution of mixed farming including milk production, for the mere raising of crops for sale, agriculture in many parts of India could be raised to a higher level. Mixed farming is already the custom in parts of Northern India, but elsewhere there is scope for development and everywhere there is room for improvement. Towards the end of 1938 the Research Council approved proposals for active demonstration work to this end by provincial and State organisations. Such developments have a very marked economic aspect. If cultivators are to expend money and labour on the better feeding of cattle they need a profitable outlet for animal products. The demand for these exists, but market organisation is of primary importance.

To animal breeding only a brief reference is possible here. Provincial and State Governments have substantially improved their organisation for the production and issue of bulls of good breed and for the encouragement of private breeders. The breed characteristics of the more important types have been published by the Research Council and several breed societies established. The All-India Cattle Show first held in January, 1937, was a great success, and has become an annual event which is being continued even in war-time. Breeders have found that the sales which result justify their exhibiting.

The improvement of cattle is necessarily a slow business, but the fruits of quarter of a century's patient work are now being realised. To quote two examples only pure bred *Sabizal* cows have now reached a milk yield of 11,000 lb. in a 10-month lactation period; ten years ago the record was 6,500 lb., and when the Pusa pedigree herd was started it was about 3,500. Secondly, the number of approved breeding bulls at studs throughout India has increased greatly. Complete figures are not available, but in the Punjab the number was 11,302 in 1937-38, compared with 2,890 in 1927-28. What perhaps, is more important is the fact that issues of pedigree sires from Government farms are now largely limited to selected areas where definite arrangements exist for the elimination of scrub sires from the breeding herds. Slowly but surely animal husbandry in India is coming into its own.

**Consolidation of Holdings.** It is no exaggeration to say that, at the present day, there is no greater single obstacle to the introduction of improved methods of cultivation in many parts of India than the fragmentation of holdings. Steady progress has been made in the removal of this disability. In the Punjab, through the medium of co-operative societies established for the purpose,



approximately 919,000 acres had been consolidated by 1938, the addition for the year being 132,000 acres in 255 villages. Ten years earlier the consolidated area was about 165,000 acres. In the Central Provinces a Consolidation of Holdings Act was passed in 1928. By 1938 an area of 894,000 acres had been consolidated, the villagers paying the entire cost. In the United Provinces considerable progress has been made on lines similar to those adopted in the Punjab, but without legislation, and about 100 co-operative consolidation societies were operating in 1938. Of special interest is the alternative method of consolidation of cropping in an intensively cultivated tract where sugar-cane, wheat and rotation crops are grown under tube-well irrigation. In the Baroda State, which commenced consolidation in 1921 and adopted the co-operative method in 1925, steady progress has been made, and 48,000 acres has been consolidated by 1938.

The most satisfactory feature is that consolidation is now popular, and the applications are in excess of the immediate capacity of the staff. In some other provinces and states interest has been aroused, and a start is being made. In various ways also steps are being taken to avoid future fragmentation of holdings, particularly in large canal colonies where the evil does not at present exist.

**Soil Management and Fertilisers.** Although the improvement in soil management is of outstanding importance I shall deal briefly with it, since this paper in the main is a record of progress and much of the work is comparatively recent. In a recent paper by Dr. Burns reference was made to "dry farming", i. e., to improved methods of cultivation in areas of deficient and uncertain rainfall. The Research Council has aided four complementary schemes in Madras, Bombay, Hyderabad State and the Punjab. The object in each case is to introduce a system of agriculture, including methods of conserving moisture, the use of drought-resisting and short-period varieties, suitable tillage methods and manuring and the necessary implements. Physiological studies and soil studies form part of the programme. In Bombay work was commenced in 1923, and by 1934 the "Bombay dry farming method" had proved its value. With an average rainfall of 23.70" the average yield of millet grain over seven years was 1,260 lb. per acre, compared with 741 with indigenous methods of cultivation. The method is now used on some thousands of acres. Work on the crops and scientific soil studies have been intensified since 1934, and some very promising results are now appearing. There are great tracts of precarious rainfall where irrigation is impossible, so that increased production by the better conservation of the scanty rainfall is of primary importance. The soil in relation to irrigation has received more attention of late years, the most notable work being at the Irrigation Department's Research Station, notably in the Punjab. Here methods of alkali prevention and the reclamation of alkali lands have been systematically studied, and a great deal of valuable information on the management of such lands secured. In Sind an alkali survey was carried out in conjunction with the planning of the Lloyd Barrage Canals. In most provinces attention has been given to the problem of waterlogging in canal areas, and both the Agricultural and Irrigation Departments are endeavouring to secure the more economical use of irrigation water.

At the Indore Research Institute which, since 1923, has been financed jointly by the Indian Central Cotton Committee and a number (now 27) of Indian States in Central India and Rajputana, the better management of the Malwa black soils has been the subject of continuous study with special reference to the avoidance of colloidal conditions incompatible with a good tilth during the monsoon period. The Indore method of compost manufacture is now well known. In the various provinces systematic attention is being given to demonstrations of compost making by one method or another according to conditions and the materials available, and to the better conservation and use of cattle manur-

Artificial fertilisers are still used in limited quantities, the consumption of ammonium sulphate being approximately 70,000 tons per annum only, and other "artificial" about 25,000 tons. On the other hand the use of the non-edible oil-cakes as manure, especially for sugar-cane, has expanded considerably, as has green manuring.

At the New Delhi Research Institute genetic studies on soil profiles, the collation of existing soil data and the preparation of a preliminary soil map of India form an important part of the Institute's programme.

**Improvement of Marketing of Agricultural Produce.** The improvement of the marketing of cotton has received the continuous attention of the Indian Central Cotton Committee since 1921, but prior to 1929 little had been done for other crops. The Royal Commission on Agriculture made definite recommendations for provincial action, and the improvement of marketing was included in the functions of the Research Council. The general plan of work was described by Mr. Livingstone, the Marketing Adviser to the Government of India, in a paper read before the Society in 1938.\* Careful marketing surveys formed the basis, and were undertaken for 32 commodities and simultaneously a survey of existing marketing methods and organisation was undertaken. The full reports have now been published on 11 commodities, viz., wheat, linseed, eggs, tobacco, grapes, coffee, rice, potatoes, milk, groundnuts, sugar and fish (preliminary), and most of the other surveys have been completed.

An agricultural marketing and grading Act was passed in 1937, which enabled statutory rules to be made for the grading and marking of the commodities scheduled. For those crops which are normally dealt in at wholesale markets, e. g., wheat and oilseeds, attention was first devoted to the standardisation and improvement of the wholesale contracts and better definitions of quality, putting as far as possible a definite premium on the sale of high quality produce. For commodities which go more directly to the consumer "national mark" schemes for graded produce were adopted. Constant consultation with traders of all classes was necessary, and a large measure of agreement was reached on rules and standards before they were introduced. Experimental grading and packing stations were set up and it was speedily found that consumers were willing to pay satisfactory prices for marked and graded produce. Ghee (melted butter fat) affords an excellent example of the success achieved. There is always a keen demand in India for pure ghee: and by the end of 1939 there were 17 licensed packers running 84 grading and packing centres and in all 6,707,000 lb. of graded ghee were sold and fetched some £ 322,000. A central control laboratory, with branches, was set up and the purity of each packing checked by analysis. Six Indian States set up their own laboratories and graded under the "Agmark" Scheme.

"Agmark" schemes were developed for a number of other commodities, and grading and packing stations set up to deal with hides, eggs, fruit, potatoes and special rices. In 1939 there were 150 grading stations which dealt with £ 450,000 worth of produce. It is of interest to note that in 1940 there were 363 authorised packers operating over 400 centres, and produce to the value of £ 767,000 was graded and marked. A particularly interesting development in 1939 was the extension of the Marketing Act to cotton of specified varieties at the request of the Indian Central Cotton Committee, to enable a scheme of "marking" improved cottons of known purity to be introduced. In the first year cotton worth £ 127,000 was sold under this scheme, and growers received an average premium of 5 per cent over the current market quotation for the same type of cotton not so certified.

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\* *Journal of the Royal Society of Arts*, Vol. 86, p. 1029.

The Royal Commission drew attention to the pressing need for the better control of the primary markets which serve the growers and for the regulation of the charges made in them, and the surveys provided the necessary detailed information. The control of such markets is purely a provincial question, and in 1939 the Punjab, North-West Frontier Province and Mysore State passed Acts for the regulation of markets on the lines of an agreed model; Madras, the Central Provinces, Hyderabad and Baroda were engaged on the revision of their existing Acts, whilst Bills had been introduced in Bengal, Sind and the United Provinces.

In March, 1939, the Central Legislature passed a new Act for the standardisation of weights in India, and during the year provincial legislation was under preparation applying these standards locally—a reform long overdue. Time does not permit a description of the arrangements made for the dissemination of market intelligence and information about prices, but the above brief account will show that a considerable advance has been made towards the solution of the problem of ensuring to the producer a fairer share of what the consumer pays and of securing better prices for high quality produce.

On this note I may appropriately conclude this imperfect review of the progress of Indian agriculture during ten years of great activity, for the whole object of all these efforts is to enable the Indian cultivator to obtain a better reward for his labours, either in cash or in kind, and to enable him to achieve a high standard of living. Much of interest and importance has necessarily been omitted, but there is no room for doubt that the application of scientific methods to the study of his problems has aided the Indian peasant. More important still is the fact that millions of cultivators now trust their agricultural and veterinary departments and know that they can be helped. (*Journal Royal Soc. Arts*, Vol. 90, No. 4607, February 20th, 1942.)

## Gleanings.

**Grow More Food—Government's Assurance to Cultivators.** In connection with the food production drive inaugurated by the Government of India, the question has been raised whether the position of the cultivator will not be seriously affected if a nationwide effort towards increased food production leads to such an augmentation of output as to affect the saleability of the crops. It has been suggested that in the event of a sudden termination of hostilities, the demand for food-stuffs may fall off, leading to a deterioration in prices.

The Government of India regard the possibility of any such developments as remote. They would, therefore, ask the cultivators to be on their guard against any exaggeration of these fears and to go ahead with their plans for increased food production to meet the proved need of the hour. With the growing demand for food stuffs on all sides, there is little chance of any serious fall in prices in the immediate future.

Even after the cessation of hostilities the demand for foodstuffs from countries now devastated by war, is likely to increase rather than decrease. India herself with her growing population needs more food than she grows at present.

It is however, likely that genuine apprehensions may be felt about the transport situation and certain temporary difficulties in the marketing of crops on that account, and it was to counter such apprehensions that it was recommended at the Food Production Conference held in New Delhi on April 6, 1942, that "the Government of India should undertake, should such a contingency threaten, to