

DEVELOPMENT OF AGRICULTURE AND ANIMAL HUSBANDRY IN INDIA—SUMMARY

EXPLANATORY NOTE

THE Memorandum which follows is not a complete plan of agricultural reconstruction for India. In the main, it is merely a skeleton, designed to serve as a framework for more detailed planning. The reasons for this are several. Agriculture cannot be considered as an independent entity. Its development is part of the larger problem of rural development which must be tackled as a whole. It is, for instance, interdependent with industry, the sound expansion of which is indispensable to any comprehensive programme for the advancement of agriculture. It must be considered in relation also to the plans for Commerce, Finance, Health, Education, etc. Nor could such a programme be prepared until numerous matters of policy, which affect planning at many stages, have been decided by Government. Further, as the Memorandum shows, there are many lines fundamental to development but concerning which surveys must be conducted, research be carried out and data be collected before planning is possible, owing to the inadequacy of existing information. Again, in view of the wide diversities in India of climates and soils, and of cultivation practices under irrigated and rainfed conditions, much of the detailed planning must fall on the shoulders of the provinces and States which alone are in a position to frame their plans to suit their own conditions and with which their ultimate execution will rest. Nevertheless, the Memorandum attempts to put first things first and, wherever it has been considered possible to do so, plans have been proposed and very rough estimates of their cost have been made. At the same time, the diversity of the problems connected with agricultural planning and the nature of the information essential as the basis for planning have been indicated. The estimates of cost refer to British India only. Lack of adequate agricultural statistics and data for a large proportion of the area under Indian States has rendered the inclusion of States impossible in these estimates. The general lines of development apply to India as a whole.

THE PROBLEM

The United Nations' Conference on Food and Agriculture placed in the forefront of its recommendations the improvement in the levels

of nutrition and the raising of the standard of living of the people. It considered it an obligation and a primary responsibility of each nation to see that its own people have the food needed for life and health. India participated in that Conference and subscribed to that obligation. To what extent action is necessary to discharge it can be gathered from statistics, incomplete and inadequate though they may be.

India is largely a country of small cultivators who follow an immemorial and traditional way of life. Its most important foods are the cereal grains, rice, wheat and the millets. Pulses are a supplement to most Indian diets. Vegetable oils and ghee are the main sources of fat for the majority of the population. The consumption of milk and milk products, though considerable in some parts of the country and among some sections of the people, is negligible among the poor in many parts. Diet surveys suggest that at least 30% of the population of India, or over 100 million people, are habitually underfed in normal times.

Apart from its inadequacy, the quality of the food consumed is often unsatisfactory and unbalanced. The intake of fat is almost invariably low. Rice diets are usually deficient in calcium and insufficiency of certain vitamins is characteristic of most Indian diets.

THE AIM

In normal times India's average annual production of the principal foods is considered to be roughly:—

	Million Tons		
Cereals	60·0
Pulses	7·5
Fats and Oils	1·9
Fruits	6·0
Vegetables	9·0
Milk	23·0*
Meat, Fish and Eggs	1·5

* Only 27 per cent. or 6·2 million tons are consumed as whole milk.

Large though this production appears, it is inadequate to provide the Nutrition experts' requirements for a suitably balanced diet in minimum quantity for the 400 million people of India. To make

available those requirements in full the production of these foods must be increased as follows:—

- Cereals by 10%
- Pulses by 20%
- Fats and Oils by 250%
- Fruits by 50%
- Vegetables by 100%
- Milk by 300%
- Fish and Eggs by 300%.

To achieve national sufficiency in human foodstuffs, therefore, these must be the minimum targets of increased production to aim at. In addition, there still remains the provision of adequate supplies of animal foodstuffs necessary for the increased outturn of work and milk to achieve this aim. It is calculated that this will necessitate increasing the present production of oilcakes and other concentrates by 400% and fodder by 55%. Finally, there has to be achieved the proper balance between food and cash crops, so that not only may the people have enough food to eat, but their purchasing power may be so increased as to place them in a position to provide themselves with the clothing and other amenities necessary to a fuller and richer life.

In India, due to a variety of reasons, the level of average production per acre is low in the case of most crops. Four-fifths of the total cultivated area are dependent purely on rainfall for the success of their crops. In much of the area rainfall is precarious or badly distributed. The cultivator himself, by reason of handicaps or ignorance, fails to make the best use of his land, of the rainfall, or even of irrigation supplies where they are available. He manures his crops inadequately and in most cases not at all. The majority of cultivators still do not use the most improved and best varieties of seed. The standard of cultivation is low and usually the only implement of cultivation is the pre-historic wooden plough. Pests and diseases of crops are allowed to go unchecked. Weeds flourish uncontrolled, and in sloping land the rich top-soil is eroded and carried away through failure to control rainfall and surface-water by bunding and other means. These are some of the directions by proper attention to which the cultivator can directly increase the production from his land. In the same way he receives a poor return from his livestock. Through inadequate feeding,

indiscriminate breeding, indifferent management and through ravage from disease, the net output per animal is one of the lowest in the world.

THE MEANS

To attain the goal of self-sufficiency in food and of increasing the purchasing power of the masses, the first necessity is to ensure the optimum utilisation of all national assets and their maximum exploitation by all means known to science and technology. Such means must include the following:

Water.—No single factor can influence crop production to the same extent as an irrigation supply, whether artificial or natural. By it alone, rainless deserts, which grow no crops, become havens of plenty, whilst tracks of precarious and uncertain rains, which in some years produce a crop and in others none at all, give an assured yield always. Even in latter areas, the degree of increased production, when controlled irrigation can be provided, is probably of the order of 100%. In rainless areas its effect is incalculable and since four-fifths of the cultivated area are unirrigated, probably for the country as a whole the maximum utilisation of all sources of water would increase production by 50%. Obviously, therefore, it is imperative that the maximum use be made of every source of water-supply. Measures to achieve this end consist of:

1. The harnessing of the water of rivers carrying a sufficient water-supply and the construction of irrigation canals to distribute that water.
2. The lifting of water by mechanical means direct from rivers and canals where irrigation by flow is not possible.
3. The utilisation of subsoil water, whose quality is suitable, by sinking more tube-wells and open percolation wells and by boring existing wells.
4. The construction of minor irrigation works, such as tanks and impounding in them the surplus rain-water which can be used for irrigation at a subsequent date.
5. The proper utilisation of rain-water by the control of erosion, the construction of bunds and terraces on sloping land, and the maximum conservation of the rainfall in the soil by suitable methods of cultivation.

The first step towards maximum water utilisation lies in carrying out surveys of resources and of the areas to be developed. Thereafter, the necessary schemes must be drawn up and not till then can final detailed estimates of cost be prepared. To complete these preliminaries may take several years but this does not mean that development must await the completion of all surveys in all areas. Construction of new works can begin as each individual area or projects has been surveyed, the scheme for its development prepared and the detailed cost estimated.

Land.—The utilisation of land to the maximum advantage has several aspects :

(a) To bring under cultivation such of the 170 million acres classified as culturable waste and fallow as is economically suitable for crop production. Soil erosion, excess or scarcity of water, excessive salinity or alkalinity, and infestation with deep-rooted grasses obviously render some of these large wastes unsuitable for cultivation. But, in many cases neither the location of the blocks available and suitable for reclamation nor their extent is known. The first essential is a survey to determine the causes responsible for keeping large blocks of land out of cultivation. These surveys must then be followed by the preparation of reclamation schemes for those areas suitable for the purpose.

(b) To prevent land going out of cultivation. Action lies primarily with the control of erosion. The control of the water in each major catchment area and the prevention of its spill on agricultural land, whose rich surface soils it carries away, is the first essential. (Incidental to this main object may be the harnessing of the water involved for irrigation purposes, or for the production of hydro-electric power or both). In this case also, the initial step is a survey of the main catchment areas, followed by the preparation of schemes to deal with them.

To protect sloping agricultural lands from the disastrous effects which heavy rainfall or uncontrolled water-supplies coming from higher levels cause through carrying away the rich top-soil, a country-wide policy of terracing and contour bunding is needed. The proper alignment and regulation of the frequency of such bunds necessitates engineering survey village by village. Only then can the necessary length of bund be determined and a plan for complete bunding within a fixed period of years be prepared.

(c) Indispensable with the proper utilisation of land is the need for carrying out scientific experiments on a scale sufficiently large to place the Agricultural Officer in a position to supply to the cultivator a schedule of cultivation suitable to his particular land and individual needs. Existing information, though considerable in some directions, is totally inadequate in others. Its collection necessitates the establishment throughout the country of at least one experimental farm in every division in which they do not exist already.

(d) The last major aspect of maximum land utilisation essentially concerns the cultivator himself and consists in the attainment of higher crop yields by improved methods of husbandry, such as manuring, the use of better seed, the improvement of cultural practices and the control of pests and diseases.

The response of food crops to manuring varies with the crop, soil, climate and facilities for irrigation. Proper manuring has produced in the rice crop increased yields per acre, varying from 20–150% but, taking India as a whole, an average increase of 30% should be well within practical achievement. Manurial experiments with wheat gave increased yields, varying from nothing to 65%. An average increase of 20% on the crop as a whole should be possible of attainment. The increase under irrigated conditions will be much higher than this average.

An all-out programme of manuring must include all forms of manure and will necessitate adequate steps to produce them in sufficient quantities. The utilisation for agricultural purposes of a much large proportion of the production of farmyard manure than the 40%, which now finds its way to the land can be attained only by the provision of adequate supplies of an alternative fuel, such as wood or oil. Green manuring must be practised, particularly on the irrigated food crops and for wheat and rice production. All vegetable wastes in town and village must be composted and returned to the soil. Oil-cakes must be made available in large quantities; this may necessitate the limitation of the export of oilseeds to their oil content only, the cake being retained as cattle food and as manure. Artificial fertilizers, particularly Sulphate of Ammonia (and for some areas phosphatic manure also) must be made available in very large quantities at economic rates. It has been calculated that there is need in India for not less than five million tons of Sulphate of Ammonia annually, the possibilities of manufacturing 350,000 tons a year as a beginning is under examination.

By the use of improved varieties of seed increased yields per acre of 10-15% can be obtained. To make sufficient seed available, the establishment of a large number of seed-farms, associated with the organized production of seed supplies by registered seed growers, is essential. The distribution of that seed and the recovery of its cost in kind or in cash necessitates the provision of some 5,000 seed stores.

Existing knowledge of improvements in cultural practice, whilst sufficient to guide cultivators in some directions, is inadequate in others, and much remaining to be done on the experimental farms to be set up, before complete guidance can be given to the cultivator under all conditions of soil and climate. Research is also needed on the designing of improved bullock-drawn implements suitable for the different conditions in India. The role which power machinery is capable of playing in increased production calls for the importation of tractors and their implements and machinery and wide experimentation with them. Until a survey has been made of the scope which different areas offer for power farming and experiments to determine its economics are carried out, the future of this type of farming in India must remain obscure.

Connected in some respects with the possibilities of power farming is the need for determining the relative scope which different systems of farming offer in India in regard to maximum production and maximum well-being. Many believe that consolidated holdings are essential to increased production. Others have successfully adopted a system of consolidated cropping using the village as a unit.

Co-operative farming and collective farming also have their advocates. Until all these systems have been tried out in large blocks it is impossible either to generalize as to which is best or to advise in regard to the areas or conditions for which any particular system is best suited. Investigations in this connection are essential and should be made without delay.

The adequate protection of crops in the field from the ravages of pests and diseases would probably increase production by 5% on the average. Similar protection of their produce in storage would preserve additional quantities of foodgrains for consumption. Means to secure these ends involve not only further research and experiments in several directions, before protective measures can be fully applied, but also the manufacture of insecticides and fungicides on an adequate scale, as well as the machines necessary for their application. If products, such as potatoes, are to be adequately protected against the

serve loss which they suffer during storage, the provision of cold stores, particularly for potatoes intended for seed purposes, is essential.

Livestock.—Increased production from Indian flocks and herds depends very largely upon the degree of improvement which can be made in both the quantity and quality of their food supply. There is a deficiency of every kind of food. The supply of straws and cereal bye-products will improve as the amount of cereals grown for human consumption is increased. The conservation of grass as hay and silage and the rational management of grazing land, if appropriately extended, will go very far towards meeting the requirements of fodder. The supply of concentrates from the oilseeds industry is but a quarter of what is required. Means must be taken to increase it both by the limitation of export and by increased production. A valuable form of livestock food consists of cultivated fodder crops, but as these often compete for acreage with crops for human consumption, they must of necessity take a second place. Nevertheless, the need for increased production of this class of food, especially for dairy cattle, is urgent and must receive due consideration.

The majority of the cattle maintained today are of a non-descript nature. Their improvement by grading up to the level of those recognized breeds, which are known to possess the desired qualities, is another important step towards increased production. This involves controlled breeding which basically demands the supply of large numbers of pedigreed bulls. With that end in view, a beginning should be made by the establishment of some 50 stud farms.

Immediate improvement of livestock production would result from the introduction of certain changes in routine village management such, for instance, as would lead to the shortening of the dry period in milch cows, to the preservation of life and health of young stock by protection from extremes of weather, and to the conservation of animal products by proper handling and preliminary processing.

The results which might be expected from the foregoing improvement must not be jeopardized by disease. Much has still to be learned about the means of controlling and suppressing prevalent contagious diseases of animals, but the prompt and widespread application of the knowledge which veterinary research has already made available, would save the country from enormous expense. The most pressing need, apart from further research, is the provision of sufficient personnel whereby appropriate measures can be applied at the right moment and before, rather than after, disease has been established.

Research is needed on a multitude of problems connected with livestock ranging from the application of scientific interference in the natural processes of reproduction and the economics of feeding, to such everyday problems as the designing of the most satisfactory form of poultry house for village conditions.

The difficulties connected with the marketing of animal products are often the limiting factors in production. The collection, transport and distribution of fresh milk present a number of problems which vary in degree and character, according to the area to be supplied. A careful survey of each tract is a necessary preliminary to the creation of the suitable organisation for it. The introduction of modern dairying equipment in the villages and the erection of a suitable plant for the manufacture of milk products are necessary extensions which will call for a heavy capital expenditure.

The fish resources of the country have never been adequately and consistently tapped. Improved methods of marine fishing must be explored and developed. Modern means of handling, processing, storing and transporting the catch must be investigated. Action in certain directions is possible at once. Thus, immediate extension of inland fisheries can take place by the planting of suitable stocks in tanks, ponds and lakes. Research is needed in both fundamental and developmental work, so that knowledge necessary for further progress may be obtained. The industry requires a regular organisation for its direction, research and extension. That should be established under an Indian Central Fish Committee with an assured annual income.

STIMULI ESSENTIAL TO INCREASE PRODUCTION

To attain the desired goal, however, the provision of the necessary stimulus is imperative. In particular, the cultivator must be assured of his own position. In Great Britain, during the war one method of providing such a stimulus has been the guarantee to the farmer of minimum prices and an assured market for his produce during the period of the war and one year thereafter. Recently, in India, a beginning has been made in a similar direction in regard to the prices of wheat, millets and cotton. But, if the cultivator is to spend money and labour on improvements essential to increased production and if in India there is to be an economy of plenty in the future, a long-term policy is indispensable in regard to assured economic prices and offtake of produce, at least in respect of the essential food crop com-

modities. Coupled with these guarantees, the maintenance by Government of buffer stocks of foodgrains is considered to be essential to the maintenance of stability and the security of all concerned.

NECESSARY REFORMS

Among other important matters, which must receive attention, if maximum production is to be attained, are the need of the cultivator for adequate security of tenure, the problem of the absentee landlord and the excessive fragmentation of holdings. Reform also is needed in the conditions under which farm produce is marketed, if the producer is to get the best return and the consumer the best quality produce. A rational and orderly system of marketing can only be built up on a basis of fair price for a given standard of quality. To control these standards, markets must be regulated; dealers—wholesale, retail and village itinerant,—must be licensed and village marketing organizations must be established.

The objective which has been set can only be attained if great expansion takes place on the research side, both at the Centre and in the Provinces and States, as well as in the staff and facilities which are indispensable, if the useful results of research are to be brought to the knowledge of the cultivator and incorporated in his everyday agricultural practice to the maximum extent.

FUTURE ROLE OF THE CENTRE

The Centre must take the lead in many matters if progress is to be rapid. On the research side, it must accept the main responsibility for fundamental research. It must advise on policy in regard to agricultural and animal husbandry matters of common interest, and must arrange adequate co-ordination of effort (research and otherwise) if overlapping is to be prevented and maximum achievement is to result in the shortest time. It cannot remain entirely aloof from the extension of the results of research into farm practice throughout the country, even though the practical extension of those results must primarily be the function of Provincial or State Departments of Agriculture. It must be also in a position to assist financially when funds are needed for encouraging and promoting research, extension or other action in the Provinces.

A FEDERAL ORGANISATION

To this end, it is considered that the time is now ripe for the creation of a Federal Department of Agriculture. Such a department

would be charged with the duties of fostering agriculture and animal husbandry in their broadest sense and in all their phases. It would formulate and establish the general policies to be pursued in its various branches. Its activities would include investigations of production, marketing and utilisations of crops and livestock, and the control of diseases and insect pests to which they are subject, the promotion of regulatory laws connected with pests, diseases, marketing, etc., the administration of federal grants for research and extension by Provincial and State institutions. It would co-ordinate all scientific investigations in the Federal Institutions, not only within themselves, but with work in the Provinces. It would conduct investigations into farm economics and would maintain bureaux of information on all aspects of plant and animal husbandry. Many of the activities of the Federal Department would be exercised through the Imperial Council of Agricultural Research, which would become a Federal Agricultural Council, dealing with both research and development.

In the Federal Department of Agriculture, research would be developed in two main directions:

(a) The existing Imperial Agricultural Research Institute and the Imperial Veterinary Research Institute would be expanded into Federal Institutes for Agriculture and Animal Husbandry, respectively. They would come under the Federal Agricultural Council and their primary function would be fundamental research.

(b) Side by side with them would be set up in appropriate region, in India a chain of Commodity Research Stations and Substations each dealing with problems connected with its own commodity or group of commodities, be they of animal or vegetable origin. These commodity stations would follow generally the organisation already existing for Jute, Cotton and Sugarcane. Each would be administered and controlled by an Indian Central Committee for the particular commodity. Finance would be provided either by a cess or duty at some stage on the commodity itself, such as exists on cotton, sugar, lac and tobacco at present, or by an annual grant from Government, as is the present case with jute.

The financial implications of the proposals for a Federal Department of Agriculture, with its Federal Agricultural Council (Rs. 8 lakhs), Federal Agricultural Research Institutes (Rs. 45 lakhs) and its chain of Commodity Stations (Rs. 135 lakhs) may be estimated at Rs. 188 lakhs a year. To this must be added (1) provision for grants to Universities,

Provinces and States for the promotion of special lines of research and assistance in special aspects of extension or in such other activities as may be considered essential, (2) funds for the post-graduate training abroad and in India of staff intended to fill the higher appointments, (3) maintenance charges on works and other items not provided for. The total annual cost at the Centre may be estimated at Rs. 300 lakhs annually. A considerable part of this expenditure would be provided from cesses or duties on the various commodities. It is not possible to estimate the non-recurring expenditure until detailed plans and schemes have been prepared.

PROVINCIAL ORGANISATION FOR RESEARCH, EDUCATION AND EXTENSION ACTIVITIES

In the past the incorporation by the cultivator of the useful results of agricultural research in his everyday agricultural and livestock practices has not kept pace with discoveries and neither the cultivator nor the country as a whole is deriving the maximum benefit from the expenditure which has been incurred on research and the results obtained from it. This unsatisfactory position is mainly the result of the failure hitherto of Provinces and States to staff their Agricultural Departments on a scale at all proportionate to the territory to be covered and the number of cultivators to be contacted. The latter have remained either unaware of the possibilities of improvement or, in the absence of local demonstration, unconvinced of their applicability under their own individual conditions. In planning for the future, therefore, a very high degree of priority must be given to the provision of the staff and other facilities necessary to terminate such a position and to ensure that, for the future, every cultivator in every village not only has knowledge of the many directions in which he can increase his yields from his holding and livestock, but puts that knowledge to practical daily use.

The only satisfactory way to achieve that end is to treat the village as a unit and to build up an adequate organisation on it. For each village there should be Village Guide. Preferably, he should be an active member of its own community, who, while cultivating his own land, could give part-time service to act as a link between the technical experts and the cultivators in his village. Initially, he would receive practical instruction of a few months' duration at departmental centres in the various improved agricultural and animal husbandry practices applicable to his village conditions and would duly introduce them himself and get others to do so. He would act as the departmental

correspondent for his village. He would be kept posted regarding all the latest useful discoveries, up-to-date information and literature. He would arrange with the departmental staff for the supply, through the village co-operative or other organisation, of the seeds, manures, insecticides and other needs of his village. For his services, he would receive an honorarium of Rs. 200 per annum. On the basis of 400,000 villages in British India, such a system of Village Guides would cost Rs. 8 crores annually. The Guide will form the connecting link with the village not only for agriculture and animal husbandry, but for all departments of Government concerned with the improvement of the lot of cultivator.

In order that adequate attention may be given in future to extension and propaganda activities in view of their enormous importance in increasing production, it is considered that the minimum average staff in a Province or State should be:

(a) For Agriculture, either one fieldman per union or group of 25 villages, one non-graduate demonstrator per assessment circle and one graduate inspector per tahsil or one Mukaddam or Kamdar per assessment circle and two graduate assistants per tahsil. In either case, the gazetted staff would consist of one Superintendent or Assistant Director per district and one Deputy Director of Agriculture per division.

(b) For Animal Husbandry one Stockman, per union; 4 Livestock Inspectors 2 of whom will have veterinary qualifications, per tahsil; 2 Livestock Officers one of whom would be veterinary, per district; and one Deputy Director of Animal Husbandry, per division.

The annual cost of agricultural extension work in British India, on the basis of this staff and allowing for their equipments whether individual, as in the case of implements and machinery for demonstration purposes, or collective, as in that of touring cinema lorries, would be of the order of one crore of rupees. About an equal sum would be needed annually to cover the same items on the animal husbandry side. The foregoing requirements would be independent of and additional to the expenditure to be incurred in producing, collecting, storing and distributing improved seed and arranging for adequate supplies of manures, implements, veterinary stores and other requisites.

The organisation, guidance and oversight of provincial agricultural and livestock operations on the scale envisaged will necessitate

a very considerable strengthening of the provincial headquarter's staff. The cost of this establishment may be estimated at Rs. 40 lakhs per annum for British India.

Provincial and State research also will require considerable re-organisation. The present staff and facilities for such work are altogether inadequate in many Provinces and States. Research stations, where they exist, need strengthening and new stations must be established, equipped and staffed. For British India the annual cost of adequate provincial research on agriculture and animal husbandry combined would be not less than Rs. 70 lakhs.

THE TRAINING OF STAFF

The developments and organisations contemplated in this skeleton plan will require for their execution the services of a very large technically trained staff of all grades and covering all the sciences applied to agriculture and animal husbandry. Assuming the availability of the necessary finances, the pace at which development can take place will be regulated largely by the numbers of trained men of the required grades available for employment in the different directions.

Suitable candidates are not available today in adequate numbers to meet the needs of Agricultural and Veterinary Departments in connection even with their relatively small war-time expansions. Obviously, therefore, special measures will be needed to train the men required both to initiate and to carry through the plan of development, as well as to maintain annual wastage. It is essential, if great delay in initiating the plan is to be avoided, to take immediate steps to organise the training of men in suitable numbers.

PLACE OF THE DEMOBILISED SOLDIER

The place of the demobilised soldier in an agriculturally reconstructed India must not be overlooked. Most of these men went to the Service from the land and most of them will return to it in due course. Full advantage must be taken of the broader outlook, which their travels and recent experiences have given them, as well as of the spirit of discipline and leadership to which they are accustomed. These qualities will be invaluable in the future development of the village and the influence of these men should be a potent factor in its future life. The fullest advantage must, therefore, be taken of them in all aspects of village welfare. Apart from those who may be provided

by Provincial or State Governments with land or other resources to undertake whole-time active farming or who themselves already possess those facilities, the demobilised soldier should find a large place in the ranks of Village Guides. The lower grades of departmental service, particularly on the extension side, also offer scope for their useful employments, after the necessary training has been given. Many of the operations envisaged in this skeleton plan will call for the services of men with technical knowledge for handling modern machines. The demobilised soldier should be admirably fitted to fill that need.

ORDER OF PRIORITY

Several years will be needed to complete the plan of agricultural and animal husbandry development which has been envisaged. In a number of directions, so far from undertaking actual developments immediately, final plans cannot even be prepared until preliminary surveys have been made and schemes drawn up. Other aspects call for extensive research before optimum treatments or optimum methods of improvement can be recommended. In some connections, legislative action must precede reconstruction. The rate of progress must also depend on the rate at which financial provision can be made. Although such considerations must necessarily postpone actual developmental operations in a variety of directions, there is ample scope, in the meantime, for action to bring into general practice, in both agriculture and animal husbandry, many ways and means by which existing knowledge can increase production economically.

To ensure development in an orderly manner, as well as to secure the maximum immediate advantages which existing scientific and technological knowledge can confer, it is desirable to indicate an order of priority of action, so that first things may be put first.

(1) *Training of staff*.—Since development on any considerable scale cannot take place till the necessary technical staff is available to undertake it, first priority of action must be given to such training. Though, for lower grades of staff, training will begin to produce some results within the first year, for higher grades the effect will not begin to be felt for about 3 years. Thereafter probably 3 years must pass before staff of all grades can be available on the scale required.

(2) *Technical surveys*.—Since the full possibilities of agricultural development cannot be assessed until certain fundamental data are collected, the conduct of these surveys must receive a high degree of preference. If, amongst the surveys themselves, priority is to be given,

a suitable order would be potential irrigation resources, anti-erosion measures and waste-land reclamation. If they proceed simultaneously, they would probably be completed within a period of 5 years, though, in the meantime, the execution of many projects, which the surveys show to be feasible, could be taken in hand.

(3) *Improvements.*—All important aspects of improvement, which call for practical action by the cultivator himself, would actually begin as soon as the necessary staff can be provided to guide and direct him. These would deal primarily with (1) full utilisation of irrigation resources, where they exist, (2) conservation of rainfall by bunding, (3) drainage where needed, (4) suitable manuring, (5) use of improved seed, (6) improved methods of cultivation, (7) protection of crops from pest and disease, (8) cattle improvement for milk and draught. The rate of progress must depend on the rate at which staff becomes available. But, in so far as departmental extension activities are concerned, assuming that all necessary training facilities are provided, it should be possible to make available trained staff of all grades to the full extent within 8 years. For several grades of lower staff, the time required would probably be much less.

In other directions, the rate of improvement will be governed by the speed with which Government can either provide in adequate quantities the necessary material, such as improved seed, artificial fertilisers, increased irrigation facilities, insecticides and fungicides, or undertake and put into effect legislation in such matters as the orderly marketing of produce.

(4) *The Federal Organisation.*—The creation of a Federal Department of Agriculture, the extension of the Imperial Council of Agricultural Research into a Federal Agricultural Council, the expansion of the Imperial Agricultural Research Institute and Imperial Veterinary Research Institute into Federal Institutes of Agricultural and Animal Husbandry Research, respectively, and the establishment of a chain of Commodity Stations, are regarded as most important steps in the development of India's agricultural economy. Research is the basis of all improvement, and it must be put on a sound footing at the earliest opportunity, if India is to obtain the best from its major industry. The Federal Organisation has been given high priority in the belief that only thereby will the maximum benefits, which can be obtained from existing knowledge and facilities, be secured with the minimum delay and the necessary machinery be put in motion to ascertain and assess possibilities where they are unknown. In the agricultural sphere,

nature still holds many secrets, which scientific and technological research can unfold to the benefit of man and beast, and nowhere is this more so than in the vast expanses and varied conditions of soil and climate of the Indian sub-continent. A Central organisation, such as is indicated, supported by adequate Provincial and State research centres and extension organisations, is essential to the progressive development of Indian agriculture and to the maximum well-being, not only of its millions of cultivators, but of the other millions of its population in town and industry whom it feeds and supplies with the essentials of life.

THE PROSPECTS, THE TIME AND THE COST

Given the necessary finance for development, the stimuli for continuous effort on the part of the cultivator and all the required goods, services and facilities, this skeleton plan envisages the ultimate possibilities of increased agricultural production as 100% over its pre-war level. Since the attainment of this ideal depends on the provision of many facilities and on the construction of works, some of which may require years to initiate and complete, it seems reasonable to conclude that production cannot be doubled in less than 15 years though an increase of 50% in production within 10 years of the termination of the war should be possible of attainment.

Any estimate of the total cost of attaining the ultimate goal must be largely guess work for the present, since so many factors are unknown and incalculable. On the non-recurring side, it is perhaps not too much to suggest that ultimately for British India Rs. 1,000 crores of capital expenditure will be required.

The developments which the skeleton plan contemplates may involve a recurring expenditure of the order of Rs. 25 crores a year. Of this total, about Rs. 3 crores would fall on the Centre and about Rs. 22 crores on the Provinces.

Considered in relation to the area involved, an annual expenditure of Rs. 25 crores represents an average of less than one rupee per acre on the present cultivated area of British India, the shares of the Centre and of the Provinces being about 2 annas and 14 annas per acre, respectively. If and when all the area recorded in statistics as culturable waste can be brought under cultivation, the average total expenditure will be only 12 annas per acre per annum. Considered from this angle, the proposals would appear to be within the range of practical finance.