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PROGRESS OF INDIAN AGRICULTURE: 1900-1980

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The roles of Famine Commission (1880), Voelekar Commission (1889) and Irrigation Commission (1893) have been emphasised. The setting up of Imperial Veterinary Research Institute at Mukteswar (1893) and Imperial Agricultural Research Institute (1902) at Pusa, Bihar, were important landmarks. The Royal Commission on Agriculture (1926), appointed to assess agricultural productivity level, recommended the establishment of Imperial Council of Agricultural Research (ICAR). This and the impact of World War II helped the reorganization of agricultural research and development of various strategies for production of fertilizers, researches in agriculture, including forestry and fisheries, and the setting up of regional crop research centres for promoting high yielding varieties.

Researches in post-independence period were focussed on the development of arid and semi-arid areas, dry land agriculture, reclamation of salt affected land, infrastructure for increasing the rate of production and improvement of the condition of marginal farmers and agricultural labourers, etc. The National Commission on Agriculture appointed in 1970 by the Government of India submitted in 1976 its report in 67 chapters. This is a comprehensive document of the activities already carried out and areas not yet attended to in the field of agriculture in its broadest sense.

The 1880 Famine Commission presided over by R. Strachey recommended the establishment of a department of agriculture in each province. Accordingly, a new secretariat was set up in the centre in 1881. This was followed by some provinces, notably Bombay, Madras, UP, Bengal, Assam, CP and Punjab, stepping up activities in agriculture and allied fields. Agricultural education got the top priority.

The centre's appointment in 1889 of J.A. Voeleker as agricultural chemist was an important step in ushering in scientific agriculture in India. Lack of scientific knowledge was attributed by him to be the cause of backwardness of agriculture. Agricultural research received attention with the appointment in 1892 of J.W. Leather. Field experiments were started by Mollison as Deputy Director of Agriculture, Bombay Presidency. At this time, Barber began his pioneering plant breeding research, initially on disease resistant sugarcane. Researches in other disciplines, such as mycology and entomology, were gradually emphasised with the appointment in 1903 of E.J. Butler and Maxwell-Lefroy. These approaches culminated in the establishment of the Imperial Agricultural Research Institute at Pusa, Bihar (in 1903), where the chemical, mycological and entomological laboratories were set up together with experimental crop farm, cattle farm and arrangement for training of students. This was possible with the financial assistance of Henry Phipps, an American philanthropist.

On the recommendation of the 1880 Famine Commission and the first Irrigation Commission (1903), extensive plans were made to irrigate large areas of agricultural

land, emphasis being given on private irrigation works. Animal husbandry, especially remedial measures for animal health care by means of vaccines and sera, was also given due importance. The setting up of Veterinary Research Institute at Mukteswar and appointment of an Imperial Bacteriologist as early as 1893 are evidences in point.

The starting of the publication, *Agriculture Ledger*, at about this time, gave adequate support to the research efforts.

From 1905 to 1919, there was considerable spurt in the breeding of suitable varieties of wheat at Pusa, of rice in Bengal, sugarcane at Coimbatore, and development of animal husbandry at Bangalore and Karnal. Following the constitutional reform in 1919, agriculture became the responsibility of the provinces. The agricultural research activities remained with the centre. The objective was to set up agricultural colleges with farms in every province. After a more or less stagnant position during the World War I, a number of Commodity Committees were set up to pay adequate attention to specific problems of each cash crop.

Despite all these efforts, the productivity level remained low. To find out reasons for this and remedy the situation, the Government of India set up the Royal Commission on Agriculture in 1926. Based on its report submitted in 1928, several far-reaching steps were taken. One of them was the establishment of the Imperial Council of Agricultural Research (ICAR).

Once again, irrigation was given due importance by setting up of research stations to look into irrigation and problems relating to its expansion. 1930s saw the tremendous adverse effect of world depression, especially in America, on all aspects of agriculture. The constitutional reforms under the Government of India Act 1935 gave some scope of recovery, by making agricultural financing easier through the establishment of the Reserve Bank of India and the Agricultural credit department of the Bank.

Sir John Russel's comprehensive report (1937) made a critical assessment of agricultural activities in the provinces and some institutes and universities, and pointed out the strong, weak and neglected areas.

During and after World War II and up to the time of Independence, considerable reorganisation of agricultural research and administration was effected. The outbreak of the war gave impetus to increasing production and productivity. In spite of this, and also introduction of rationing, an unprecedented famine in 1943, essentially man-made, caused the death of millions of people of Bengal, particularly of the poorer sections. To boost up foodgrains output, indigenous production of fertilisers was encouraged. Nitrogenous fertiliser factories at Travancore and Sindri were the result of this policy.

Soon after the war, a number of steps were taken to reorient researches in agriculture, including forestry and fisheries; several commodity research institutes came into being. The Foodgrains Policy Committee of 1947 recommended greater

attention to minor irrigation works, development of local manures, distribution of improved seeds, production of fertilisers, reclamation of wastelands, etc. Field trials to assess soil fertility and fertiliser requirements were arranged on the basis of the recommendations made by A.B. Stewart. Animal husbandry and veterinary research received similar attention following a comprehensive review of the existing status.

The partition of India in 1947 caused considerable imbalance in agricultural production. With the setting up of the Planning Commission in 1950, and the institution of Five Year Plans, agricultural development (including animal husbandry, forestry and fishery) assumed greater significance in the matter of stabilising the country's economy.

Research support to agriculture came by way of establishment of institutes and formation of Commodity Committees by the government. Agricultural research so far was restricted to certain crops and institutions. There was not much coordination. ICAR started All-India Coordinated Research Projects which paved the way for a better understanding of locational and regional problems, and their remedies. This attempt led to projects on cotton, oilseeds, millets and maize.

The first of the agricultural universities wedded to integrated teaching, research and extension was set up in 1961 at Pantnagar, UP. This was followed by a series of these universities in the various states.

The increase in production, especially food crops, during 1951-1967, was the result of increasing irrigation, improved agricultural practices, introduction of improved seeds of some crops and increased use of chemical fertilisers. Other measures such as soil and water conservation, land development, consolidation of holdings, agricultural credit and marketing, price incentive, education and research lent support to all-round production activities. This trend was vigorously followed during 1967-1974. Agricultural development based on the adoption of new technology required harnessing of irrigation water, and use of quality seeds, chemical fertilizers and a wide range of pesticides. The rate of rise in production was 4.1% in the first plan but decreased gradually to 2.2% in the fourth plan. This was partly due to fall in area under cultivation. But the main reason lay in the fact that a majority of the poor farmers could ill-afford the relatively costly new technology; added to this was the nonavailability of inputs in remote areas. Obviously, the new technology was not appropriate and cannot be made so by any extension innovations whatsoever.

The pre-plan period witnessed a huge population of animals of poor quality. Programmes of breed improvement, provision of food and fodder, and health measures went by default.

Considerable challenges had to be faced during the sixties. While some degree of success in the production of one or two cereal crops and some nonfood crops was achieved, this was not enough to raise hope. The improvement was, however, spectacular in the wake of the introduction of Taichung Native I and IR-8 varieties

of paddy which have got the dwarfing gene. New varieties were produced by manipulating IR-8 to suit diverse local situations. Nearly one hundred such varieties have so far been released. But owing to lack of adequate inputs, the coverage of the total area of 38 million hectares by the high yielding varieties has not been uniform.

Wheat cultivation has given a better account following the introduction of the Mexican varieties. Here also, new varieties were developed to suit certain areas, and to make the varieties, to some extent, disease resistant, particularly against rusts. The multiline approach to breeding has shown some definite advantages in the matter of combating disease and stabilising production. It is, however, interesting to note that none of the varieties perform in farmers' fields as much as they do on national demonstrations. The reason for this failure deserves deeper search. May be, one of the ways of a breakthrough in production lies in this direction.

Considerable success has been achieved in the case of evolution of high yielding hybrids of sorghum and maize. But improvements made in pulses, which constitute an important item in Indian diet, were not so marked.

Many potentially high yielding varieties of castor, rape seed, mustard, groundnut, safflower, sunflower, linseed, taramira, toria and raya have been evolved. Of these, the most important is groundnut, but seed supply is inadequate for large-scale production. Perennial sources like coconut and oil palm are of great importance, but their production is hampered by diseases.

Potato research has given high dividends, so much so that the yields have been doubled in the course of 30 years, making India a leading potato producer. The main achievements are the breeding of Kufri varieties suiting almost all possible growing conditions, and development of Seed Plot Technique for disease-free seed.

The Coimbatore Sugarcane Breeding Institute is pioneer in evolving new varieties of sugarcane. Coimbatore varieties now occupy nearly 70% of the area under sugarcane. More than 20 other countries use Coimbatore canes. The Institute has tried several short duration varieties (8 months instead of 14-18 months) which have a higher sucrose content.

In the field of fruits like mango, grape, papaya, apple, and vegetables of different kinds, research work has been directed towards good quality as well as high yield. Some promising varieties are in commercial use, and others are in the pipeline.

The All-India Coordinated Cotton Improvement Project has got 30 research centres representing different agroclimatic regions in the country. A large number of varieties having improved quality and better yield have been released, including intrahirsutum and interspecific varieties.

Jute varieties suitable for different agroclimatic conditions and for multiple cropping have been released by the Jute Agricultural Research Institute. There is

considerable technological gap in the area of retting, which, if properly done, makes high quality fibre.

Soil survey and soil fertility researches, including availability of major and micronutrients, have been undertaken on a comprehensive scale, providing thereby an excellent support to the new technology.

Cultural practices like multiple and relay cropping and intercropping are being standardised for the purpose of optimising the use of land, water and other inputs. Suitable packages of practice have been worked out on the basis of these researches. They are of great practical value.

Intensive agriculture demands use of machines and tools for land preparation, sowing, harvesting, etc. and processing of agricultural products. Agricultural research institutes and universities are engaged in developing such machines and tools suitable for different local situations.

Forest denudation on a large scale, and consequent soil erosion, have raised real alarm in the minds of conservationists. The main reason for denudation is the increasing demand for fuelwood, paper, pulp and timber. Clandestine felling and no replanting are the other causes of denudation. Aggressive programmes for afforestation coupled with measures to stop clandestine felling are immediately needed.

The investment on forest research and development has not been commensurate with the magnitude of the problem.

Closely connected with forest development is the question of wild life preservation and management. The Indian Board for Wild Life, set up in 1952, has been instrumental in executing the 'Project Tiger' programme, in addition to setting up 126 sanctuaries and 5 national parks in the country.

The broad principles for producing and feeding crossbred animals for better performance have been laid down for the breeding of efficient livestock. Because of weak oestrous in buffaloes, artificial insemination becomes less successful if oestrous is not properly detected. Researches on locating the time of oestrus by determining progresterone level of plasma, and alternatively, on inducing oestrous by using chemicals like prostaglandin F_2 alpha and estrumate have been carried out with limited success. The problem of preserving buffalo semen for artificial insemination work has been solved by developing technology for frozen semen after nearly two decades of research. Suitable diluters have also been prepared, which ensure fairly good recovery of sperms. Sheep and goat constitute an important group of livestock, closely related to the economy of arid, semi-arid and tribal areas. Some useful breeds have been identified for the purpose of meat and wool.

Scientific research on poultry development started in an organised fashion with the establishment of the Poultry Research Division of IVRI. The introduction of deep

litter and cage systems of poultry keeping, production of balanced feed and multiplication of exotic and high yielding layers, health care, etc. have made an enormous impact on commercial poultry farming in both public and private sectors.

The occurrence of well-defined breeds of milch and draught animals in specified tracts for each class is the handiwork of modest farmers and the environmental factors. The occurrence of poor "nondescripts" in regions of high rainfall and paddy cultivation, and in coastal regions of India is caused by chronic underfeeding, malnutrition and indiscriminate breeding. Early attempts to breed camels, horses and cattle were aimed mostly at meeting military needs.

The Division of Animal Breeding and Genetics of IVRI has systematically explored the possibilities of artificial insemination (AI) on the basis of investigations on semen characteristics of different breeds of cattle, buffalo, goat, sheep, white leghorn and desi birds. The success of AI programmes is, to a large extent, attributed to thorough investigations and careful planning.

IVRI has developed a vaccine against rinderpest and its large-scale production using the tissue culture technique. It has also produced the polyvalent hydrogel vaccine for foot and mouth disease of livestock and stabilised the production of rabies vaccine.

Research centres spread over the whole country are working on various other diseases of livestock, including contagious bovine pleuropneumonia, loptospirosis, salmonellosis, tuberculosis and Johne's disease, mastitis and brucellosis. The FAO/WHO Brucella Reference Centre, catering to the needs of the countries of SE Asia region, is located at IVRI. The National Brucella Reference Centre is also located there.

ICAR has established a number of centres to study parasitic diseases of cattle, goat and sheep and to find remedies for them.

Improvement has been achieved in *desi* poultry by a process of feeding, culling and selective breeding for high egg-laying capacities. The keeping quality of eggs could be increased by lime sealing of heat treated eggs. The vaccine for Ranikhet disease was evolved by IVRI. Immunity is produced in 3-4 years after vaccination and lasts for 3-4 years. An intranasal application of the UK F strain followed by the Mukteswar strain between 6 and 10 weeks gives lifelong immunity. Fowl-pox can be eradicated for life by administering the vaccine developed at IVRI.

Significant advances have been made in the development of designs of trawlers and fishing gears as a result of researches carried out by the Central Institute of Fish Technology. It has also developed some standardized methods of processing and preserving fish. The Central Inland Fisheries Research Institute has established methods of breeding, rearing and management of both captured and culture fisheries in fresh and brackish waters. Aquaculture techniques of induced breeding by pituitary hormone

administration of major carps and Chinese carps and of bandh breeding of grass carp and silver carp have opened up new avenues for fresh water fish seed and fish production. The development of a hatchery provided with circulating water and package of practices for composite fish culture have made fish production commercially viable under pond condition.

Soon after independence, research efforts were also directed to the development of arid zones, drylands, hill areas, salt-affected lands and tribal areas. The Central Arid Zone Research Institute has made a thorough assessment of the natural resources of Indian arid zones together with areas affected by salinity and alkalinity, the land use pattern of these zones, soil fertility level, water resources, livestock population, cropping systems, etc. in order to make their effective utilisation. The Institute has identified suitable crops and evolved economical cropping and water harvesting systems.

The Dry Farming Research Scheme of ICAR conducted for ten years (1933-43) came out with recommendations such as bunding, deep ploughing, use of farmyard manure and of low seed rate for dryland agriculture. The yield improvement was marginal. Later researches suggested that in view of the short period of water availability, crops which mature within this period would grow favourably. Such plant materials became available by 1955, the most important being jowar CSH-1 and bajra HB-1, and cotton-PRS. They could really make a breakthrough in dryland agriculture. The All-India Coordinated Research Project for Dryland Agriculture has systematically made use of jowar, bajra and cotton varieties bred for low rainfall conditions. Twenty three research centres located in various dryland areas are collaborating in this project. During the last decade or so, quite a few good yielding crops for different areas have been identified. Cultivation practices suitable for each area have also been evolved.

An alternative to jhuming in the hill areas has been suggested in which the lower portion of a hill slope (approximately 1/3 area) is bench-terraced for normal agriculture, mostly paddy or maize cultivation, the mid-portion, also comprising 1/3 area, is half-moon terraced and used for horticultural crops, while the steepest slope is utilised for forest plantation. This land use pattern conserves soil against erosion and gives economic returns.

Salt-affected areas are the product of irrigated agriculture with faulty drainage. Such soils as have turned sodic may be reclaimed by the use of gypsum, the technology for which has been successfully developed by the Central Institute for Soil Salinity Research. It has evolved packages of practice suitable for specific situations. In the saline areas, salt-tolerant crops seem to work better.

The problem of introducing agriculture in the tribal areas is attended with many difficulties. The studies so far initiated in the tribal areas suggest that in keeping with the traditional beliefs of these people, it would be expedient to work within the existing farming practices, and gradually to introduce improvements. Fruit trees, pig and poultry farming and mixed farming fit in with tribal situations. Not many scientists

have the inclination and patience to work in such difficult areas, and hence not much success has been achieved in the development of tribal areas.

In the above context, the Government of India appointed the National Commission on Agriculture (NCA) on 29 August 1970. The NCA submitted its final report in January 1976 in 15 parts consisting of 16 chapters. It also submitted in the course of its deliberations 24 interim reports. In addition, 16 detailed reports were prepared on rainfall and cropping patterns for consideration of state authorities dealing with crop planning. Some NCA recommendations have been implemented, but many more are lying unattended.

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