STATEMENT OF PROBLEMS AND MEANS OF INCREASING RICE PRODUCTION

By Dr. K. Ramiah

[*Rice Expert (Retired), Bangalore*]

India has the largest area under rice (75 million acres) among the rice growing countries of the world, and her production, about 25 million tons of white rice, is the second largest. Rice is the most important staple food of the country and contributes to over 45 per cent. of the total cereal production. The average acre yield of about 800 lb. of rice is perhaps the lowest in Asia, the only other country that records still lower yields being the Philippines. India and Japan are the two largest rice deficit countries of Asia. During and immediately after World War II, world rice production was considerably short of requirements, price shot up and rice deficit countries experienced great difficulties.

The chief rice surplus countries of Asia, namely, Burma, Thailand and Indo-China before World War II used to meet not only the deficit of other Asian countries but also export appreciable quantities of rice to markets outside Asia. At the present moment, however, they are not in a position even to meet the complete needs of Asia. Because of the great rice shortage and the consequent more favourable price for rice, countries outside Asia that previously did not grow much rice increased their production, and among these, U.S. is the most important. She has become the third largest rice exporting country now. All countries in Asia took steps to increase their internal production, and it may be said that the pre-war level of production was reached by about 1951–52. Favourable seasons and good harvests in 1953 and 1954 created a temporary situation of falling prices and rice surplus countries meeting difficulties to dispose off their surplus. Among the remedies considered to relieve the situation was one of advising rice deficit countries of South-East Asia that they should not aim at self-sufficiency because the economy of rice surplus countries was so much dependent on their rice exports. This, however, was only a temporary phase and the present position is again what used to exist previous to 1953.

Steps taken to increase internal production has given somewhat satisfactory results in many countries, but the most outstanding results have been obtained in Japan. The increased production has, however, been more than

off-set by the increase in population. The additional production in all countries including India has mostly come from increase in the area under the crop. Japan is the only country where increased production has followed increased acre yields as a result of adopting intensified cultivation practices. It may be mentioned here that generally increase in area is accompanied by a fall in acre yields.

Scope for increasing the area under the crop does not exist in many countries and even where they do, may involve a good deal of capital investment, and the new area may not be quite suitable for the crop. India has to depend more and more upon increasing her acre yields rather than on increasing the area under the crop. A rough examination of the existing statistics over a period of 50 years from 1900 does indicate a definite downward trend in acre yields. This is in contrast with the position in Japan where the acre yields has a marked upward trend though this was not very apparent during the period of World War II. The comparison between the two countries may not be strictly valid because, firstly, the total rice area of Japan is only a small fraction of that of India, and secondly, rice growing conditions in Japan are relatively much more uniform than in the continent of India. A closer study* of the acre yields in India for a 5-year post-plan period does indicate a 10 per cent. improvement corresponding to a 2 per cent. annual increase. This increase is not, however, evenly spread over the whole rice area of the country. The increase has come about by an increase in the acre yields of nearly 16–17 per cent. in the two States of Madras and Andhra Pradesh, about 9 per cent. increase in the yields of Mysore, West Bengal and Madhya Pradesh, and there has been no appreciable improvement in the acre yields of other States. The acre yields of the problem States of East Uttar Pradesh, Bihar and Orissa bring down the average for the whole country. It has to be mentioned in this connection that the present upward trend in higher acre yields, if maintained, can only meet the continuously increasing demand for more food because of the rapidly increasing population. It will not allow for any improvement in the present level of *per capita* cereal consumption which is the lowest, and much below the optimum requirements.

The chief methods available to increase acre yields are: (i) improvement of water facilities, (ii) improvement of varieties by breeding, (iii) improvement of the fertility of the soil, (iv) improvement of cultivation practices and (v) prevention of losses due to pests and diseases. These are briefly referred to in the following pages.

* Information provided by Dr. V. G. Panse, Statistical Adviser, I.C.A.R.

1. With regard to improving water facilities several projects, large and small, have been executed and their role in increasing production is just becoming significant. It has to be understood that only one-third of the rice area in the country has irrigation facilities. Some knowledge exists on the water requirements of the crop, but this knowledge is more empirical and a good deal of research is needed to understand the soil-water-plant relationship. Critical information on the water requirements at the different phases of the plant's growth does not exist. It is known that lack of water at critical stages of plant's growth can appreciably affect production. It can also be said that lack of drainage, characteristic of the lower portions of river deltas, also affects production. A study of the relation between water-supply by irrigation or by rain does indicate that regulated and adequate water-supply by irrigation is much more important than rain.

2. It can be said that India has made a considerable advance in rice breeding, but this advance is not common to the whole country. It needs intensification in several areas. One reason that rice breeding has not contributed tangibly to increased production is the lack of suitable organisation for seed multiplication and distribution of improved varieties. The matter has started receiving attention only in recent years. The principal objective in breeding has hitherto been increased acre yields though other benefits have been obtained incidentally. Breeding for resistance to diseases has also received some attention with noteworthy success in Madras. The present position of varieties calls for intensification of breeding with additional objectives. The most important of these objectives are: (i) varieties with strong non-lodging straw, (ii) varieties with a greater response to soil fertility, (iii) varieties non-sensitive to photoperiod, (iv) varieties that will mature early, etc. The International Rice Hybridisation Project initiated by F.A.O. in 1951 had the above objectives in view. Additional objectives in breeding that offer promise are resistance to adverse factors and improved nutritional quality. The lack of trained personnel and facilities is, however, a bottleneck operating against intensifying breeding programmes in all rice States. Breeding for several of the objectives mentioned above can, however, lend itself to a co-operative undertaking among the States.

3. Ideas on soil fertility have changed and soil survey and chemical analysis of the soil are not the sole criterion for determining fertility. The soil analysis has to be integrated with extensive field experiments. In rice areas where only a single crop of rice is grown in a year, the fallow period helps the soil to recoup fertility, and acre yield is maintained at a constant though low level from year to year. Experimental work has shown that

additions of both organic and inorganic fertilisers to this crop can increase production. One of the easiest methods of supplying organic manure for rice is by growing a green manure crop, often a legume, and turning it into the soil before rice is planted. This is the cheapest form of manuring rice crop and the practice has to be intensified wherever facilities exist or can be managed. A judicious application of chemical fertilisers in addition to organic manures is a sure means of increasing production. Though more research is required there is enough information that has become available in the last few years which can be utilised to go ahead with the use of chemical fertilisers in suitable quantities in different parts of India. Rice growers, particularly in the Southern States, are getting increasingly fertiliser minded, and the present difficulty is lack of adequate supplies to meet the increasing demand.

Among the essential nutrients, the greatest need for rice is nitrogen and the response to application of nitrogen is practically universal throughout the country. The response for phosphorus is somewhat lower than for nitrogen, but the need for phosphorus is found to exist on nearly 50 per cent. of the total rice area in the country. In fact, in some areas as in parts of Assam, Madhya Pradesh and Bihar, phosphorus is the limiting factor to increased rice production. In these areas no response is obtained for nitrogen without the addition of phosphorus. The all-India fertiliser trials in the cultivators' fields have shown that response to nitrogen at 30 lb. per acre is high in all places and the response ranges from 330–886 lb. per acre. The response to an equal quantity of phosphorus is much more variable and ranges from 90–940 lb. per acre. Based on the soil types the response to nitrogen over phosphates is more definite according to the soil type. It is low in coastal alluvium and laterite soils, but high in medium black, red and gravelly soils. These trials have also shown that the response to nitrogen and phosphorus obtained in cultivators' fields are much higher than those obtained in experimental stations in earlier years. Besides nitrogen and phosphorus, special areas have also shown response to potash.

Although ammonium sulphate has been the chief nitrogenous fertiliser in use so far, experiments have shown that other more concentrated nutrients like urea and ammonium nitrate can give equally satisfactory results. It is possible that the efficiency of these fertilisers may be somewhat lower than that of ammonium sulphate in some areas, but the greater concentration of nitrogen and less cost per lb. of nitrogen are points in their favour. With regard to requirements of fertilisers, it has to be understood that organic manures and chemical fertilisers are different in their functions and have

to be looked upon as complementary agents in crop production rather than as a substitute for each other.

Fundamental to the use of fertilisers is the study of chemistry of swamp soils. Tnis has not received much attention in India so far. Work would be particularly desirable to obtain information on the availability or otherwise of particular nutrients as a result of the swamp conditions under which the plant grows. For example, the rice plant needs a considerable amount of silica and iron which the plant can utilise only under swamp conditions. Connected with the use of fertilisers, investigations would also appear necessary to determine how much of the nutrients applied to the soil is actually utilised by the plant. Information is lacking on the question of absorption and assimilation of nutrients by the rice plant at different phases of its growth. It is only such information that can ultimately lead to more dependable results on the question of nutrients to be applied, and how and when they are to be applied to get the maximum benefit.

Experiments at the Cuttack Rice Research Institute and also elsewhere have definitely shown that the application of nitrogen in the form of ammonium sulphate in the subsurface (plough sole) is much more efficient than surface application. There is urgent need for extending this practice under cultivators' conditions. There is also information available that the nitrogen is better applied in split doses at different growth phases of the plant, particularly, when the variety grown takes 150 days or more to reach maturity.

4. Wet rice cultivation does not offer much scope for introduction of large-scale power-driven machinery. There is considerable scope, however, for introduction of improved hand and animal-driven implements. In some areas where carrying out the field operations in proper time is more important, even power-driven machinery may offer scope provided they are either co-operatively owned or can be hired out to growers at reasonable rates. Two operations that may be considered in this connection are preparation of the land for planting, and threshing of the harvested produce. Transplanting seedlings in puddle is the most arduous operation concerned in wet rice cultivation, and research is needed to develop a direct method of sowing the crop, and experimental results already available indicate considerable scope for the practice. One operation that does not receive sufficient attention in India and which may be responsible for a loss of 10–15 per cent. in yield is weeding. More advanced countries where labour is more expensive than in India are successfully using herbicides to control weeds. Their efficiency has also been established in India, but they cost more than hand-weeding.

5. Post-war research on chemical insecticides has produced phenomenal results, and very efficient insecticides are now available. With a suitable organisation to provide timely help to the rice grower, loss of crop due to insects can be almost completely eliminated. Chemicals may also be useful to control some diseases, but the more effective means of preventing losses due to diseases will be to intensify breeding and to evolve disease resistant varieties. Breeding for resistance to blast has proved successful in Madras and since this is the most important disease of the southern region, there is scope for undertaking a co-operative project of breeding for resistance to blast among the States of the region. Breeding for resistance to insects has not received much attention, but the enormous variability present in rice varieties of resistance to stem-borer, the most pernicious insect pest of rice, can be utilised in a suitable breeding programme.

6. In considering various methods of increasing production, it is necessary to emphasise that the greatest benefit can accrue only from a fully co-ordinated programme where all aspects of production receive attention. The importance of this point has become particularly apparent in the programme of the Japanese method of rice cultivation which is being followed in different parts of India. The features connected with the Japanese method are several in number, but the full benefit of the method is realised only when all the features are followed together. It has been estimated by experiments that application of chemical fertilisers is the most important feature of the Japanese method and accounts for nearly 60–70 per cent. of the higher yield obtained as a result of the method. The other cultivation practices associated with the method account for the rest of the higher yield obtained. It should be mentioned that the essential elements of the Japanese method are interrelated and lack of any one of these is likely to reduce the efficiency of others.