

PLANNING FOR THE RELEASE OF SYNERGISTIC FORCES IN AGRICULTURE

By

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Synergistic inter-actions have been the most potent tools employed in biological evolution and organisation. In a country with poor resources, planning for synergistic effects is the only means of making rapid progress in the economic field. Unfortunately, little serious attention has been paid to the conscious development and release of synergistic forces in economic growth and development. In the field of agriculture, the High-Yielding Varieties Programme particularly in wheat is the first example of the initiation of a well-planned synergistic inter-action in increasing productivity. The result has been the spread of new wheat varieties to over 4 million hectares in contrast to the target of 2 million hectares by 1969-70. Due to the inadequate development and introduction of the different components of a synergistic package covering both pre-harvest and post-harvest technology, the success in the case of rice, maize, jowar and bajra has not been as spectacular as in the case of wheat. The position is even worse in unirrigated areas where small independent steps such as contour bunding have been the primary methods adopted for achieving agrarian advance. Since interest has now been aroused in such areas because of social considerations I would like to deal in this article with what has been achieved in the irrigated areas and what can be accomplished in dry areas.

I. Irrigated areas:

Until recently the production potential of Indian soils was considered to be low. The impact of the High Yielding Varieties Programme initiated in 1966 has helped to destroy this concept and it is now clear that the tropical and sub-tropical climate, far from being a handicap, is full of immense potentialities for crop growth. The High Yielding Varieties Programme was conceived for

- (a) Capitalising on the advantageous features of our agricultural situation and achieving food self-sufficiency by 1970-71;
- (b) For showing that even a farm holding of one hectare in size has the potential for giving a good income; and
- (c) For leading to alternative land use and crop use patterns which could help in making agriculture a potent instrument of agrarian prosperity, in addition to making India self-sufficient in its food needs. The success of the programme has generated a climate of self-confidence in our agricultural

capabilities. However, it is already obvious that if the programme is to achieve the aims stated earlier it is essential that the difficulties and problems of farmers with small holdings in irrigated areas should be studied and solved. Also, problems relating to post-harvest technology such as processing, storage, marketing and pricing need more concerted and coordinated attention. The changing ecology of rural areas as a result of the exploitation of water resources and the introduction of new practices need also both understanding and scientific control. Stability in production can be achieved only through an integrated attention to all problems concerning soil, plant, water and economic relationship. It is essential that India uses the latest scientific tools in studying the major problems dealing with crop production.

Analysis of the economic benefits accruing to farmers in the different districts covered by the High Yielding Varieties Programme has shown that in districts like Ludhiana where the adoption of the new technology has been most widespread, large farmers, small farmers and landless labour have all benefitted from the increased income. Also, a wide range of agro-industries has sprung up leading to the absorption of labour from agriculture. This in turn has led to the necessity of introducing more efficient implements and agricultural machinery. In contrast to this situation, mono-culture rice areas such as Kuttanad in Kerala, Thanjavur in Tamil Nadu and Bardwan in Bengal are regions characterised by a considerable degree of agrarian unrest. Although there has been a slight increase in the income from agriculture in these areas, the landless labour and many tenant farmers have really lost ground in real income. This is an irony because these districts are well-endowed with culture and have a high yield and income potential. The new technology in rice is unfortunately not as advanced as in the case of wheat and it is necessary to step up our efforts in evolving a improved technology for rice cultivation. Also in mono-culture areas there is need for evolving plans for the development of agro-based industries so that some of the surplus farm labour can find alternative gainful employment. Diversification of cropping patterns in addition to rationalization of land tenure and ownership systems are urgently needed. There is no scientific excuse for breeding poverty in agricultural populations in areas endowed with good water supply.

II. Unirrigated Areas

1. Dimensional considerations:

Unirrigated farms occupy nearly 80 per cent of the total cropped area of 138 million hectares. Out of this area, about 41.6 million hectares have an average rainfall of 1150 mm and above and about 49 million hectares receive a rainfall ranging between 750 and 1140 mm. It is the areas where there is neither dependable irrigation nor adequate rainfall that cropping offers both poor returns and great instability.

Research on dry farming practices has been in progress for about 30 years and certain useful practices for moisture and soil conservation have been developed. Studies have also been conducted at several research centres on the selection of varieties which perform better under conditions of low rainfall, on the methods of application of nutrients to crops and on suitable cropping patterns. However, no attempt has so far been made to apply an integrated package of technology involving the simultaneous application of all the results of research. Consequently, the individual practices developed by scientists working in different disciplines have not found wide adoption because of their marginal impact on productivity and income. It is only when the different procedures like better tillage, soil and moisture conservation, better varieties and better nutrition are made to interact that an yield and income jump of a larger quantum per unit area is likely to arise.

The dry areas contribute as much as 42 per cent of the total food output. Also, in these areas the relative proportion of landless labour is high with the result that whenever crops fail due to drought, there is considerable unemployment and misery. The introduction of a new agricultural development strategy for such areas based on the available research information is, therefore, an immediate necessity. The desert areas of Rajasthan and Kutch need a technology different from those of unirrigated, low rainfall areas and hence should not be mixed up with the latter.

2. Important Parameters which need to be taken into consideration in developing the new technology:

a) Topographic features: In many dry areas, the land is very undulating as a result of erosion of different kinds over a long period of time. In such areas, it would be essential to introduce some basic soil and moisture conservation measures before the other components of the new technology can be successfully introduced. For doing this, consolidation of land holdings would be very essential. In areas where the level of the land is not unfavourable for adopting moisture conservation practices, consolidation of holdings, though desirable, will not be an immediate pre-requisite for introducing new practices. The areas where consolidation of holdings should be taken up immediately should be worked out by a group of soil conservation engineers on the basis of studies of topographic features.

b) Soil characters: A soil map of the dry areas is appended. In areas with heavy or medium black soils, the water holding capacity is quite high. In contrast water conservation needs more attention in the light red or loamy soils. The precise techniques which will have to be introduced for the conservation of moisture will vary depending on the physical characteristics of the soil. For example, deep

ploughing would be very beneficial for retaining moisture and for promoting root growth in the light soils with a hard pan below, while it would not be essential in the heavy black soils. The depth of the soil and the nature of its origin will all have to be taken into consideration while formulating the precise cultural practices that should be recommended.

c) Chemical constituents of the soil: A soil fertility map of the dry regions is appended. Most of the soils in the dry areas are very low in nitrogen and hence the application of nutrients would have an immediate beneficial effect. Studies have shown that to get a tonne of wheat, about 25 kg of Nitrogen would have to be available to the plant and that only about 20% of this quantity is generally provided by the soil. Therefore, the amount of nutrition supplied would set the ceiling with regard to yield. The areas which are favourable for being developed into animal rearing regions will have to be examined for the presence of micro-nutrients in addition to the major elements like nitrogen, phosphorus and potash. The type of wool produced or the rate of digestion of the different kinds of fodder crops may all be influenced by the adequacy of micro-nutrients like cobalt and Mn.

d) Rainfall pattern: The pattern of rainfall needs to be studied carefully in each region for evolving new crop patterns. In the heavy black soils, often no crop is grown during the rainy period because of difficulties in land preparation and weed control. In general, the aim should be to develop techniques by which two short duration crops can be taken in most of the dry areas in the place of a single long duration crop generally cultivated now.

e) Introduction of water harvesting procedures: In ancient India, the construction of tanks was resorted to very widely for collecting and storing rain water. During the last few centuries, many of the tanks have silted up through erosion and neglect. Over 1,000 large tanks have been found in by A chaeologists in Madhya Pradesh which had apparently gone out of use in recent times. Collection and storage of water during the rainy period should form an integral part of the new strategy of development of dry areas. For this purpose, both centralised storage reservoirs as well as a decentralised net work of individual farm storage structures may have to be developed depending upon the topographic features and soil structure of the region. The use of indigenous material like bentonite clay should be studied in lining reservoirs. The exploitation of ground water resources, wherever possible, should also be initiated.

f) Marketability of produce and general farm economy: It is obvious that if both irrigated and unirrigated areas increase substantially the productivity of our major food crops, the prices of food grains cannot be maintained at a remunerative level. Therefore, the cropping patterns developed for the dry

areas should be such that the marketability of the produce at remunerative levels can be assured. Deep-rooted crops like castor and cotton as well as pulses and groundnut do well in dry areas and with the introduction of better moisture conservation and crop-feeding practices, their yields can be substantially increased. Similarly, animal husbandry will have to be fostered by both increasing food and fodder production as well as arranging for proper marketing. This would imply also an attention to communications and warehousing facilities. Unless suitable cropping and land-use patterns which would assure a better return from unit area are introduced, it may be difficult to get the new practices adopted by the farming community on a large scale.

g) Weather data: Weather data at the macro-level are available for most parts of the country. The coverage of the meteorological stations in the dry areas is inadequate for more sophisticated crop planning. For this purpose a greater dispersal of meteorological stations with facility for recording the number of sunshine hours in addition to rainfall, temperature and wind velocity is required. Steps should also be initiated for making medium range weather forecasting, so that the sowing operations can be organised scientifically.

h) Intensification of surveys and the use of Remote Sensing techniques: The soil survey data presently available largely relate to the catchment areas of the River Valley Projects. It is necessary that new techniques such as Remote Sensing are adopted for getting information speedily on land classification, organic matter content and soil moisture availability. The United States is planning to launch an Earth Resources Satellite sometime towards the end of 1971. It would be very useful to develop a team of scientists immediately who would be able to interpret the information collected by this satellite from our country.

i) Problems of malnutrition in dry areas: The drought affected areas have in addition to problems of protein-calorie malnutrition have also special problems such as pellagora arising from Jowar being the sole staple and lathyrism caused by the excessive consumption of Khesari dal. By suitable crop planning, these diseases can be banished. The animals in these areas, being poorly fed, have also very little capacity to handle new implements requiring a greater output of energy. Therefore, while planning the introduction of a new technology, it is very important to remember that certain changes like heavy iron ploughs to poor vigour of both the cattle and human populations will have to be taken into account.

j) Animal improvement: The prospects for better feeding and for genetic upgrading through artificial insemination should be explored.

3. Scientific Ingredients of the New Technology

The development of a new technology for drought-prone areas has to be based on (a) land consolidation and soil conservation, (b) improvements in tillage leading to better soil structure and root penetration, (c) addition of organic matter in the form of plant residues with a view to improving the physical and biological characteristics of the soil, (d) adoption of water-harvesting procedures resulting in storing as much of the precipitation as possible for the use of crops, (e) addition of plant nutrients through deep placement of fertilizers and foliar feeding, (f) improving the biological fixation of nitrogen through the use of efficient strains of rhizobia, particularly those which are tolerant to salt, (g) the introduction of photo-insensitive and quick maturing crops which are less affected by drought, (h) development of series of single, double and mixed crop rotations from which the farmer can be advised to adopt the one which is most suited to the likely weather pattern during a season (advances in weather forecasting render such planning possible), (i) popularization of crops like soyabean, high-protein maize, macroni wheat, short-duration varieties of castor and cotton and perennial crops like cashewnut oil palm and dates which can form the base for small scale food industries and export earnings, and (j) the popularisation of grasses like lemon grass, Panicum, Cenchrus and high-protein bajra, and (k) genetic upgrading of the nondescript cattle population by an extensive programme of artificial insemination with semen from superior breeds. While the above would constitute the major ingredients of an immediate action plan, a systematic survey and development of ground water resources should be initiated so as to gradually reduce the effects of weather on cropping and to increase the income potential of agriculture.

An analysis of the percentage of agricultural workers in relation to the total work force reveals that even in 1981 69.51 per cent of workers will have to depend on agriculture for their livelihood. It is, therefore, very important that serious attention is paid to increasing the employment potential of agriculture. A study carried out at the Punjab Agricultural University reveals that the introduction of an improved technology enhances the employment opportunities by over 25%. This is with a two-crop per year system. The employment potential becomes greater when 3 and 4 crop relay systems are introduced. Similarly, in unirrigated areas the replacement of a single long-duration variety with a two crop system would help to increase employment and minimise under-employment. For achieving this, agriculture has to be looked at not merely as an instrument of achieving food self-sufficiency but as a method of improving agrarian prosperity.

What has happened in the irrigated areas particularly in the wheat areas is only a breakthrough in yield possibilities. During the seventies, we should strive to transform the breakthrough into a revolution. This will be possible with the present resources only if we pay attention to synergistic planning and implementation.
