

# THE GREEN-REVOLUTION PROS AND CONS

## Adoption of new technology in farm management bring self-sufficiency in food

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THE IMPACT OF THE 'GR' TECHNOLOGY ON EMPLOYMENT IS NOT CLEAR-CUT BECAUSE A WIDE VARIETY OF FACTORS ENTER THE EXPLANATIONS SO FAR EMPLOYMENT EFFECT OF THE NEW TECHNOLOGY IS CONCERNED. SUCH FACTORS INCLUDE QUESTIONS ABOUT FAMILY AND NON-FAMILY LABOUR, PERMANENT AND TEMPORARY LABOUR, PEAK AND OFF PEAK LABOUR REQUIREMENTS, SHORT-TERM AND LONG-TERM IMPACTS ON EMPLOYMENT AND SO ON.

**T**he 1960 was an era in which the Green Revolution acquired a central role in the development of agriculture in the less developed countries. There was a wave of optimism about the growth and output of food supplies and hence about the 'overall development of the LDCs of the third world. But the optimism gave way in the following decade i.e., 1970s to concern about the future trends of food production and particularly to concern about deepening rural poverty. The purpose of this paper is to examine the pros and cons of the new technology by reviewing some studies in 'technological' as well as 'institutional' framework on Farm Management related to the Green Revolution.

Seed-fertilizer-water and tractor are the core of the GR of which the new high-yielding varieties (HYVS) of wheat and rice are the most prominent. The fact that new HYVS are not sen-

sitive to differences in day-length makes them adaptable to a wide range of conditions and thereby increase the possibility of wide adoption in many parts of the world.

### IMPACTS OF GREEN REVOLUTION

The GR had its impacts on the various aspects of farming including the agrarian relations of production and exchange. We shall, however, pay attention to the following aspects in particular.

#### IMPACT ON AGRICULTURAL PRODUCTION

There is no doubt about the fact that the countries where 'green revolution' has taken place, were originally importers of large quantities of foodgrain. Whatsoever, the amount of food these countries produced of their own, it was produced at a high cost (Dalrymple and Jones, 1973). The HYVS have made a large contribution to the total agri-



cultural output of these countries. In the early part of the 1960s, new varieties of wheat were taken up by Mexican growers who planted on 90% of the country's wheat land, doubling the average yield per acre/hectare in comparison to the traditional varieties of wheat (Ojala, 1972). Multiple cropping pattern has been possible due to HYVS because these varieties are, generally, early maturing and therefore their growing season can be shortened by almost one-third. As such two or more crops can be grown and harvested in a 12 months period in tropical and sub-tropical regions. The breeding of early-maturing

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rice varieties enabled the producers of Taiwan to more than double (ie; quadruple) cropping by adding a winter catch-crop and a summer catch-crop between the first and second rice crops (Ho, 1966).

The proportion of the total areas sown to HYVS of wheat and rice in the LDSCs in 1976-77 is shown in the Table.

**TABLE**  
**PERCENTAGE OF HYVS AS A**  
**PERCENTAGE OF TOTAL**  
**AREA SOWN TO WHEAT AND**  
**RICE IN THE LDSCS IN 1976-77**

Crop	Area
Wheat	30
Rice	13
Other	4

Source: Food and Agriculture Organization, Rome, 1978

The Mexican wheat varieties were introduced in Pakistan in 1965. By the year 1971, 3,037,000 hectares or about 50% of the area under wheat were planted to the new high yielding varieties (IRRI, 1975). The area planted to HYVS of wheat and rice rose from zero in 1965-66 to 43.9 million tons in 1976-77 with slowing-down in 1973-75 due to fertilizer shortage (FAO, 1979). Wellhausen (1970) has documented the impact of HYVS of wheat on the economies of several countries. Pakistan raised its total output of wheat in five years from 4.6 million to 8.4 million, an increase of 83%. India, with similar varieties and technology, raised production from 12 million tons in 1965 to over 20 million tons in 1970, an increase of 64%.

Due to high yields, water is used efficiently by HYVS in comparison to traditional varieties. In a comparative study of well irrigation in India, it was found that the response to increments of water and fertilizer was four times as large for Mexi-

## THE DOMINATING OPINION IN THE LITERATURE ABOUT THE IMPACTS OF THE 'GR' ON EMPLOYMENT IS THAT WITH NO CHANGE IN THE DEGREE OF MECHANISATION, THE GR HAS INCREASED LABOUR REQUIREMENT PER UNIT OF LAND, BUT HAS DECREASED LABOUR PER UNIT OF OUTPUT.

can wheat as for traditional variety, and almost five times as large for hybrid millet as for native variety (Moorti, 1971).

The Philippines attained self-sufficiency in rice in five years with extensive plantings of IR8 variety. Some shortage in rice, however, occurred in 1971, the causes of which are somewhat socio-economic rather than pure technological (Castillo, 1975).

The spread of hybrid maize in LDSCs is generally slow. The reason of this is the nature of problems associated with the production of seed and the need to replace the hybrid seed every year. Yet in Thailand, the production of maize increased at the rate of about 52,000 hectares and 100,000 tons per year by the use of new HYVS. Pakistan reported a 30% increase in yield of maize. India also reported an increase in the area by 40-50% since 1960, with output per unit i.e., acre/hectare increasing steadily.

### IMPACT ON EMPLOYMENT

The impact of the 'GR' technology on employment is not clear-cut because a wide variety of factors enter the explanations so far employment effect of the new technology is concerned. Such factors include questions about family and non-family labour, permanent and temporary labour, peak and off peak labour requirements, short-term and long-term impacts on employment and so on. In a study of 32 villages covering a broad geographic rice growing in Asia and reflecting a wide range of conditions, it was found that a large proportion of rice growers reported an increase in

the use of family or hired labour following the adoption of new high yielding varieties of rice. The increase in pre-harvest labour requirement was related to the concurrent adoption of other preharvest improved practices. Villages with a high percentage of farms reporting increase in labour requirements were those in which a high percentage of farmers had also adopted fertilizer use, insecticides, and straight-row planting (Barker and Anden, 1975).

In certain land operations such as land preparation, seeding or transplanting, the 'GR' may have no effect on labour requirements, but if harvesting and threshing is carried out in the traditional way, these operations are bound to require more labour. The use of fertilizer generally requires intensive weeding, thus creating demand for labour. Multiple-cropping patterns increase labour requirements and can also help to level off seasonal peaks in labour requirements (Giles, 1975). The dominating opinion in the literature about the impacts of the 'GR' on employment is that with no change in the degree of mechanization, the GR has increased labour requirement per unit of land but has decreased labour per unit of output. Within crops, increases per unit of land have been larger for wheat than for rice (Dalrymple and Jones, Opcit).

The long-term effects of the 'GR' on employment are temporary because, in the long run, rising real wages and labour problem (i.e., unrest) lead to an increase in mechanization, especially on big farms. Higher profitability also encourages the use of machinery which en-

courages labour-saving practices (Baker and Anden, Op cit). In Mexico, for example, the profits generated by the 'GR' made possible for large farmers to invest heavily in labour-saving machinery, which has become a symbol of status and progress. The result was that by 1971, in Sonora many field workers who previously participated in the clearing of land, could work for only six months in a year.

Changes in the employment of labour force also occur due to the type of machinery used. A typical wheat harvesting combine originally required eight to nine men to operate it and to handle the sacks of grain. As the cost of labour increased, the old machinery was replaced by modern combine, operated by a single worker. Labour-saving combines were not the only innovation to be adopted; larger tractors replaced small tractors and new labour-saving attachments were increasingly introduced (Alcantara, 1976). In Thailand, rice-cultivators found it economical to hire tractors for ploughing, instead of using buffaloes which are required to be maintained throughout the year and are used only for a few weeks at the time of ploughing. In 1968, some 20,000-25,000 tractors ploughed an estimated quarter of the rice-acreage mostly on a custom-hire basis (Brown, 1968).

There does not seem clear consensus regarding the overall long term effect of the 'GR' technology on farm employment. Johl, (1975) argues that new technology is essentially bullock-displacing, rather than labour displacing. In Pakistan, for example, the total changes in the number of work animal after purchase of tractors as reported by private tractor owners, shows a reduction of 56%. In the Punjab, Baluchistan, N.W.F.P. and Sind, the percentage of reduction in the number of work animals was 62, 45, 37 and 36 respectively (Agric-statistics of Pakistan, 1981).



This suggest that Sind and N.W.F.P. are the least mechanized Provinces in terms of agricultural practices. However, the new jobs created by the adoption of HYVS for operating tractors, pumps, the application of fertilizer and the resulting double-cropping would more than compensate for the loss of work associated with the use of bullock power. It has been argued by many that increased agricultural output improves the overall national economy, thereby increasing employment opportunities especially in agro-based industries. Baker and Anden's (Op cit) findings confirm that even where the use of tractors and herbicides was common, labour requirements had increased with the adoption of HYVS. The labour-saving effects of tractors and herbicides had apparently been more than offset by the increased pre-harvest labour requirements of HYVS. This seems to be more nearer to truth as long as mechanization is selective; but when discriminate, HYVS accompanied by mechanization, may cause unemployment of agricultural labour. For example, in the Punjab province of Pakistan, mechanization reduced the labour force

by about 50% (Bose and Clark, 1969). The mechanized cultivation of wheat may cause unemployment of labour (Dalrymple and Jones, op cit). Multiple-cropping patterns which is possible by the use of HYVS is not without problems. It requires an appropriate varieties of seed, a relatively high degree of technical know-how and farm management skill, an assured supply of water and an increase in the use of inputs such as fertilizers and pesticides, improved methods of agricultural marketing and credit, (Dalrymple, 1971). All this is not within the reach of a majority of farmers in LDCs who are just survival minded due to: (a) their own socio-economic conditions of reproduction and (b) due to agrarian structure and environment in which they operate, a topic to which we now pay attention in the following.

## GREEN REVOLUTION AND THE AGRARIAN TRANSFORMATION

So far I have discussed and analysed the GR and its impacts from the point of view of main stream agricultural eco-

nomics of Farm management involving those scholars who write mainly in technological or neo-classical tradition and who prescribe policies and strategies aim at certain goals. Among them J. Mellor's approach (1966 and 1976) has been, perhaps, the most influential in the modern period in Pakistan and India.

There is, however, another school of writers — radical economists — as they are generally called, who examine the question of GR and mechanization with a very different set of argument to locate the problem not in overall technical constraints but in agrarian structure and conditions of production. To name but a few such writers, we may include. A. Bhaduri (1983) from India and H. Alavi (1976), a former Pakistani scholar of repute, now in the U.K. They advance a rather different level of argument. It has been suggested by A. Bhaduri (Op cit) that, given a system of share cropping by a semi-proletarian class of tenant farmers who are bound by the consumption loans to the land-lord, the decision whether to introduce or not to introduce the new technology rests with the land owner and not the tenants. Thus, explanation is to be found in the contradiction between forces and relations of production in pre-capitalist agriculture. The land-lord does not like to introduce changes which would improve the output of land. It is because that increased productivity is likely to lead to improve the economic condition of the tiller of the soil which in turn is highly likely to lead the eventual independence of the tenant farmer from debt-bondage and thus to the breakdown of the exploitative relations of production. Many have argued that it is profitability of usurious money lending under the conditions of production (ie., economic conditions of the farmers) that retards a shift to the 'GR' technology. This argument is interesting because

**THERE IS A GROWING CONSENSUS OF OPINION IN THE LITERATURE THAT 'GR' IS BEING RETARDED EITHER BECAUSE OF TECHNOLOGICAL OR INSTITUTIONAL OR BOTH THE CONSTRAINTS, BUT THE EXPLANATIONS VARY WITH EACH SCHOOL OF THOUGHT. THERE IS NO DOUBT THAT THE EFFECTS OF 'GR' ON THE TOTAL AGRICULTURAL OUTPUT HAVE BEEN DRAMATIC IN PAKISTAN, YET THE SELF-SUFFICIENCY IN THE PRODUCTION OF FOOD, ESPECIALLY WHEAT REMAINS A DREAM FOR PAKISTAN AS THE COUNTRY CONTINUOUSLY NEEDS TO IMPORT WHEAT CAUSING A FOREIGN EXCHANGE CONSTRAINT.**

it suggests the fact that the existing economic structure i.e., the structure of land-ownership (which is a reflection of economic structure) plays an important role in determining the response to the 'GR' technology. It may also be kept in view that there is nothing absolute about the pre-existent economic or say land-ownership structure which would always and permanently withstand the opportunities made available by the new technology. Indeed, in Pakistan and even in Indian Bengal where from Bhaduri (Op cit) draws his evidence, there is evidence of the adoption of 'GR' technology despite debt-bondage (Rudra, 1974). However, in areas where the new technology has been adopted it has been noted that it is the only rich farmers who adopt first. By and large small cultivators do not first adopt it. This is considered as a limiting factor. A number of arguments are given such as imperfections in credit and distribution system, in which the large farmers have a dominating influence, the financial risks associated with the 'GR' technology, involving increased cash outlays on purchased inputs.

On the question of the impact of 'GR' on agrarian structure, especially income generated in the process, assessments have varied as shown by the studies

on Pakistan. According to Chaudhry (1982) the 'GR' has helped the pursuit of greater social equality and a more egalitarian distribution of income. But Khan's (1983) assessment shows that the rural inequality in the distribution of income has increased in Pakistan. However, income from the agriculture does not depend upon farming only. A cultivator, apart from working on his own land, may also hire-out his services during off-peak period and earn some amount of money. So it is not possible to arrive at a final conclusion about the trend of agrarian income due to 'GR'. However, given the nature of the distribution of the means of production, i.e. land in agriculture one may expect an unequal and differentiated pattern of income distribution in Pakistan.

Disparate assessments have been made by many Indian agricultural economists on the question of the extent to which the 'GR' has contributed to the transformation of agrarian relation and in particular the 'mode of production' in Indian agriculture. No researcher, to my knowledge, in Pakistan has so far attempted to investigate the relations of production in this direction. Such discussions are specifically focused on whether and to what extent, there has been



a transition to agrarian capitalism due to the penetration of the new technology. The debate which started on the Indian agriculture in 1970s in the ECONOMIC AND POLITICAL WEEKLY (Bombay) remained inconclusive. J. Harriss (1982) in a survey article has synthesised the various positions taken by the participants in the Indian debate. One view is that capitalism has made significant progress in the Indian agriculture. This is, as argument goes, in the sense of a distinct switch to capitalist relations of production, a change catalyzed by the entry of the 'GR' technology in agriculture. A contrary position has been that the capitalist farmer in the sense of 'industrial capitalist' is difficult to locate because of the continuous existence of 'pre-capitalist' relations of production and exchange in agriculture. Others have argued that important pre-capitalist relations exist in agriculture though there may be some changes; they seem to take place within the overall framework of pre-capitalist relations rather than a transition towards wage labour. Another view is that the agriculture is 'capitalist' and that it is dominated by and is an integral part of the world capitalist system and that pre-capitalist farms are the only super-

ficial aspects.

There is yet another important area which is concerned with the issue of 'proletarianization'. Some scholars look at this as proceeding apace as an integral part of the transition to capitalism in agriculture. If we take 'proletarianization' i.e., turning of small landowners into working class (i.e., becoming land-less to work as wage-labourers), as a condition of 'capitalist agriculture' there is an observable trend in Pakistan's agriculture towards the growth of a class of workers who depend for their subsistence for the most part being suppliers of agricultural labourers. (see; Khan, 1981, for statistical evidence). My micro-level study of the Nawabshah District in Sind Province also suggests that the dependence of a large majority of the farmers on merchants capital (in the form of fertilizer and cash loans) causes debt bondage which in the long run creates such economic conditions in which producers (i.e., farmers) become non-viable. Such production condition then push towards 'Proletarianization' (Kamdar, M.S. 1987).

So, in summing up the pros and cons of the 'GR', may say that there is a growing consensus of opinion in the literature that 'GR' is being retarded either

because of technological or institutional or both the constraints, but the explanations vary with each school of thought. There is no doubt that the effects of 'GR' on the total agricultural output have been dramatic in Pakistan, yet the self sufficiency in the production of food, especially wheat remains a dream for Pakistan as the country continuously needs to import wheat causing a foreign exchange constraint (see; Statistical Bulletin on wheat in Pakistan, 1983, for data on import of wheat (quantity and value) in Pakistan).

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