

SILVER JUBILEE COMMEMORATION MEDAL LECTURE—1979

Green Revolution in India—Progress, Problems and Prospect

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AN outstanding achievement of agricultural research and extension in India is the attainment of self-sufficiency in food by the country. This is in spite of the fact that India's population increased from 200 millions in 1929 to over 600 millions in 1979. Increase in food production is largely due to the introduction of high-yielding varieties of wheat, rice, bajra, sorghum, and maize and their adaptation to Indian conditions. Our scientists were not the mere recipients of this material but improved it significantly. They also worked out packages of practices including agronomic and plant protection measures in respect of these crops. The newly started agricultural universities forged a linkage between the scientists and the farmers. The new varieties found ready acceptance by the farmers who adopted tractor cultivation, tube-well irrigation and the use of chemical fertilizers and plant-protection chemicals. Owing to the adoption of modern technology by the farmers, production of foodgrains increased in a remarkable manner. It almost trebled in a period of twelve years, taking 1965 — 1966 as base. Increase in pro-

duction of wheat was most spectacular. It rose from 10 million tonnes to 31 million tonnes during the last decade. Total food-grain production rose from 72 million tonnes to 125 million tonnes in the same period.

We always look to western countries for inspiration and have a tendency to ignore or belittle our own achievements. It is in the Punjab that progress in food production has been most remarkable. Taiwan has about the same population as Punjab, and is regarded as a model of success in agriculture. Punjab showed faster growth rate than Taiwan. The entire history of agriculture does not reveal an example of success as of green revolution in the Punjab. Wheat production rose from about 2.5 million tonnes in 1967 to 6.6 million tonnes in 1978. Increase in the production of rice has been equally spectacular. It was 0.338 million tonnes in 1966-67 and 2.494 million tonnes in 1977-78. This is the result of adoption of science and technology by the farmers.

Food Production in the British Period

To realize the significance of this achieve-

ment, let us look back to the India before Independence. During the British period from the middle of the 19th century onwards when the country was plagued by droughts and famines, canal irrigation began. In Punjab, U.P. and Madras States large irrigation projects were launched by the Britishers. Up to the middle of the present century, extension in the irrigation by canals was the major input in agriculture. However, food-grain production during the British period stagnated with an insignificant growth rate (0.11% per year), while population was rising at the rate of 1.5% per year.

Agriculture since Independence

Since Independence, great emphasis was laid on multipurpose dams which provided canal irrigation as well as power for tubewells which tapped groundwater resources. Since 1950, the increase in production of foodgrains was 2.8% per year while the population growth rate was about 2.1%. The increase in food production was higher as compared with China where it is estimated at 2% per year.

From 1950 to 1960 the dependence was on traditional technology. More area was brought under irrigation and waste-lands were reclaimed. Mellor states: "as much as a-fifth of the production increase was due to the expansion of irrigation, some two-fifths to the increased utilization of labour associated with population growth and perhaps a third simply to increasing the amount of land under cultivation. The latter two factors and even the first can be attributed in large measure to new energies released and new incentives provided by national independence."*

Steel mills in the first two Five-Year Plans

The construction of steel mills during the first two Five-Year Plans ushered an industrial revolution in India. These provided steel for improved agricultural implements and agricultural machinery and pipes for tubewells. Tractors which were not at all manufactured in the pre-independence India are now manufactured in significant numbers. Hence, those who criticise the authors of the first two five-year plans for laying too much emphasis on steel mills are misleading the people. In fact, there is a direct relationship between input industry (including steel mills) and improved agriculture.

Intensive agricultural areas programme

Food production in the country no doubt expanded under challenges for periodical droughts and rising population. Discovery of antibiotics added a new dimension to the population problem. Population of India which was estimated at 100 millions during the reign of Akbar, has exceeded 600 million.

Behind the massive effort which culminated in the Green Revolution and self-sufficiency in food lies an era of wise planning and administrative effort. During the period 1960-1965, agricultural universities were developed and these were entrusted with the responsibility of research, education and extension. In this period, districts with assured irrigation were selected and provided with extension staff and adequate number of fertilizer stores. Thus a scarce input like chemical fertilizer was channelled to productive areas where it was carefully used for crop production. During the period 1961-1965 the use of chemical fertilizers accounted for 40% of the increase in grain production.

* Mellor, J. W. 1977 The Agriculture of India, *Scientific American*, September issue.

Green Revolution in India 1966-72

A most significant development in Indian agriculture since Independence is the Green Revolution in some States in northern India, Gujarat in the west, and Andhra Pradesh and Tamil Nadu in the south. Green Revolution in India is most noticeable in the Punjab, Haryana, Ganganagar District of Rajasthan and western Uttar Pradesh. Why is it so? Apart from the human element, the experienced refugee farmers from West Pakistan who were resettled in these areas, these states also enjoy the benefit of consolidation of holdings. The ownership of land is also equitable and with the implementation of the present land reforms no farmer would have more than 18 acres of double-cropped land. Besides, Punjab and western Uttar Pradesh have well-developed agricultural universities which provide service to the farmers through research, education and extension. These states also have well-organized co-operative credit societies which supply fertilizers to the farmers on loan basis and also make arrangement for marketing their produce through Marketing Federations. The Agro-industries in the private sector provide threshers, seed-cum-fertilizer drills and other agricultural implements. This has resulted in the training of a large number of mechanics who serve the farmers in looking after their machinery. Apart from irrigation from canals, large number of tubewells have been sunk to provide irrigation. A tubewell owned by a farmer places a source of water at his command which he can use whenever he likes. The programme of rural electrification has given great impetus to the sinking of tubewells. A network of roads has been provided and nearly all the villages in Punjab and Haryana are now approachable by *pacca* roads. Use of tractors has greatly helped in intensification of cropping and has promoted multiple cropping.

Mexican high-yielding dwarf wheats spark the Green Revolution in India

It is the introduction of high-yielding dwarf wheat strains from Mexico which sparked the Green Revolution in India. This agricultural revolution is the result of a well-planned plant-breeding research strategy and co-ordinated work approach of highly experienced agricultural scientists and bold administrative and policy decisions. The simple fertilizer trials conducted in farmers' fields during 1959-61 had revealed that the tall varieties then cultivated in India do not respond well to nitrogen application and have a tendency to lodge. Hence, in 1962, the Indian Agricultural Research Institute, New Delhi, sent a proposal to the Government of India that Dr N E Borlaug of the International Maize and Wheat Research Centre, Mexico, may be invited to India and be requested to supply us with dwarf wheat material containing the 'Norin' dwarfing genes in order to break the barrier to high yields in wheat. Dr Borlaug accepted the invitation and visited the major wheat-growing areas of India in March 1963. This visit paved the way for our getting seeds of four commercial Mexican semi-dwarf wheats along with a few seeds of 613 different breeding lines. Seeds of this material were distributed by IARI in collaboration with the Rockefeller Foundation to the Punjab Agricultural University, Ludhiana; Pantnagar University in U.P. and to several other institutions. The performance of the Mexican varieties was very impressive.

The yield potential of Mexican wheat is as high as 60 quintals/ha as against 30 quintals of the best indigenous tall wheats. This is mainly due to the fact that these varieties are short-stemmed and can absorb large quantities of fertilizers without lodging as compared with the traditional varieties which grow too high, become top heavy and fall down. They

are much more responsive to fertilizers at all levels of application.

Chemical fertilizers

Chemical fertilizers, farmyard manure and green manures are all necessary for crop production. To emphasize the role of organic manures as against chemical fertilizers and to say that the latter are harmful or not necessary is a perverse view. It has been calculated that if there was sole reliance on farmyard manure and compost, only 7% of the net cropped area in Punjab State could be fertilized. The same would apply to many other states. High-yielding varieties of foodgrains require heavy doses of chemical fertilizers. Consumption of fertilizers sharply increased in the states in which green revolution became a reality. For example, in the Punjab the consumption increased from 10 kg of plant food per hectare in 1966-67 to 29 kg in 1968-69. In Kerala, which comes next, it was 22.91 kg/ha and in Bihar only 3.95 kg/ha in 1968-69. But for the chemical fertilizers there would have been no green revolution in India.

Mechanization needed to sustain Green Revolution

There are many misconceptions about the role of mechanization in Indian agriculture. Some people believe that in India, mechanized tilling will reduce and not enhance the yield because we have a 'tropical climate' and a 'thin layer of fertility'. Our 'tropical climate' has blessed us with many days of sunshine. And regarding the 'thin layer of fertility', our Indo-Gangetic plains from the Punjab, U.P., Bihar to W. Bengal contain the best agricultural land in the world. If at all we have the 'thin layer of fertility' then it is all the more reason to go in for mechanized deep ploughing and subsoiling to prevent the top few inches of the soil from being over-

worked. Many people do not know that the roots of Mexican wheat are about 6 to 7 feet in length. Cotton, sugarcane and tobacco are also long-rooted. Deep ploughing with tractor-drawn implements breaks the hard compacted layer which forms below the top soil by continuous ploughing with desi plough. Thus, roots of above-mentioned crops are enabled to draw nutrients from the deeper layers of soil. If mechanization in India could result in deserts, as some people apprehend, then by now Bihar would have become the wheat bowl and Punjab and Haryana large expanses of deserts. Indeed, it is mechanization that is taming the 'Great Indian Desert of Ganganagar in Rajasthan'. It is a pleasing sight to see tractors there, working endlessly to level the sand dunes for better irrigation, food production and ultimately greening the desert.

Farm mechanization is a necessity. After harvesting a crop there is a race against time to prepare the land and sow the next crop in time. A delay of 15 to 20 days can convert a possible bumper crop into an average, mediocre crop. For example, to reap a bumper wheat crop the sowing of the Kalyan Sona and PV 18 wheat varieties should commence from the first week of November. By early sowing, these varieties escape exposure to mid-season rusts and high temperatures near maturity. Delaying beyond the optimum sowing period results in a progressive decline in the yield.

Mechanization helps greatly in the utilization of scarce resources. By properly levelling the land, water is utilized effectively. Deep ploughing with discs and cultivators prepares the land better for sowing. Proper depth of the seeds and placement with respect to fertilizer with drills optimizes the use of costly fertilizer. Multi-cropping is necessary to utilize the scarcest resource of all-land. This can be accomplished most efficiently only by in-

creasing mechanization in Indian farming. Never was the necessity of mechanized threshing realized more than at the time when the first bumper harvests of the high-yielding varieties of the Green Revolution started pouring in. The conventional method of bullock-drawn *phalas*, and winnowing could not cope with the harvests and so mechanical threshers, driven by diesel engines, electric motors and tractor power take-off points came to stay.

At a time when animals are competing with humans for food, reducing the number of bullocks by mechanization is imperative. Estimates show that fodder crops for animals cover one-seventh of the cropped land area. Leaving aside buffaloes and cows the remainder of the fodder crops are accounted for by bullocks. Bullocks, of course, do not have a main switch that would enable in switching them off in the off season, so assuming a half-half distribution would mean that bullocks have staked their claim to one-fourteenth of the cropped agricultural land in India—a tremendous waste.

Political leaders and urban-bred economists with no practical experience of farming have deep-rooted, false ideas that mechanization will aggravate the rural unemployment problem, by displacing labour. Their attention needs to be drawn to the Punjab which has some highly mechanized farms and no rural labour unemployment. Use of tractors has led to multiple cropping and as a result so much work has been created that local labour is unable to cope with it. In fact, it is the migrant labour from U.P. and Bihar which is now sustaining Punjab agriculture. Thus, the Green Revolution in Punjab has substantially helped other states too by providing employment to the unemployed and partially-employed farm workers. Though the employment of a tractor on a farm

does displace some workers in its immediate field of operation, on the whole mechanization helps by raising productivity and creation of more employment opportunities by multi-cropping and intensification of cropping. Now there is no slack season in intensively cultivated areas and farmers keep busy throughout the year. This important fact has also been brought out by a recent study (Impact of Mechanization in Agriculture on un-employment) carried out by the National Council of Applied Economic Research. The study has pointed out that the negative effects of mechanization are more than neutralized and offset by positive gains, more efficient agriculture, better standard of living, making mechanization beneficial on the whole. Notably, this study was done not in the Punjab but in U.P.

It is also an interesting fact that Green Revolution areas in India are exactly those which have comparatively sizeable number of tractors, viz. Punjab, Haryana, Terai of U.P. and Ganganagar district of Rajasthan. If Punjab farmers had not eighty thousand tractors there would have been no green revolution in the State.

Browning of the Green Revolution

Oil problem

The crunch in agriculture came in 1972-1973 as a result of the oil problem, an offshoot of the Middle East War. The Arab countries got conscious of the fact that their oil resources are not inexhaustible. So they decided to conserve them and to get much higher price from the importing countries. While some years ago the price of oil was 1 dollar per barrel, it now costs more than 30 dollars. The developing countries of Asia and Africa suffered more grievously by the hike in the price of oil as compared with industrialised countries of the West. Oil provides not only an essen-

tial input for industry, but is also crucial for agriculture. Most of the fertilizers produced in the world are naphtha-based. Apart from this, oil is also used for tractors and diesel engines. The effect of the alarming increase in the price of petroleum is being felt all-over the world and the price of fertilizers has increased by 2 to 3 times.

Oil resources are non-renewable, and oil will become more costly from year to year. As oil is the source from which fertilizers and plant protection chemicals are manufactured, and as it is also used for pump-sets and tractors, food production will become costlier. In fact, the prospect of food production in the next decade is grim. Politicians do not realize that the real problem in this country is not shortage of land, but shortage of plant food. Poverty of the peasant can be abolished only when the poverty of the soil is removed.

Organic manures are not sufficient for crop production. High-yielding varieties require higher energy for their proper growth and optimum yields. It is the chemical fertilizers which have made the Green Revolution a reality. The depleting oil resources of the world inevitably point out the necessity of effective population control measures, which no government can afford to ignore.

Rise in the price of Inputs

Since 1972 there has been a phenomenal rise in the price of agricultural inputs. Taking 1967 as the base year, the index of prices of agricultural input in Punjab was 146.61 in 1973 and 217.76 in 1975 as given below:

<i>Item</i>	<i>Price</i>	
	1967 Rs.	1975 Rs.
I. Tractor		
(i) Massey Ferguson Tractor (35 H.P.)	21,563	45,583
(ii) International tractors (35 H.P.)	21,610	47,222
(ii) H.M.T. Zetor tractor	13,700	32,730
II. Electric motors and diesel engines	984	1,622
(i) Electric motor (5 H.P.)		
(ii) Kirloskar Diesel Engine	2,740	3,580
III. Other inputs		
(i) Urea (per tonne)	840	2,000
(ii) CAN (per tonne)	510	1,095
(iii) Diesel oil (per litre)	0.86	1.40 (1976)
IV. Electricity		
(i) Electricity (per H.P.)	12.50	19.00
(ii) Annual bill for electric motor (5 H.P.)	792.00	1,140.00
V. Miscellaneous		
(i) The wages of agricultural labour	4.93	10.00 (1978) plus food

Low profitability in farming

The net result of the high price of agricultural inputs is that profitability in farming is now low. If the cost of land and the loss in interest is counted, few farms are making a profit. As most of the farmlands are ancestral, this aspect is seldom considered. Where efficiency is high and seed is raised, there is some profit. In Ropar Farm, which is with the Punjab Agricultural University and is well run with the best expertise, the gross income was Rs. 1,900 against an expenditure of Rs. 1,700 per acre. Thus the net income or profit was only about Rs. 200 per acre. Village studies of accounts of farmers in the Punjab also reveal a similar situation. This also shows that, if some people have been claiming fantastic incomes, it was for some other reasons.

Recovery in 1975-76

The set-back which the Green Revolution received on account of sharp increase in the price of agricultural inputs continued from 1972 to 1974. Production of wheat in Punjab fell from 5.618 million tonnes to 5.181 million tonnes. The Government of India increased the procurement price from Rs. 75/- to Rs. 105/- per quintal. Production responded to this stimulus and in 1975-76 it reached 5.788 million tonnes. In 1976-77 the Punjab Government provided a subsidy of Rs. 75.5 million on phosphatic fertilizers. In 1977-78, the Punjab Government provided a subsidy of Rs. 75 million for phosphatic fertilizers, and the production reached 6.639 million tonnes. Rainfall was also favourable in these years.

In 1978-79, Punjab produced 7.45 million tonnes of wheat and the procurement price was Rs. 112 per quintal. In 1979-80, the worst drought year in the history of the country, Punjab produced 7.90 million

tonnes of wheat and the procurement price was Rs. 117 per quintal. The stimulus which remunerative price provides to agricultural production is amply borne by this experience. Besides, it also proves that application of science and technology is the best shield against hostile weather.

Glut in the production of sugarcane, potatoes, cotton, etc.—1977-78

In 1977-78 we witnessed a strange phenomenon of higher agricultural production but less income to the farmers. A recent study has shown that the farm sector has not really benefited from the increase in agricultural production. The total value realization from various crops was lower in 1977-78 than in 1976-77.

While wheat output increased by over two million tonnes, from about 29 million tonnes in 1976-77 to 31.3 million tonnes in 1977-78, the total value of the crop at the current prices decreased by 25%, from Rs. 47,800 million to Rs. 36,000 millions. The average price of wheat in Delhi markets for instance, was Rs. 165 a quintal in June 1977 and only Rs. 115 a quintal in June 1978.

The situation with regard to oilseeds, cotton, tobacco and sugarcane is similar. According to the data compiled by the National Co-operative Marketing Federation (NAFED), the decrease in value realization in these crops in 1977-78 over 1976-77 varied from 4% in groundnut to 34% in sugarcane (*gur*).

The production of cotton went up during this period—from 2.9 million tonnes to 3.6 million tonnes. Due to the fall in the average price from Rs. 450 to Rs. 325 a quintal, the total value of the crop dropped by nearly 12%—from Rs. 13,400 millions to Rs. 11,800 millions. This caused great distress among the farmers of cotton-growing states. It is also noteworthy

that though there was sharp fall in the price of cotton, the price of cloth did not decrease.

An increase of about 4% in the output of rapeseed and mustard led to a decline of about 6% in the monetary value of the crop. Similarly in tobacco, while the production rose by only 6% the fall in value was nearly 11%.

In 1977-78 the potato growers suffered heavy losses. Some of the growers allowed large quantities of potatoes to remain in the soil as they could not meet even the cost of labour involved in the digging operation. Large heaps of rotting potatoes could be seen along the boundaries of fields in Punjab and Haryana. This is a situation which will have an adverse effect on agricultural production. It will kill the farmers' enthusiasm. There is urgent need to improve this situation.

Storage and marketing require attention

While the consumers are complaining about high prices, the producers are not able to meet the cost of production of crops. The prices of agricultural commodities are falling not because their production has outstripped peoples' needs, but because the facilities to efficiently procure, store, process and distribute them are inadequate. The agricultural marketing mechanism, which was evolved during the period of shortages, deserves a complete overhaul. Our farmers have learnt the technology of production and now we should channelise our resources to improve our marketing and storage practices. The profit of middle-men should also be rigorously controlled, so that the benefit passes on to the growers and the consumers.

The proposal of the Central Government to encourage construction of godowns in rural areas for storage of the produce near the place of production is timely and welcome. The storage of food-

grains at the farmer's level should also be encouraged by manufacture of metal storage bins in large numbers. Stores should also be built in all the villages selected as Focal Points under the scheme of Integrated Rural Development Programme. It will enable the growers to realize better prices through deferred sale of their produce. Steps are also needed to remove transportation bottle-necks and to find external markets for selected items like fruits, vegetables and potatoes. Export of even a small quantity boosts the price of these commodities to a reasonable level. This was the case when export of potatoes to Iran was permitted some years ago.

More cold storage units and refrigerated vans required

For the preservation of fruits, potatoes and vegetables, there is urgent need of larger number of cold storages. The states of the Punjab, Haryana, Himachal Pradesh, U.P. and Bihar should make an assessment of their needs for more cold storages. The governments of these states should undertake studies to find out what is the existing storage capacity of the cold storages in their respective states, and to what extent their number should be increased. When this is done, the state government should encourage the entrepreneurs to set up cold storage units. Electricity should be supplied to such cold storages on priority basis. There is also need of more refrigeration vans for transport of potatoes and vegetables to cities like Bombay. At present, a large percentage of potatoes rot in transit.

Hazards in farming — Fields are not factories

Agriculture is dependent upon weather. Multipurpose hydro-electric dams have only partially liberated us from such de-

pendence. When there is failure of monsoons, reservoirs of dams in south India are severely depleted. Such droughts also affect reservoirs in the Himalayan zone, though less severely, as the rivers are snowed. Prolonged drought over two years also affects snow-fall and storage of water is seriously affected even in dams in the Himalayan zone. As the available water is required both for irrigation and power generation, there has to be careful management of discharge of water. Power generation is curtailed, and that in turn affects pumping of ground-water. Moreover, recharge of ground-water does not take place, and water level in tubewells goes down; and quantity of water gets depleted.

While poor rainfall affects crop production even in irrigated areas, it is the rainfed areas in Gujarat, Rajasthan, Maharashtra, Karnataka and Madhya Pradesh which suffer severely. In drought years the production of bajra and jowar goes down alarmingly, thus creating severe food shortages.

It is in such drought years that intensive agriculture with the use of modern inputs in irrigated areas saves the situation.

Apart from drought, cyclones, floods, wind storms and hailstorms cause great damage to crops including fruits. Fruit-setting is gravely affected when rain falls on fruit trees at flowering time, or the temperature drops. Vast areas in rice-growing region of Andhra are damaged by cyclones. The large damage to wheat in Punjab and Haryana in 1976 by hailstorms is still fresh in our minds. It should not be forgotten that to grow an acre of wheat a farmer invests over one thousand rupees in the cultivation, irrigation and fertilization and if the crop is destroyed by hail, the farmer is ruined. Thus the farmer is at the mercy of the

forces of nature, and fields can never become factories. Hence agriculture, in order to be successful, must be supported by the Government through various measures.

Give world price for wheat and rice to the farmers

Over the centuries farmers in this country have been the most exploited and the least privileged people. They have been carrying on their traditional farming with the aid of bullocks and using farm-yard manure. They have never received proper remuneration for their labour. While they provided cheap food to the urban dwellers, they themselves were steeped in poverty. While wealth accumulated in the cities, the villages remained primitive and shabby. The year 1966 is crucial in the history of agriculture in India as it marks a sharp break with the past. The Government of India adopted the policy of giving incentive price to the farmer. This meant that apart from meeting their cost of production, including family labour, the farmer must make some profit so that he has incentive in making investment in the improvement of land. For this, much credit is due to Shri C. Subramaniam who was Minister for Food and Agriculture during the critical period of droughts and scarcity. Modern agriculture is obviously radically different from traditional one. The inputs of modern agriculture are costly and have to be purchased. The farmer will use them only when he recovers their cost and also makes some profit. To sustain the green revolution and to ensure food supplies to the people, the policy of incentive price for foodgrains must not be whittled down. In fact, there is no reason why our farmers should not get a price for foodgrains which they produce, at world price level, particularly when they

make use of costly machinery, fertilizers, herbicides and pesticides as in the so-called advanced countries.

Land reforms necessary but stability in future also necessary

Adoption of policy of incentive price for crops, necessarily leads to land reforms. The gains of incentive price must spread over a large number of farmers and they must not be gobbled up by a few farmers. Whatever the ceilings imposed on land holdings, they must be quickly and honestly implemented. States like the Punjab and Haryana, where distribution of land holdings is equitable and self-cultivation prevails, have given the best results in agricultural production. After the implementation of existing ceiling laws, there should be stability and no attempt should be made to lower the ceilings. Uncertainty is the worst enemy of agricultural development.

Green Revolution has benefited the entire population

Apart from providing food to the people, which is a basic necessity, Green Revolution has benefited the entire economy of the country. Another feature of the Green Revolution as noticed in the Punjab and Haryana is that the social side-effects have not been adverse as in Pakistan and Mexico. This is because of the remarkably equitable system of land distribution on account of peasant proprietorship with vast number of people working on medium-sized farms. The gains of the Green Revolution have been equitably shared by the farmers, agricultural workers, and artisans who manufacture agricultural implements. In fact, the gains of this agricultural change have widely diffused with the result that there is general well-being and rural poverty as it exists in other states of India, is no longer there in the

Punjab. Intensive agriculture has generated large demand for human labour for hoeing of crops. Even Mexican wheats, though sown with tractor-drawn seed-cum-fertilizer drills, are hand-hoed. Generous wages in cash and kind are given to farm labourers. Hence, the fruits of labour are shared by all.

Urban and rural interests—no conflict now

Before independence there was a sharp cleavage between the urban and rural people. The money-lenders were mostly urbanites, and the farmers were their victims. Now the banks have replaced the money-lenders. The phenomenon of green revolution has shown that the interests of the urban people are intertwined with those of the farmers. When the farmers prosper, the urban shopkeepers also prosper. Industry received an impetus, as a new market was created for the sale of agricultural machinery and consumer goods. Besides, new avenues for employment were created for the urban population and large number of them got employed in selling inputs, e.g. fertilizers, plant protection chemicals and agricultural machinery. The economy of small towns received an impetus, the number of shops selling consumer goods multiplied and they had a greater variety of goods for sale to their rural clientele.

Abolishing poverty in rural areas

A subject of topical interest is how to abolish poverty of the rural people. Solution lies not only in redistribution of land which has been largely accomplished due to implementation of ceiling laws, but also in providing incentive price to farmers for their produce. If the farmer prospers every one prospers. The farmer is enabled to pay higher wages to the agricultural labourers. The wages of agricultural labourers in Punjab and Haryana

are the highest in India. They are about ten rupees per day plus food. As a result the agricultural labourers have prospered and have shared the gains of high productivity. On the other hand in southern and eastern India, the agricultural labourers hardly get Rs. 3/- to Rs. 4/- per day. This disparity must be ended and wages of agricultural labourers in the states in eastern and southern India should be brought to the same level as in the Punjab and Haryana. What is needed is a National Wage Policy for agricultural labour. This is the most effective method for removing poverty in the rural areas in these states. Besides, it would also level off the cost of production all over the country.

Population Control Necessary

An effective birth control programme is necessary, if the standard of living of people is to be raised. It has been estimated that our population would be 1270 million by the year 2015. What would be the effect of this extra population on requirements of food, housing, health care, education and transport is too depressing to contemplate. The oil problem has already given us a warning that resources are not limitless. We must plan for a population which we can maintain in reasonable comfort within our resources. This also highlights the need of a vast expansion of health and family planning services. Family planning programmes suffered during the Janata regime. Officials who took serious interest in these programmes were subjected to enquiries on the charge of excesses. The morale of the family planning workers should be raised by providing them every type of encouragement. The Ministry of Family Welfare should be renamed as Ministry for Family Planning, so that due emphasis is given to the objectives of the programme. Population problem should be

tackled as a national problem and should not be politicised.

Farmer—The key element in agricultural production

We must not forget that the most important input in agriculture is the human element, the farmer. The modern farmer is not an illiterate man, a mere clod-hopper whose main task is walking behind a pair of bullocks and twisting their tails. A modern farmer is a technologist who understands the use of fertilizers, plant protection chemicals and the doses in which they are applied. He understands the use of agricultural machinery. Above all, he is a manager whose main work is to procure inputs in time and to organize family as well as hired labour so that they work productively. If he is encouraged and enthused he will conquer the malaise which has affected Indian agriculture. If he is frustrated and discouraged, then no progress is possible. Hence it is necessary that he should be given stability so that he works with confidence. He should also be given respect and his advice should be taken before changes in policies are made which affect agricultural production.

We should abjure double-standards and learn to tolerate prosperity in rural areas. Thousands of people in the urban areas own cars, but the mere sight of a farmer on a scooter becomes an eye-sore to some people. Our concept of a farmer is a shabbily dressed person wearing a dirty dhoti. Our farmers and the agricultural labourer should live just as well and dress as well as urban people. Our aim should be to bring the rural areas a' par with the urban areas so far as standard of living is concerned.

We have a large potential for irrigation and we have experienced and hard-working farmers who know the techniques of

scientific farming. We have also a large cadre of trained scientists. They gave us the Green Revolution. Incentive-oriented policies should be followed and the far-

mers be given facilities and freedom to work and they will meet the challenge of food production for our rising population.

TABLE 1
Progress of Consolidation of holdings in the States

States	Net cultivated area '000' Hect.	Area consolidated '000' Hect.	Percentage
I Good progress			
Punjab	41.67	41.67	100.00
Haryana	36.44	36.44	100.00
U.P.	173.75	134.48	77.40
Maharashtra	182.96	127.53	69.70
Himachal Pradesh	5.52	1.85	33.51
Madhya Pradesh	185.34	34.58	18.66
Karnataka	92.06	10.83	11.76
II Poor progress			
Gujarat	96.18	11.16	11.60
Rajasthan	150.60	17.12	11.37
Bihar	83.50	5.65	6.77
Andhra Pradesh	106.02	3.31	3.12
III Disappointing			
J & K	7.11	0.22	3.09
Orissa	58.77	0.11	0.19
Assam	26.79	—	—
W. Bengal	61.85	—	—

Consolidation of holding provides the base for agricultural development. With his land in one block, the farmer can invest in land development, viz. sinking of tubewells, fencing and land shaping. The States in which consolidation of holding has made substantial progress are leading in agricultural development.

TABLE 2

The state of Irrigation in the States
1976-77

States	Net cultivated area '000' Hect.	Area irrigated '000' Hect.	Percentage
Punjab	4,167	3,194	76.6
Haryana	3,646	1,798	49.3
U.P.	17,375	8,260	47.3
J & K	711	306	43.0
Tamil Nadu	6,007	2,330	38.8
Bihar	8,350	2,879	34.5
Andhra Pradesh	10,602	3,434	32.4
W. Bengal	6,185	1,439	23.3
Assam	2,679	572	21.4
Orissa	5,877	1,049	17.8
Rajasthan	15,060	2,608	17.3
H.P.	522	90	16.3
Karnataka	9,206	1,215	13.2
Gujarat	9,618	1,233	12.8
M.P.	18,534	1,982	10.7
Kerala	2,201	211	10.0
Maharashtra	18,186	1,518	8.3
All India	1,40,117	34,484	24.6

Water is a key input in agriculture. States which have highest percentage of irrigated area lead in agricultural production.

TABLE 3

Progress in sinking of tube-wells powered by electricity. Tube-wells per 100 hectares of cropped area, 1977-78

	State	Net cultivated area 000 hect.	No. of tubewells energised.	Per 1000 Hectare
I	Tamil Nadu	5,989	805,779	134.5
	Punjab	4,158	196,296	47.0
	Haryana	3,624	166,631	46.00
	Andhra Pradesh	11,172	337,546	30.2
	Kerala	2,189	58,922	26.9
	Maharashtra	18,262	488,706	26.8
	Karnataka	10,360	262,362	25.3
	U.P.	17,223	293,603	17.0
	Bihar	8,470	139,982	16.5
II	Gujarat	9,658	156,028	16.2
	M.P.	18,715	215,923	11.5
	Rajasthan	15,105	128,961	8.5
	W. Bengal	6,185	20,346	3.3
III	Orissa	6,137	6,064	1.0
	Assam	2,600	1,054	0.4
	All India	142,245	32,99,657	23.2

A tubewell provides a source of irrigation at the command of the farmer. States with maximum number of tubewells lead in agricultural progress.

TABLE 4

Consumption of plant nutrients per unit of gross cropped area, 1977-78

	States	Kg/ha			Total
		N	P ₂ O ₅	K ₂ O	
I Green Revolution States	Punjab	51.1	16.7	4.6	72.4
	Tamil Nadu	36.7	10.1	12.2	59.0
	Andhra Pradesh	27.1	10.3	2.9	40.3
	Uttar Pradesh	27.8	6.0	3.1	36.9
	Haryana	27.6	5.3	1.8	34.7
II States with medium progress	Gujarat	17.2	8.3	3.0	28.5
	Kerala	12.4	5.4	8.5	26.3
	Karnataka	14.4	5.1	4.6	24.1
	West Bengal	14.3	3.6	3.7	21.6
	Maharashtra	11.6	3.6	3.1	18.3
III States with poor agriculture	Bihar	12.2	2.0	1.2	15.4
	Jammu & Kashmir	10.5	2.5	0.5	13.5
	Himachal Pradesh	7.3	1.8	1.6	10.7
	Orissa	5.9	1.6	0.8	8.3
	Madhya Pradesh	4.7	2.3	0.5	7.5
	Rajasthan	5.3	1.0	0.3	6.6
	Assam	1.5	0.1	0.2	1.8
All India		17.0	5.6	3.0	25.0

Consumption of fertilizers per unit of gross cropped area is an index of advance in agriculture. According to this index the five top green revolution States in India are the Punjab, Tamil Nadu, Andhra Pradesh, Uttar Pradesh and Haryana.

TABLE 5

Tractors per 1000 hectares of Cropped Area
1977-78

State	Tractors per 1000 hectares of cropped area	No. of tractors
Punjab	10.90	68,762
Haryana	6.98	38,036
Uttar Pradesh	2.61	60,748
Tamil Nadu	1.95	14,075
Gujarat	1.54	15,661
J & K	1.29	1,191
Rajasthan	1.27	21,861
Bihar	1.10	12,447
Karnataka	0.99	11,093
Andhra Pradesh	0.97	12,538
Kerala	0.85	2,529
Himachal Pradesh	0.85	790
Madhya Pradesh	0.70	14,976
Maharashtra	0.65	12,842
Assam	0.49	1,562
Orissa	0.31	2,397
West Bengal	0.28	2,250
Others	2.85	4,862
Total	1.74	2,98,610

Use of tractors indicates intensity of cropping. According to this index, Punjab is the leading State, followed by Haryana, U.P., Tamil Nadu and Gujarat.

Source: *The Economic Times*, May 21, 1979.

TABLE 6

Index of agricultural input prices and its relationship to procurement prices of wheat and rice and effect on production in Punjab

Year	Index of Agr. Inputs Prices	Procurement price of wheat per quintal	Production of wheat in Punjab	Procurement price of paddy per quintal	Production of rice in Punjab
1966-67	100.00	71.0	2451	41.0	338
1967-68	107.0	76.0	3335	45.0	415
1968-69	121.9	76.0	4491	52.5	470
1969-70	124.3	76.0	4865	52.5	535
1970-71	127.9	76.0	5145	53.0	688
1971-72	136.3	76.0	5618	53.0	920
1972-73	162.8	81.0	5368	53.0	955
1973-74	205.0	105.0	5181	70.0	1140
1974-75	206.1	113.0	5286	74.0	1179
1975-76	207.1	105.0	5788	76.0	1447
1976-77	212.5	110.0	6392	76.0	1776
1977-78	213.7	112.5	6648	79.0	2491
1978-79	220.7	115.0	7434	87.0	3092
1979-80	252.4	117.0	7900	95.0	3056

An incentive price, which covers the cost of production of wheat and rice and also provides a modest profit to the farmers, is the key to increased production. When the price given was unremunerative, production fell down. To keep the green revolution moving forward, incentive price for foodgrains must be given to the producers.