Agricultural Growth and the Green Revolution

In popular parlance, the phenomenon of the Green Revolution is identified with India's being catapulted from a chronically food-short country, with a begging-bowl image, to one which was self-sufficient and which became over time even surplus in food. The change follows the major technological reforms that occurred in Indian agriculture, particularly from the mid-1960s. There has been much debate on the timing and the political and economic factors behind the ushering in of the New Agricultural Strategy which led to the Green Revolution. Its impact on the nature of agricultural growth, on the changing position of various agrarian classes, particularly the poor, and on the class balance of governments has also generated lively controversy. The brief overall description of this phenomenon given here is inevitably laced with elements of this controversy.

The view that in the 'Nehru years', that is, from independence till his death in 1964, Indian agriculture was neglected or that the focus was only on institutional reforms and not on the technological base for agriculture has increasingly been abandoned. Nehru was well aware of the centrality of agricultural development in meeting his dream of rapid industrialization. The plan outlays on agriculture from the First Plan itself were substantial by any standards. Apart from the First Plan, where the outlay on agriculture and irrigation was 31 per cent of the total, in all the Plans that followed, the outlay was between 20 and 24 per cent, irrespective of the changes in regimes. It is true, that in the initial years, during the first two Plans, the expectations of output increases on the basis of institutional reforms, particularly when accompanied by cooperative farming, were quite high and proved to be misjudgements. However, simultaneously, with the efforts at institutional reforms, Nehru from the very beginning placed great emphasis on creating the physical and scientific infrastructure necessary for modern agriculture. Massive irrigation and power projects like the Bhakra-Nangal, numerous agricultural universities and research laboratories, fertilizer plants, etc., took their due place along with steel plants as the 'temples of modern India' in the Nehruvian vision.

Over time, by the late 1950s and early 1960s, as the benefits from the land reforms that could be carried out in Indian conditions had begun to peak and the possibilities of agricultural growth based on extension of agriculture, that is, bringing more area under cultivation, were also reaching their limit, Nehru's focus inevitably shifted further towards technological solutions. (After all, countries like Japan and China which had carried out more far-reaching land reforms also had to follow the path of making modern technological improvements in agriculture to keep up their growth rates.) Even the New Agricultural Strategy of picking out select areas with certain natural advantages for intensive development with a package programme the Intensive Agricultural Districts Programme (IADP) was launched in fifteen districts, one for each state, on an experimental basis during the Third Plan in Nehru's lifetime—a practice which was to be generalized on a large scale a few years later. As one of the major scholars of the Green Revolution, G.S. Bhalla, says:[1]

> The qualitative technological transformation in India—the Green Revolution . . .

came about not during his lifetime but soon after his death. But the foundations for the technological development were laid during Nehru's time.

However, by the mid-1960s, the impact of certain long-term trends, as well as several immediate imperatives coincided with critical scientific breakthroughs to create a conjuncture which called for and enabled a big push towards the New Agricultural Strategy.

Despite the very creditable growth of agricultural output between 1949 and 1965 of about 3 per cent per annum, India had been facing food shortages since the mid-1950s and in the mid-1960s India was in the throes of a crisis. Agricultural growth had begun to stagnate in the early 1960s. The massive jump in population growth rates after independence, to about 2.2 per cent per annum from about 1 per cent in the previous half century, the slow but steady rise in per capita income, and the huge (and rising with each Plan) outlay towards planned industrialization, put long-term pressures on Indian agriculture, creating, for example, a demand for food which Indian markets were not able to meet fully. From the mid-1950s, food prices state to rise. To meet the food shortage and to stabilize prices India was forced to import increasing amounts of food. The alternative was to go in for large-scale forced procurements from the countryside at huge human cost, a path which was unacceptable in India but was adopted by other countries like Russia or China which did not have democracy as a safeguard. The controversial agreements made by India to import food from the US under the PL-480 scheme started in 1956. Nearly 3 million tonnes of foodgrains were imported under this scheme in the very first year and the volume of imports kept rising thereafter, reaching more than 4.5 million tonnes in 1963.

In this situation came the two wars with China (1962) and Pakistan (1965) and two successive drought years in 1965–66 leading to a fall in agricultural output by 17 per cent and food output by 20 per cent. Food prices shot up, rising at the rate of nearly 20 per cent per annum between 1965 and 1968. India was forced to import more than 10 million tonnes of foodgrains in 1966. It is in this moment of crisis, with famine conditions emerging in various parts of the country, especially in Bihar and Uttar Pradesh, that the US threatened to renege on commitments of food exports to India. The Indo-Pak war, India's stand on Vietnam and the desire to arm twist India into accepting an economic policy package favoured by the US had convinced President Johnson that India should be put 'on a short leash' and what better way to do it than to cynically use India's desperate dependence on the US for food!

Given this scenario of the mid-1960s, economic self-reliance and particularly food self-sufficiency became the top priority objectives of Indian economic policy and for that matter of foreign policy. The New Agricultural Strategy began to be implemented in right earnest. The then prime minister, Lal Bahadur Shastri, Food Minister, C. Subramaniam, and Indira Gandhi, who followed Shastri in 1966 after his brief tenure, all gave full support to and crafted this basic transition in the strategy for developing Indian agriculture. The World Bank-appointed Bell Mission recommended such a transition and the US pressed in its favour, but they appear to have been 'leaning on open doors', as a considerable consensus in favour of such a change had emerged within India. Critical inputs like high-yield variety (HYV) seeds (the suitability to Indian conditions of the high-yielding Mexican dwarf wheat proved to be an extremely timely scientific breakthrough), chemical fertilizers and pesticides, agricultural machinery including tractors,

pump-sets, etc., soil-testing facilities, agricultural education programmes and institutional credit were concentrated on areas which had assured irrigation and other natural and institutional advantages. Some 32 million acres of land, about 10 per cent of the total cultivated area, was, thus, initially chosen for receiving the package programme benefits on top priority.

Government investment in agriculture rose significantly. Institutional finance made available to agriculture doubled between 1968 and 1973. The Agricultural Prices Commission was set up in 1965 and efforts were made to see that the farmer was assured a market at sustained remunerative prices. Public investment, institutional credit, remunerative prices and the availability of the new technology at low prices raised the profitability of private investment by farmers and as a result the total gross capital formation in agriculture began to grow faster. This was reflected in, for example, the rate of increase in the gross irrigated area rising from about 1 million hectares per annum in the pre-Green Revolution period to about 2.5 million hectares per annum during the 1970s. Also, between 1960–61 and 1970–71 the number of electric and diesel pumpsets increased from 421,000 to 2.4 million, tubewells increased from 90,000 to 460,000 and tractors from 31,000 to 140,000. Also, consumption of chemical fertilizers, nitrogen, phosphorus and potassium, increased from 306,000 metric tonnes in 1960–61 to 2,350,000 in 1970–71. Most of this increase occurred in the second half of the period.

The results of this new strategy began to be witnessed within a short period. Between 1967–68 and 1970–71 foodgrain production rose by 35 per cent. Again, between 1964–65 and 1971–72 aggregate food production increased from 89 to 112 million tonnes, calculated to be a 10 per cent per capita increase. Net food imports fell from 10.3 million tonnes in 1966 to 3.6 million tonnes in 1970, while food availability increased from 73.5 million tonnes to 99.5 million tonnes over the same period. It has been estimated that 'but for the new agricultural strategy India would have to import a minimum of about 8 to 10 million tons of wheat yearly at a cost of $600 to 800 million'.[2] Food availability continued to increase sharply to 110.25 million tonnes in 1978 and 128.8 million tonnes in 1984, putting an end to India's 'begging-bowl' image. By the 1980s, not only was India self-sufficient in food with buffer food stocks of over 30 million tonnes, but it was even exporting food to pay back earlier loans or as loans to food-deficit countries. It was this comfortable situation which enabled India to successfully deal with the severe and widespread droughts of 1987 and 1988 without large-scale foreign help as was needed in the mid-1960s. By the end of the 1990s, foodgrain production in India was nearly 200 million tonnes, up from 51 million tonnes in 1950–51, a growth rate of about 3 per cent, ahead of the high population growth rate of 2.1 per cent.

A major impact of the Green Revolution strategy was that through increases in agricultural yields India was able to maintain, once again, the high rate of agricultural growth achieved since independence. The average rate of growth achieved between 1949– 50 and 1989–90 was about 2.7 per cent per annum. In the pre-Green Revolution period, 1949–50 to 1964–65, about 51 per cent of the growth in agricultural output was accounted for by increase in area (which grew at 1.61 per cent per year) and 49 per cent by increase in yield (which grew at 1.5 per cent per year), that is, both area and yield increases were equally important in maintaining growth levels. Once the possibilities of area increases reached saturation point rapid yield increases became

necessary if a similar growth rate was to be maintained. This is what the Green Revolution strategy succeeded in doing. Between 1967–68 and 1989–90 about 80 per cent of the growth of agricultural output was explained by increases in yields per acre (which grew at 2.5 per cent per year) while increase in acreage (which grew only at 0.26 per cent per year) accounted for only 20 per cent. In fact, in recent years, virtually the entire output growth has been attributed to increases in yield, as agricultural acreage has remained stagnant and even shrunk.

It must be recognized that, apart from the maintaining of the agricultural growth rates, the critical impact of the Green Revolution was that it generated a rapid increase in the marketable surplus of foodgrains. This aspect has perhaps not been sufficiently highlighted. A number of factors explain why the New Agricultural Strategy generated large marketable surpluses; the fact that the initial breakthrough in food production occurred in the relatively developed regions in north-western India and parts of southern India where food consumption levels were already high meant that a large proportion of the additional output was marketed; the use of labour per unit of output tended to decline, creating a marketable surplus from the rural areas to the extent that the proportion of the output which had to be set aside for consumption by labour declined; and the fact that output increases occurred mainly as a result of yield increases and not increases in acreage led to a fall in the need for foodgrain as seed per unit of output.

It was the marketed surpluses as a result of the Green Revolution (and not any unprecedented rise in aggregate all-India growth rates) which enabled internal procurement of food by the government and the building up of large food stocks. The food requirements generated by a strategy of rapid industrial development, the rapidly growing urban and general population and the periodically food-deficit areas could now be met internally. The liberation from dependence on PL-480 or other imports for the above was a major step in the direction of self-reliant independent development for India.

However, doubts about the New Agricultural Strategy began to be expressed from the very early stages of its implementation. One persistent argument had been that by concentrating resources on the regions that already had certain advantages the Green Revolution strategy was further accentuating regional inequality. Clearly, the solution to such fears lay in spreading the Green Revolution further and not opposing it per se. The research of scholars like G.S. Bhalla show that instead of promoting further inequality, the Green Revolution has over time actually spread to large parts of the country bringing prosperity to these regions.[3] In the first phase of the Green Revolution, 1962–65 to 1970–73, an all-India compounded growth rate of 2.08 per cent per year was achieved but it was mainly the result of sharp increases in yield in wheat in the north-western region of Punjab, Haryana and western Uttar Pradesh, which grew at a much faster rate than the average, Punjab registering a stupendous rate of 6.63 per cent. In the second phase, 1970–73 to 1980–83, with the extension of HYV seed technology from wheat to rice, the Green Revolution spread to other parts of the country, notably eastern Uttar Pradesh, Andhra Pradesh, particularly the coastal areas, parts of Karnataka and Tamil Nadu and so on. Regions like Maharashtra, Gujarat, Andhra Pradesh now grew much faster than the all-India growth rate of 2.38 per cent per year. The third phase of the Green Revolution, 1980–83 to 1992–95, showed very significant and encouraging results. The Green Revolution now spread to the erstwhile low-

growth areas of the eastern region of West Bengal, Bihar, Assam and Orissa, with West Bengal achieving an unprecedented growth rate of 5.39 per cent per annum. Other regions, particularly the southern region and Madhya Pradesh and Rajasthan of the central region grew rapidly as well. In fact, for the first time, the southern region registered a higher rate of growth than the north-western region. By the end of the third phase, the coefficient of variation of the output growth levels and yield (per hectare) levels between the various states fell substantially compared to earlier decades. This period, therefore, saw not only a marked overall (all-India) acceleration of the growth of agricultural output touching an unprecedented growth rate of 3.4 per cent per year, but also witnessed a much more diversified growth pattern, considerably reducing regional inequality by increasing the spread of rural prosperity.

In the early stages of the Green Revolution, particularly the early 1970s, a considerable opinion emerged that the Green Revolution was leading to class polarization in the countryside. It was argued that rich peasants and capitalist farmers were getting strengthened partly at the expense of the small peasants, tenants, etc., who, unable to access the modern inputs, were being pushed into the rank of the landless, that is, a process of de-peasantization was in progress. Further, the mechanization of agriculture was displacing labour, leading to increasing unemployment and a fall in wages of agricultural labour. In other words, on the whole, a process of relative immiseration of the rural poor and for some sections even absolute immiseration was taking place, creating conditions for agrarian unrest and revolt. 'The Green Revolution will lead to the Red Revolution' was the catchy slogan doing the rounds in some circles in the late 1960s and early 1970s.

Later events and recent scholarship has shown most of these misgivings were unfounded, as were the reservations about regional inequality. From the very beginning of the initiation of the New Agricultural Strategy there was an awareness that steps would have to be taken to ensure that the poor farmers could access the benefits of the new technology and the agricultural labourers' interests were protected. (It may be noted that the immediate, though somewhat alarmist, warning signals put out by sections of the Indian intelligentsia regarding the negative effects of the new strategy on the poor perhaps contributed to the early consciousness and efforts to prevent such a denouement.) Shortly after the strategy was fully on course a concerted effort was made once again, as part of the *garibi hatao* campaign launched by Indira Gandhi in the late sixties and seventies, to reach the rural poor, small farmers and the landless. A series of programmes such as the Rural Works Programme (RWP), SFDA, MFAL, Crash Scheme for Rural Employment (CSRE), EGS in Maharashtra, were launched. The SFDA and the MFAL, for example, identified more than a million small farmers and over half a million marginal fanners who were given short-, medium-and long-term loans. Small and marginal farmers were also assisted by government subsidies of 25 per cent and 33.3 per cent of the investments for which they borrowed, respectively. Millions of poor farmers also benefited from the massive increase in institutional credit made available to agriculture, through cooperative societies, land development banks, nationalized commercial banks, the Agricultural Refinance Corporation, etc., with a special effort, which was considerably successful, to see that the credit reached the poorer sections as well.

With all their weaknesses and loopholes these programmes had a considerable cumulative effect. So much so that eminent economist Raj Krishna reported in 1979 that 'small farmers, as a class, command more productive assets and inputs per unit of land than large farmers'.[4] Though the small farmers, with operational holdings of 5 acres or less, cultivated only 21 per cent of the total cultivated area, their share of net irrigated area was 31.4 per cent, of total fertilizer use 32 per cent and of total agricultural credit 33 per cent. The new Green Revolution technology proved to be not only scale neutral but appears to have evolved an inverse relationship between scale and productivity. Small farmers applying more inputs per unit of land compared to large farmers were able to produce 26 per cent of the value of agricultural output with 21 per cent of the land.

The Green Revolution, far from pushing the small farmer into the ranks of the landless, actually enabled him to survive. With the adoption of the new technology, improved seeds and other agricultural inputs, the small farmer became relatively more viable and did not have to sell out to the large farmer in distress. Studies such as those of G.S. Bhalla and G.K. Chadha have confirmed this phenomenon.[5] In fact, the share of the large landowners operating 25 acres or more in the total number of holdings and in the total area cultivated has consistently declined over the years since independence. And the number of holdings and the area controlled by the marginal, small and medium landowners has remained stable or risen over the years. The Green Revolution notwithstanding, India has remained a country dominated by small and medium farmers. In 1980–81, cultivators operating holdings of 25 acres or less constituted nearly 98 per cent of the total operational holdings, cultivating 77.2 per cent of the total area, and cultivators operating holdings of 10 acres or less constituted 88.5 per cent of the total operational holdings, cultivating 47.5 per cent of the total area.

Tenants and sharecroppers, who did not have security of tenure, were perhaps the only losers. These sections came under pressure as rents and land values rose rapidly in areas where the Green Revolution spread. Also, in these areas the owners tended to get rid of the unprotected tenants in order to resume self-cultivation with hired labour and modern equipment. 'Secure' tenants and sharecroppers were, however, like landowning small peasants, beneficiaries of the new technology.

Fears of the Green Revolution leading to increasing rural unemployment because of labour-displacing mechanization proved to be baseless. On the basis of a field trip made as early as February 1969 in Punjab, Wolf Ladejinsky (who advised General MacArthur in planning land reforms in Japan during the period of Allied occupation after the war and after that was closely associated with land reforms in Taiwan, South Vietnam, Nepal, Indonesia, the Philippines and India) reported that with the spread of the new technology 'the demand for casual labour has increased and so have wages and the landless labourer is somewhat better off than in the past'.[6] The 'victims' of tractorization were bullocks not labour. The net impact of tractorization, taking into account increase in cropping intensity etc., was an increased demand for labour. The fear that indiscriminate mechanization in the next, post-tractorization phase, such as large-scale introduction of combine harvesters and threshers would lead to displacement of labour also does not appear to have materialized on a significant scale in any part of the country till today. In

Punjab, for example, the number of agricultural labourers is said to have trebled between 1961 and 1981, while the number of landless agricultural households declined. The additional demand for labour was met through large-scale migration of labour from the poorer districts of eastern Uttar Pradesh and Bihar.

It has been argued, however, that in the later phases of the Green Revolution the *rate* of increase in employment in agriculture, which accompanied agricultural growth, tended to slacken, that is, the employment elasticity of output growth declined. The complaint, however, was about the failure to generate sufficient additional employment. There was no question of any displacement of labour.

Besides, the general experience of the Green Revolution in region after region—Punjab, Haryana, coastal Andhra, Maharashtra, Tamil Nadu, etc.—has been that apart from the growth in agricultural employment, it has generated non-agricultural rural and semi-urban employment, through the development of agro-industries, rapid increase in trade and warehousing of agricultural produce and agricultural inputs like fertilizers and pesticides, massive growth of the transport industry, manufacturing of a large range of farm implements and other inputs, heavy demand for repairs and servicing of trucks, tractors, electric and diesel pumps and other modern agricultural equipment and machinery and so on. Since over time almost all the agricultural machinery and equipment was produced indigenously, mechanization in agriculture created urban factory employment. Also, the increase in rural incomes following the Green Revolution led to increased demand for masons, carpenters, tailors, weavers, etc. in the rural areas and for factory-produced consumer durables from transistor radios, watches, cycles, fans, televisions, washing machines, motorcycles, sewing machines to cars and air conditioners. Since the rural demand for some of these commodities began to exceed the urban demand, forcing their manufacturers to turn towards the countryside, its impact on generating urban employment is not inconsequential. It is significant that Punjab saw a striking increase of about 50 per cent in urban employment between 1971 and 1981, partly reflecting the impact of development in agriculture in the non-agricultural sector.

However, all the employment generated by the Green Revolution was still not sufficient to meet the employment requirements of the rapidly growing population, a large proportion of which lived in the countryside. Urgent short-term and long-term steps were therefore necessary to deal with this situation. Here, too, the Green Revolution proved critical. The surplus stocks of foodgrain that became available as a result of the agricultural breakthrough made it possible to launch employment-generating poverty alleviation programmes on a considerable scale, particularly in the agriculturally backward areas. As the agricultural expert and policy-maker C.H. Hanumantha Rao put it:[7]

> From about 20 million person-days of employment generated in the mid-1960s, the employment generated under such programmes in the country as a whole amounted to 850 million person-days in 1988–89. These employment programmes, together with the income generated under the Integrated Rural Development Programme (IRDP), seem to make up for about half the deficiency in employment generation in agriculture in the post-green revolution period . . . These programmes were made

possible because of the increased availability of foodgrains from internal procurement.

The Green Revolution did, however, contribute to an increase in inequality in the countryside. But the poor too benefited in absolute terms though their well-to-do neighbours did far better relatively. Yet, pursuing a strategy which was more 'equitable' and 'politically correct' but left the rural poor, already living at the edges of survival, worse off would be cruel. Some of the earliest reports of the impact of the New Agricultural Strategy, such as those of Daniel Thorner based on field visits to coastal Andhra, Thanjavur in Tamil Nadu, parts of Haryana, western Uttar Pradesh, etc., in 1966 and 1967–68 and those of Ladejinsky from Punjab in 1969 confirm that, while inequity increased, the poor including the small peasant and the landless agricultural labourer benefited. Real wages of agricultural labour consistently rose in areas where the Green Revolution spread. Increase in wages in the high-growth areas, such as Punjab, would have been much sharper but for the migration of labour from low-wage areas of Bihar and Uttar Pradesh But then not only were the migrant labourers beneficiaries of considerably higher wages, the wage levels in the areas they came from also tended to rise. Interstate disparities in agricultural wages began to decline from the mid-1970s, partly because of the migration of labour from the backward regions to the Green Revolution areas.

In summary, then, the Green Revolution had a major impact on rural poverty levels through its impact on food availability, decline in relative prices of food (the most important item of expenditure for the poor), generating of agricultural and non-agricultural employment, rise in wages and so on. The link between the spread of agricultural growth or the Green Revolution in an area and the fall in the numbers of the rural population living below the poverty line in that area is now widely accepted and can be seen to be operating in a large and growing part of the country. With the majority of the Indian population still dependent on agriculture the critical importance of spreading the Green Revolution type of development as an anti-poverty measure has been widely recognized. (The slowing down in recent years of public investment in irrigation and other infrastructure, which is critical for the spread of rapid agricultural growth, has been widely criticized for this reason.)

The Green Revolution, therefore, has not spawned any 'Red Revolution' in the countryside. Peasant protest and even peasant militancy has been on the rise but then these are not movements of the lowest strata demanding a systemic overthrow but of small, medium and large peasants who are beneficiaries of the system and want more via higher prices for their produce and lower input costs through state subsidy. In fact, over the years the political clout of these sections has increased and the governments of the day have felt compelled, to a greater or lesser degree, to make concessions to them, which were often not economically viable. Most states, for example, provide electrical power for agricultural purposes at prices far below the cost of production, with some states like Punjab providing it free! Such developments have in the long run adversely affected the overall health of the Indian economy including that of agriculture.

A major and pressing issue that has surfaced in recent years relates to the question of environmental degradation and the long-term sustainability of agricultural growth. The negative environmental impact of excessive use of chemical fertilizers and pesticides, as well as the

plateauing of the growth rates in areas using such technology over a long period, such as Punjab, has been well-documented. The excessive withdrawal of groundwater for irrigation, which is taking place in many Green Revolution areas without adequate recharging of the subsoil aquifers, is also environmentally unsustainable. However, there are no easy answers to this problem. While agricultural growth with this technology is throwing up problems, absence of agricultural growth throws up other critical environmental problems apart from the obvious economic and political ones. It has been argued that in India the ecological degradation occurs *mainly* due to the extension of cultivation to the marginal and sub-marginal dryland and to deforestation and it has also been noted that 'across different states in India, the extension of areas under cultivation and the denudation of forests seems to be high *where the progress of yield-increasing technology is slow*',[9] and the poor are forced to depend on marginal lands, village commons and forests, etc. The renowned agricultural expert M.S. Swaminathan, has estimated that to produce the current level of foodgrains output with the pre-Green Revolution yields per hectare of wheat and rice would require an additional 80 million hectares of land, that is, it would require an impossible increase of about 66 per cent in the existing cultivable area![10] Clearly, yield-increasing technology has been critical for forest-saving in a situation where India's forest cover has depleted to dangerous levels.

Given this situation, any blind opposition to agricultural growth with the existing modern technology would be unsustainable and counter-productive. However, it has become necessary to make a major effort in educating the farmers so that excessive and improper use of chemical fertilizers and pesticides, wasteful irrigation practices, etc., are checked and they are acquainted with the necessity of retaining biodiversity and of learning from traditional methods of retaining the ecological balance while using modern technology. Partly, the answer lies in the direction of further scientific breakthroughs, particularly in the area of biotechnology. It is felt that top priority needs to be given to research in this frontier area, if India is to achieve sustainable growth with self-reliance in the emerging world context today, as she has been able to do in the past with the Green Revolution technology.