

SUSTAINABLE DEVELOPMENT OF INDIAN
AGRICULTURE: GREEN REVOLUTION REVISITED

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SUSTAINABLE DEVELOPMENT OF INDIAN AGRICULTURE :
GREEN REVOLUTION REVISITED

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Sustainable Development of Indian Agriculture
, Green Revolution Revisited

There are many things unique about the story of technological change in Indian Agriculture in sixties, seventies and eighties in India. However, my regret is that when our experience is applied in Africa or other developing countries, all the wrong lessons are learned.

This note has three parts: first deals with the current challenges in Indian agriculture. Part two deals with the historical review of the social, political and economic forces that shaped our policies. Part three deals with the issues to be faced in the nineties.

Part one: where have we reached ?

- (a) The growth rate has been 3.1, 2.5 and 2.7% per annum during 1951-52 to 1964-65 (pre green revolution); 1969-70 to 1987-88 (post green revolution) and 1951-52 - 1987-88 (almost whole period after independence in 1947). The growth in pre-sixties was contributed mainly by bringing new area under cultivation either by cutting forests or previously fallow land. In post sixties, yield increased entirely because of increase in the productivity.
- (b) While the jump from 74.2 million tonnes in 1966-67 (a drought year) to 94.0 million tonnes in 1967-68 after introduction of new technology was indeed very dramatic given the fact that post war economy (wars of 1962 and 1965) was quite sluggish as far as public investments were concerned. However, we had reached a figure of 82.3 million tonnes way back in 1960-61 when monsoon was good. Also, the production level hovered around 100 million tonnes till 1975. It came down to 97 million ton in a year of severe drought in 1972-73 and to 99.8 million ton in another drought year 1974-75.
- (c) The jump of 20 million tonnes in 1975-76, 1982-83 and 1988-89 to take the production levels to 170 million tonnes has been contributed by good monsoon but also better distribution of inputs, improved irrigation infrastructure, technological upgradation, and resurgence of productive potential in Eastern India.
- (d) Per capita availability of foodgrains and pulses has remained around 441 grams per day. It was as high as 480 gms in 1965. Population growth rate has kept a pace with the food production.
- (e) Per capita income of rural producers (1966-77 to 1978-79) has ranged from Rs.1,627/-, Rs.1,270/- in Punjab and Haryana

to Rs.395/- in Bihar. It ranged from Rs.600 to 750 in 6 states and Rs. 490 to 600 in 12 states.

(f) The growth rate of wheat has been 5.1 per cent per annum between 1969-70 to 1987-88 and has been higher or at same level for several other cash crops and vegetables like potato. The oilseeds have a growth rate around 3.7 percent, rice 2.4 percent, pulses around 1 percent, jowar 0.3 percent and Bajra negative. Thus the green revolution has escaped the rainfed crops affecting the poorest people so far.

(g) Input productivity has been declining at an alarming pace. With 1970-71 as base of 100, the index has come down to less than 60 in 1987-88. Fertilizer consumption has increased by about 387 percent during 1970-71 to 1988-89, gross irrigated area has increased by about 30 percent, power consumption by 88 percent, pesticides by about 323 percent during the same period.

The food production increased by only 57 percent.

The non-sustainable nature of the green revolution doesn't need a more telling testimony.

(h) Despite increasing production in recent years, government has found it difficult to fulfill its procurement current targets to meet obligations of food stock for national security and public distribution system. The larger irrigated land holders have increased their capacity to stock grains.

(i) The expenditure on drought relief has continuously increased being more than Rs.2000 crores during 1987. If the bank loans waived or to be waived may be added to it, it may increase by another couple of thousand crores.

(j) The rainfed crops like oilseeds and pulses have been pushed over to more and more marginal lands making technological change in them all the more difficult.

(k) Most of the millet, pulse and rainfed oilseed growers being scattered, vulnerable to seasonal fluctuations and living in the regions with low population density have poor access to formal delivery systems for meeting various minimum needs. The market forces are also quite weak.

(l) Emigration of poor people from drought and flood prone regions and hill areas to cities adds to the problem of urban poverty. This also robs the disadvantaged regions of many able men and women who could have taken some risk to undertake technological transformation. This is in addition to the misery that children and other family members of these migrants have to suffer

(m) The proportion of women headed or managed households, is

quite large in these regions. Given conspicuous neglect of women clients by public agencies, poor infrastructure becomes poorer for these families.

Part two: Historical overview of technological change.

There was a strong research interest among Indian Scientists in forties on finding out best way of conjunctive use of organic and inorganic fertilizers. The agronomic ways of weed control were given importance and overall pest and weed problems in any case were less severe. Dr. N.R. Dhar had pioneered many imaginative experiments on sustainable agriculture in Allahabad.

We begin the story of technological change from 1962, the year India had the first major war with China and realized its poor defense preparedness. National consensus on several macro policy issues primarily aimed at import substituting self-reliant economy started breaking down.

The year 1964-65 was a major drought. The war with Pakistan in 1965 increased the pressure on economy. But stoppage of US shipments of cheap food aid provided the right stimuli for searching alternatives for self reliance in food sector. It may be recalled that America had by then given considerable aid both for setting up so called community development blocks (of about 80-100 villagers each) all over the country and also for meeting the needs of public distribution and emergency aid for victims of natural disasters. American interest in keeping communists at bay was served well.

Distribution of imported wheat under public employment programmes had created taste and market for wheat even in the non wheat growing regions .

Indian Scientists were aware of the high yield responsiveness of Mexican varieties of wheat and IR varieties of paddy. Decision to bulk import the wheat seeds heralded the massive effort for technological change primarily in the Indo-gangetic plain with good rich soil and abundant waters,

Even though the extension machinery was quite weak and so were the markets, the alleged resistance of Indian farmer to a visibly 'viable' technology evaporated in the thin air.

The drought of 1965-66 had also witnessed deaths on large scale (the last time it happened) in Bihar. New technology led to high yields and also high incomes but initially to only those who had.

* Further as American publications in Foreign Affairs (David K Kunkel, 1984) showed, India was a good example of how American "food aid leads to cash sales for US farmers" for edible oil and livestock products. Pakistan was shown to have become largest importer of American vegetable oil under P L 480 and GSM 102. access to irrigation and institutions providing other inputs. Disparities increased and the rural tensions started mounting.

By 1967, four major events took place -

-The devaluation of rupee and its failure to boost Indian exports.-large scale violence in rural areas by left radical groups called as Naxalite movement.

- Several states had opposition SVD (joint front) governments ruled mainly by the rightist parties. - Central government though ruled by congress was critically dependent upon communist party for support.

-By this time, several Communist leaders had infiltrated congress party hoping to capture it from within.

-Around the same time, experiment in social control of banking had started. But with split in the ruling party on the eve of election for the president of the country, a new polarized party with relative dominance of socialist ideology emerged on the scene.

A confidential report of the Home Ministry by this time had brought to fore the need for land reforms and pressure for direct attack on poverty if rural violence had to be contained.

Bankers by then had begun to see the potential of mobilizing rural savings accruing on account of technological change.

Government wanted to prove its socialistic ideals and thus nationalised the banks among other measures.

Rural credit also started being pumped into the agricultural sector to improve incentives for technological transformation.

By early seventies, India had to face another war (1971) which transformed the fortunes of the ruling party. Even though politically it was less dependent upon the leftist allies (because it had huge majority in the parliament), the efforts for containing hopes of small and marginal farmers and landless labourer had to be initiated. Several subsidy linked programmes for provision of credit for irrigation, land development and other assets started.

There was a brief spell when several programmes aimed at solving eco-specific problems of the country were launched eg. Drought Prone Area Programme, Hill or Tribal area development programme etc.

By 1973, the failure of poverty alleviating programmes was obvious. It was also clear that trickle down of growth made possible though new technology may not take place at sufficient pace and scale. The land reforms had got stuck through complicated but easy loopholes left in the acts leading to large scale litigation.

The country side was getting restive. The erstwhile social

colleagues of the then prime minister were also getting disillusioned.

The oil price hike in 1973 and resultant inflation made worse by the drought of 1972-74 resulted in a widespread social unrest. The difference this time was that unrest was not restricted merely to rural areas this time. It spread to urban areas too. By 1974, the country was facing a massive industrial unrest, widespread social discontent and clamour for change. But change that followed was a shock therapy type. Emergency was declared in June 1975 and all fundamental rights were suspended.

Among other things, two or three things had crystallised by now:

- (i) World Bank had extended massive line of credit for mechanisation and minor irrigation;
- (ii) technological change was indeed diffusing rather widely leading to perceptible change in food supply;
- (iii) Political tilt of ruling party towards the right was being manifested openly.

While Price Commission had been set up in mid sixties, the terms of trade were moving against agriculture. Even though there were a few announcements ostensibly to help poor but it was clear that government had lost contact with people.

Emergency excesses led to the change in government. The new political alignment was certainly to the right but also had some committed socialists. The direct attack on the poverty through IRDP (Integrated Rural Development Programme) started in 1978. Agricultural prices were made more favourable and input subsidies continued. Good monsoon coupled with continued supply of new varieties of wheat and paddy helped in achieving new heights in food production.

Emphasis remained on input responsive technologies for increasing the yield.

By 1983-84, thanks to the recognition of seed distribution as a major bottleneck, attention was shifted to Eastern India where growth rate had been low. Good monsoon coupled with good management of input distribution, food grain production increased again.

By now however, two major signals started appearing:

- The input output ratio was becoming seriously adverse in the agricultural sector.
- Efforts of the government to reduce subsidies to contain budget deficit were not meeting much success.

This government ruled by a coalition of opposite political inter-

ests broke up and the old party came back to power.

The political change this time had some very clear implications for technology transfer.

Despite the drought of 1979, the scientists and the public officials were happy that food production had not dipped too low. The mechanization, which was slowed down due to large scale studies on its labour displacing effects was reintroduced in early eighties. Mounting of inventories in tractor industry was the major reason. But pressure from affluent farmer had also made some difference. The credit constraint had been removed. Fertilizer subsidies continued.

Emphasis was shifting towards high tech approach to agricultural development through reliance on Biotechnology and infact import of seeds made more easily possible than hitherto.

It was realized belatedly that standardized approach for agricultural development relying on the most favoured and well endowed regions may not work any more. The attention started increasing towards regionalization of technological change policies.

But this time next yield barrier was crossed in 1988-89, the non-sustainability of agricultural technology was becoming more and obvious. At the same time need for better soil and water conservation through watershed management in dry regions and restoration of ecological balance in hill areas denuded severely in the past was being felt. But the patience for technologies which could generate surplus in longer period of time but in a sustainable manner was just not there. There was no appreciation for decentralised planning nor was there any attention towards improving the capacity of agricultural scientists to continue to deliver results. The research funds per scientists in the country had gone down in real terms by as much half and in many state more than that. Budget of Indian Council of Agricultural Research was almost equal to or slightly more than the budget of Department of Biotechnology alone.

Sustainability of the institutions in which research for sustainable agriculture could be done was itself under doubt. The private and public corporate sector (particularly agri-input industries) was thriving on the work of agricultural scientists but was hardly making any investment in improving research productivity.

Part Three: Where do we go from here:

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The following research needs based on the lessons of Green Revolution in India are unlikely to attract attention within India without considerable pressure from relevant but less powerful constituencies.

Some constituencies are historically quite weak such as the ones belonging to graziers or livestock herdsman, rearers of bullocks

following extensive systems of resource management; makers of hand tools or bullock drawn implements, small scale manufacturers of herbal non-toxic pesticides; developers of non-monetary input requiring technologies etc.

But then sustainable development requires close involvement of these very constituencies.

Research Issues:

- (1) The time of individual oriented technologies is over. More and more emphasis will need to be placed on the group based technologies. The areas where group action is called for include:
 - (a) Synchronization of sowing schedules of certain crop to avoid synchronization with pest reproduction cycle in certain crops where this is a major problem.
 - (b) Watershed management of both arable and non-arable land belonging to individuals as well as villages, forest and revenue department.
 - (c) Synchronized sprays coupled with pest reducing crop rotations and mixtures to minimize use of chemicals in the short run and total elimination in the long run.
 - (d) Biological pest control coupled with water management and drainage
- (2) Most of the post graduate and even other research particularly in the discipline of Agronomy is concentrated on Inorganic Fertilizer. Very little work is being done on green manuring, conjunctive use of inorganic or organic manure and replenishment of micronutrients through ash and other organic supplements.
- (3) Genetic uniformity in high growth regions has created another major reason for concern. Very few varieties of wheat occupy large areas. And a large number of rice varieties with IR parents have common genetic source of disease resistance. Diversity in genes can not be achieved in the short run without making a trade off in yield. Just like Europe and America provide incentives to growers to fallow the land or for cutting the dairy animals, incentives for genetic diversity, and green manuring will have to be provided in India in high growth regions. These will be necessary till alternative genetic sources of resistance and yields are available.
- (4) The shift from crop to trees (horticultural and/or timber) is taking place both for reducing the need for outside labour and also for reaping larger commercial gain by larger farmers. As long as the shift is marginal, nothing much may matter. But once it becomes largescale, the imbalances in

food supply may emerge. Agro-forestry for high and slow growth regions thus is an urgent priority.

- (5) The tilt towards fashionable technologies rather than relevant technologies has to be reversed. Even though we do not have even ten calves produced under field conditions from Embryo-transfer technology, the scarce resources for dairy research and technology transfer are being misallocated towards such technology. Even the conventional technologies like frozen semen (Of good local breeds) for upgrading cattle haven't yet been provided at large scale. Shifting gears every now and then on technologies popular in west in costing us a lot. Of course the problem is common to most disciplines and not merely to dairy. If elites in third world recognize merit of third world scholar only / mainly when they get approval/notice from the west, then is not it natural that the scholars (undoubtedly highly competent) should work on problems fashionable in west.
6. Synchronization of maturity was a necessary trait in cereals for improving mechanizations in west. Research on their subject became popular in seventies in India also because many scientists returning from US or UK after training carried on this research. Perhaps alternative ways of combining response to inputs could have been found if searched.
7. It should be mandatory for every agri-input industry to contribute a part of its profits to a National Fund for Sustainable Research (NFSR) to be managed by a group of interdisciplinary scientists, NGOs and committed public servants. NFSR should be used to fund long range research programme for identifying low /no external input sustainable technologies.
8. One of the casualties of the green revolution in India has been the discontinuance or weakening of longitudinal research. Without such research, comprehensive understanding of changes in ecosystem can not be achieved. There are hardly any experiments in the country running for 30-40 years to provide basis for developing long range forecasts for different type of technologies (particularly for soil & water conservation, but also for input use). Unfortunately most foreign aid agencies reinforce such a bias among the Indian institutions. Capacity in society to face long term challenges can't be developed unless basic research on system basis is supported in different agro-climatic regions of the country.
9. The continued neglect of dry regions is really criminal. It is a pity that when we think of hill areas or drought prone regions, we conjure image of domestic servant or a cheap labour. National Commission on Development of Backward Areas (1981, Planning Commission, New Delhi) went so far as to say that we should not try to create conditions by which supply of cheap labour for large irrigation projects is

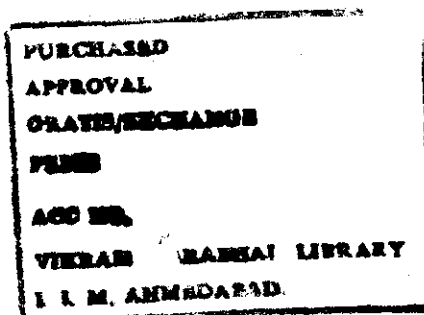
affected adversely.

10. It is true that far fewer Members of Parliament are elected from dry regions due to low population density and hence much political pressure is not expected in the short run. But it should be acknowledged that low investment in pasture development in dry regions affects the sustainability in other regions directly. For instance,
- population growth rate of sheep and goat has been several hundred percent compared to 30-60 percent increase in cattle in most districts in Western India. Poor have to increase weight of low capital requiring enterprise in their portfolio if they have to survive without any support for other possible technologies or enterprises.
 - The cultivation of marginal regions increases siltation rate of seasonal rivulets in these regions further affecting the run off, soil and water conservation. Even snap floods have been experienced in some parts of Rajasthan - a phenomenon unheard of in history.
 - Continued emphasis on crop varieties with high harvest index (grain/straw ratio) has intensified pressure on dry matter supply. The pressure on trees for leaves and energy (twigs) is inevitable. Tractorization in dry regions does damage in two ways, (i) it makes escaping spontaneously sprouted tree seedlings while ploughing virtually impossible (this was possible with bullock ploughing) and (ii) it increases the tendency to cultivate river banks, marginal lands which were earlier left as fallow. Once the soil is loosened and grass roots are removed, the rate of soil erosion increases. Strong winds do bring this sand (and some silt) on to the neighbouring regions. This trend will only increase in future.
 - Mining of ground water in high growth regions has assumed alarming proportion.
11. Development of Common Property Institutions for generation of collective restraint is most essential. It is obvious that, as the water table goes down lesser and lesser people are able to mine it. Having lost the battle of land reforms the struggle for water reforms must not be lost.
12. The dilemma of continuing malnutrition and poverty among 30 - 40 per cent of the people having no purchasing power is manifesting in certain paradoxical ways. For instance, wheat was sought to be exported a few years ago when the food stocks reached a level of 30 million ton. It was realised that (a) more and more countries were trying to seek self reliance reducing the demand for wheat at commercial prices, (b) the quality of wheat was not good such that even Russia - a close ally of India refused to buy a few lakhs ton of wheat and (c) the African countries which had

need for this grains did not have the ability to pay in hard currency. Instead of using those stocks for launching massive employment programme for reclaiming denuded forest lands and other eroded lands, thinking of export was obviously a short sighted answer.

13. The demand of manufaured goods which are income inelastic is unlikely to increase unless the distribution of purchasing power becomes more even.

Green revolution has certainly proved that Indian farmers were no less enterprising than the farmers anywhere else in the World. However, it is also true that the rate and pattern of growth is not sustainable either ecologically or even politically. Some of the tensions in high growth regions are arising because of the inability of state to continue the subsidy at the rate at which these were available earlier. On the other hand that deterioration in the level of living of the people in drought prone regions and hill areas is leading to demands for separate states and more autonomy. There is no denying the fact that next round of violence could be in the backward regions if neglect continues to be what it has been. The recent trend towards inviting multi-national corporations for initiating agribusiness model of contract farming in the high growth regions cannot but bring the experience of Latin America and Phillipines into India. It is a pity that planners cannot see that.



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