 DOI:10.5958/j.0976-4038.5.1.030

India's Green Revolution: Fact and Fallacy

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Article History

Manuscript No. 542a
Received in 6th November, 2013
Received in revised form 5th January, 2014
Accepted in final form 26th February, 2014

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Keywords

STI, green revolution, agricultural technology, agricultural production, rural

Abstract

In independent India the first remarkable attempt to agri-rural development has been popularly referred to as 'green revolution'. This strategy of agri-rural development was based on the idea that traditional agriculture is rain-fed, inefficient and low productive unable to meet the ever rising demand of growing population. Thus, the idea to increase agricultural food production originated from the phenomena of consecutive famines occurred in many parts of India during 1940s. However, diffusion of agricultural innovation of green revolution has brought many undesirable consequences in rural society. Therefore, there is no valid reason to cheer so much about the monumental increase in food grain production. Mere increase in production is not the panacea for all rural social problems. Without a reform in agricultural tax policy, land ownership, credit service, structure and function of society and above all a desirable change in the mind-set of people, policy makers and politicians, no technology, innovation, practice and idea can bring prosperity in rural India. This paper throws light on some of the less discussed issues of India's famous green revolution which must be taken into consideration before kick starting a second green revolution or evergreen revolution based on genetically modified crops, nano-technology, biotechnology, system of rice intensification (SRI), or ground water irrigation, and so on.

1. Introduction

With the launch of auspices Intensive Agriculture District Program (IADP) popularly known as 'package program' using 'high yielding variety' (HYV) seed, fertilizer and pesticide agriculture in India has been transformed from a traditional to modern form. No doubt, India has become self-sufficient in food grain production after that. But the basic purposes of poverty alleviation, eradication of hunger, improvement in standard of living have not been changed as desired. Poverty is not simple as understood and perceived by the policy makers, development professionals and academicians. Poverty is much more complex with many dimensions caused by interplay of a number of factors (Chambers, 1983). Mere increase in food-grain production is not the panacea for problems of poverty and hunger. Though transforming agriculture by 'science, technology and innovation' (STI) green revolution has made India self-sufficient in food grain production, still India has the highest number of malnourished persons in the world. Nearly 75% Indian leaves in villages and 65% are engaged in agriculture who feed over a billion of Indians contributing about 18% to gross domestic product (GDP). But Indian agriculture is in a state of crisis (Chand et al., 2007; Swaminathan, 2012). About 40% of farmers want to quit farming due to many reasons. On the other hand, National Food Security Bill to ensure 'food for all and for ever' should include nutrition also which is directly related to the Right to Education Act because learning can not take place if a child is malnourished. And without education of its people a country can not prosper. Therefore 'Future belongs to nations with grains and not guns' (Swaminathan, 2012). Indeed future of India depends to a great extent on agriculture. "(And)…in principle India should have no difficulty in meeting the food needs of its population for at least a century. If Indian people were to go hungry, it can be said with authority that it would not have anything to do with their number but with the callous mismanagement of the country's natural resources...Ultimately it is the nature of Indian society that will determine the carrying capacity of India's lands" (Second Citizens' Report on the Environment, 1984-85: Population and Environment: Cited in

Ratnagar, 1989). This paper gives an insight into some issues pertaining to Green Revolution which are either overlooked, misunderstood or ignored by the development professionals, policy makers and academicians while talking about the fruits of green revolution as well as planning the future strategy of agri-rural development based on STI.

2. Ironies of Green Revolution

In independent India the first remarkable attempt to agri-rural development has been popularly referred to as 'green revolution' involving a novel and noble way of agriculture encompassing high yielding variety (HYV) seed, use of fertilizer, pesticide and machinery with assured irrigation. This strategy of agri-rural development was based on the idea that traditional agriculture is rain-fed, inefficient and low productive unable to meet the ever rising demand of growing population. And interestingly the idea to increase agricultural food production originated from the phenomena of disastrous famine experienced by many parts of India during 1940s. It is now a fact that those incidences of acute food shortages were largely natural due to drought or flood aggravated by existing social structure (class, caste and social tradition) of the rural society which was man-made. Thus, the new era was started under the new agricultural strategy reckoned as 'green revolution'. However, diffusion of agricultural innovation of green revolution has brought many undesirable consequences in rural society. The results or consequences of 'green revolution' are listed as follows (Bardhan, 1970; Ladejinsky, 1969ab, 1970, 1973; Oommen, 1971):

- Increased production mainly wheat, followed by rice, unit^{-1} of land.
- Indiscriminate use of fertilizer and pesticide leading to loss of soil health, pest resistant, environmental pollution.
- Increased ground water extraction leading to water table depletion.
- Increased mechanization leading to decreased use of oxen.
- Increased income.
- Increased labor utilization (demand for casual labor has increased, so the wages).
- Economic disparity (uneven share of gain-widening the gap between rich and poor).
- Concentrated in resource-endowed areas (uneven development).
- Mainly benefited the States of Punjab, Haryana, Western Uttar Pradesh and scattered islands here and there.

A review of literature gives an insight into the ironies of green revolution which were less cheerful for one or the other reason. A brief visit to a few places in two States of Punjab and Bihar where green revolution were taking place Ladejinsky (1969ab) observed the following: "With a level of literacy not more than 15% and other problems piled upon problems, Bihar is not Punjab, but there too not many farmers need persuasion any longer that the new technology is good for them…The share-croppers are…worse off now than before because as ownership of improved land is prized very highly there is mounting determination among owners not to permit the tenants to share in the rights of the land they cultivate…It is not, however, the new technology which is the primary cause of the accentuated imbalances in the countryside. It is not the new technology that the credit services does not serve those for whom it was originally intended; that the extension services are not living up to expectations; that the panchayats are political rather than developmental bodies; that security of tenure is a luxury of the few; that rents are exorbitant; that ceilings on agricultural land are notional; that for the greater part tenurial legislation is deliberately miscarried; or that wage scales are hardly sufficient to keep soul and body together. These are man-made (social and) institutional inequities".

3. Fallacy of Green Revolution: Tragedy of the Commons

Ladejinsky (1973) further observed that "The term 'green revolution' suffers from the word 'revolution'. The word revolution stands for a sharp break from the situation that existed before the revolution. It implies also that transformation can be attained quickly. Thus defined, 'revolution' is the milestone around the green revolution's neck and many of the ills ascribed to the green revolution flow from it. But more modestly viewed as evolution in the process of finding a way out of the customary behavior of traditional agriculture, the green revolution has served the country well, all the constraints notwithstanding…But the new technology's failure to live up to its production potential is centered on the well known proposition that 'nobody has been able to invent a cow which will give milk without being fed'. And this is at the heart of the unrealized potential where the technology is firmly implanted, and why so many crops have not been touched by it. The fault does not lie with the inherent advantages of the technology; their sophistication in raising yields has been proved. Rather, the fault lies with the failure to help them along in a variety of both man-made and natural inadequacies encompassing skills, irrigation facilities, allocation of resources, and the whole gamut of physical inputs, research, organization and communication. The point to stress here is that the existence of a breakthrough away from traditional agriculture is in the making. And it matters not whether one marks it 'revolutionary' or just plain 'evolutionary"".

There is a belief that green revolution has made the rich richer and the poor poorer, thereby has created a situation of unrest across the countryside. Oommen (1971) explained the

phenomenon of agrarian conflict in the following way: "The prevailing explanation of agrarian conflicts and unrest in the countryside may be summarized as follows: The strategy of agricultural development adopted so far has been mainly production-oriented and the problem of distributive justice has remained unattended to; the fruits of the 'green revolution' are pocketed mainly by the rich and prosperous farmers and the disparity between them and the have-nots, particularly landless laborers, has increased; the increased disparity has led to a sense of deprivation among the weaker and poorer agrarian classes and their frustrations are manifest in agrarian tensions, occasionally leading to eruption and violence. This causal explanation of agrarian tensions…is naive and too simple; the problem is much more enormous and complex. The major factors involved in agrarian conflict…are (i) perception of prevalent disparities in income by the rural poor; (ii) the strength of the agricultural labor force and its consciousness of its political bargaining power; (iii) the existence of an adequate support-structure provided by the political parties; (iv) the rising aspirations of the rural masses; and (v) the increasing lack of fit between the socio-political framework and the economic order".

On the other hand, diffusion of an innovation in a society leads to a wave of innovation, the graphical representation of which shows an 'S'-shaped curve, called the 'diffusion curve', i.e. the diffusion process starts up slowly, then gather momentum, and finally peter out when all farmers adopt the innovation (Rogers, 2003; Roling, 2006), and consequently leads to a situation as described below.

"…When a new technology begins to be adopted it allows the ones using it to produce more, or more efficiently, against the going price, which is initially still determined by the old state-of-the-art…But as more farmers adopt (seeing the good results of the early ones), the state-of-the-art changes. Total production increases. Prices start to drop. People who have not adopted the innovation yet see their incomes drop, even if they work as hard as before. Price squeeze finally forces them to also adopt…Farmers, who are too small, too old, too sick, or too stupid to keep up, eventually drop out. Their resources (such as land) are taken over by the 'stayers'. This process is called 'scale enlargement'. Under this situation those who survive usually have large enterprises, a good education, an enormous working capital (tractors, buildings, livestock, etc.), they are highly organized, and they are embedded in a network of supporting institutions and organizations, including input service cooperatives, farmers' unions, truckers, processors, retailers (e.g. supermarkets), vets, and so on…When it works, the diffusion process have important consequences at the macro level, e.g. labors moves out of farming, farmers' cannot hold on to the benefits of technological innovation (global food prices have continuously declined over the past 40 years)…" (Roling, 2006). This is the actual situation at present in most of the developing countries which is expected to worsen further in near future if appropriate measures are not taken in time.

4. Traditional versus Modern Agriculture

The National Commission on Agriculture (1976), reporting on the low efficiency of Indian agriculture and its inability to keep pace with population growth, states that "Over vast areas of the country agriculture has continued to be traditional in character, resulting in low yields, limited income, and lack of capacity to invest..." "With population increase in the late nineteenth century…plus colonial motivations to increase revenues through increasing the area under cultivation, a viable system was lost. Modern HYV and chemical fertilizers have, with the neglect of irrigation, only increased the cost of agricultural production" (Cited in: Ratnagar, 1989).

"While the dominant view is that the traditional character of Indian agriculture has obstructed development…A fairly prevalent view is that…poverty is caused by 'the fact that most of the (indigenous) economies are non-monetized and hence the cropping pattern has been non-commercial…Unless the (indigenous communities) become more economic-minded and more rational, any attempt to modernize…will be futile' [Pal, P.N., 1972. Policy measures of tribal agriculture. In: Patel, M.L., (Ed.), Agro-economic Problems of Tribal India, Bhopal, 3-22: Cited in Ratnagar, 1989]. "…Non-market production in agriculture is not only more equitable than production for the market which invariably widens the gap between the rich and the poor, but ecologically sounder, aiming not at maximization of profit but at reducing risks and at diversification….Productivity was higher when land was under tribal tenure and management, and the interests of states in revenues were in abeyance… This implies that it is not centuries of marginalization and exploitation, but the very structure of tribal economy and society, which are at the root of development-wallahs' headaches…Soil fertility, manuring, the variety and efficiency of ploughs, water-wheels and so on to show that we cannot justifiably infer agricultural stagnation or decline in the medieval India…" (Ratnagar, 1989).

Though Indian agriculture has transformed from subsistence farming to market-oriented agriculture towards high-value commodities many of the problems that existed prior to the green revolution still persist, e.g. poverty, hunger and malnutrition, ever growing population, fragmentation of land into smaller holdings, and depletion of natural resources, especially soil and water. Climate change has now emerged as a new menace. A large population of young farmers want to give up agriculture if get an alternative employment and livelihood (Sud, 2012). If it is to believe that increased agricultural

production will improve the economic condition of the farmers, thereby will help alleviate poverty and hunger, why the tremendous increase in food-grain production has not able to do so? Fault lies in our perception of poverty in terms of money. Also new era of commercialization, marketization, aggravated by globalization has contributed to poverty. Therefore, the all pervasive concept and philosophy that traditional way of doing thing is undesirable is not right. We must try to understand the reality and act accordingly.

The idea that increased food production is the solution for poverty and hunger is all pervasive. Hence emphasis is always given to produce more and more by hook or by crook. But to produce more one requires fertile soil, fertilizer, irrigation, high yielding seed, and the like. Poorest of the poor is devoid of all these requirements. Was it madness on the part of us to use STI for increasing production? Were irrigation channel, pods, bunds, wells constructed during the earlier days not technology? Why then instead of importance of these technologies for irrigation we advocated the technology to use precious ground water with the help of costly and destructive technologies not affordable by the poor? When will we do the justice to science, to do justice to the poor in the name of which we are doing all the harmful and destructive activities to ruin our land, water and air and thereby our future? Mere increase in food production by adoption of costly technology is not the panacea for multifaceted problem of Indian agrarian scenario. Time has come to use STI for man kind. Before advocating and prescribing we must put our shoes into the others for whom we show our concern. There is no more need of new technology which make the poor more dependent on others and more vulnerable. Instead we need to concentrate on our own poor man's technology to be modified by modern technology, if need be.

5. Kick-starting a Second Green Revolution: are we Moving on the Right Path?

In the context of West Bengal-a State not as much as benefited from green revolution as the State of Punjab, Haryana or Western Uttar Pradesh-Mukherji, et al. (2012) commented that "With ease in electrification procedure, farmers of West Bengal will be able to make intensive use of groundwater for increasing their agricultural production. This will also contribute to poverty alleviation in a state that is home to 214 lakh of poor and of these 84% live in rural areas. These initiatives will also give concrete shape to the central government's policy directive of encouraging food production in eastern India without compromising groundwater resource sustainability". And recently (November, 2011) the Government of West Bengal has adopted a policy to kick start a second green revolution making the electrification procedure easier so that farmers can extract ground water more than before using pump sets for more production. It is also believed that this will contribute to poverty alleviation without compromising groundwater resource sustainability (Mukherji, et al., 2012; *Ananda Bazar Patrika* (in Bengali) August 30, October 2, 2012).

"The basic premise of the Groundwater Model Bill, 2011 is that it is small farmers and all persons living in rural areas that are most directly affected by the existing framework that gives exclusive control over groundwater to landowners and no effective control to other groundwater users or democratically elected local bodies of governance. The Groundwater Model Bill, 2011 is thus based on the idea that while protection of groundwater is a key to the long-term sustainability of the resource, this must be considered in a framework in which livelihoods and basic drinking water needs are of central importance…Groundwater is now the main source of water for all main water uses and needs to be given the policy attention it deserves. The fact that it is a politically sensitive topic because any reform will affect some powerful constituencies cannot be an excuse anymore for lack of action. Inaction only increases existing inequalities in access to groundwater by progressively reinforcing the power of bigger landowners at the expense of other water users. Further inaction has a price that will be borne by future generations since use beyond yearly replenishment is by definition an 'unsustainable' use of groundwater in the longer term. The fact that this may be beyond the time horizon of the average office holder cannot be an excuse for delaying action until it is too late" (Cullet, 2012).

It is an established fact that ground water table has been depleted severely over the years. Also the NASA satellite image has shown rapid reduction of groundwater storage in India including West Bengal. Many parts of India as well as the world are facing acute scarcity of water. Being the source of drinking water for majority of Indian population extraction of precious and scarce ground water for agricultural production is a wrong approach to sustainable development. Unless an alternative source of irrigation for agricultural production is adopted in near future there will be a situation in India where water will be the single most important agenda around which everything will revolve-from political issue to social conflict. Before making an endeavor towards a second green revolution in West Bengal as well as in rest of India following the means of intensive ground water extraction, organic farming, integrated pest and nutrient management, genetically modified crop, biotechnology, and the like, lesions from first green revolution must be taken into serious consideration (Bhalla, 2007; Ray and Ghosh, 2007; Ghosh, 2012; *Ananda Bazar Patrika* (in Bengali) April 25, 2009, September 5, 2012; Herren, 2012), because diffusion of an innovation invariably brings many consequences evil to the society not expected and desired before.

If we really want to increase production to feed the hungry population it is not necessary to grow rice only which demands huge water. We can turn on millets, pulses and oil seeds which will serve multi-purpose-feed the growing and poor population, help the poor and tribal farmers who often located at the periphery socially, economically and geographically and who constitute a bulk of the hungry and poor population, it will make dry, arid and semi-arid farms productive, put less stress on already exhausted lands, and the like. There is no alternative to honesty. Honesty is the best policy to do something in alleviating hunger and poverty. Unless immediate attention is paid to soil health care and enhancement, water conservation and efficient use, adoption of climate-resilient technologies, timely supply of the needed inputs at affordable price, credit and insurance, and above all producer-oriented marketing the goal of achieving sustainable and inclusive growth can not be realized (Swaminathan, 2012).

Intensive cultivation focusing mainly on rice and wheat has already impoverished the soil. Though we produce food grain sufficient for our need, still hunger and poverty loom large. However, for the sake of discussion let us consider that to feed ever increasing population food production must be increased. But land is limited. It means food production has to be increased from same quantity of land. Therefore, scientists after tireless research have developed a new 'technology' called 'system of rice intensification' (SRI) to increase production unit^{-1} land with minimum input. But SRI will do nothing but aggravate the condition already worsened. In fact intensive paddy cultivation creates damage to the soil health by destroying the life of soil. "Paddy, by nature, prefers to keep its root system oversaturated by water and almost devoid of oxygen, which is in contrast to the soil's natural environment of well-drained to moderately well-drained conditions, with a reasonable supply of air and water. This soil environment is preferred by the majority of crops and a large number of aerobic microbial populations. Continuous *boro* cultivation has turned vast tracts of moderately well-drained irrigated land to imperfectly drained, and thereafter, to poorly-drained lands. After a length of time, the soil eco-system is irreversibly damaged" (Ghosh, 2012).

6. Self-reliance, Agriculture-based Industry and Judicial use of Resources: Evergreen Revolution

It is high time to think of alternative agriculture based on millets, oilseeds and pulses which are also the crops grown by the poor in their dry, arid and semi-arid lands. Besides, there is a need of paradigm shift from 'patronage' to 'right' approach, and from 'service' to 'self-reliant' (Swaminathan, 2012). "… Green revolution 'trinity' of chemical fertilizers, pesticides and hybrid seeds brought the majority of peasants both into indebtedness and into dependence on multinationals and the State. Both are aspects of a system that results in only 'green islands' of developed agriculture producing surplus food, and with in fact only a minority of farmers even there gaining real prosperity…Self-reliance has to begin from agriculture and from agriculture-related industry that is not dependent on a high degree of industrial (chemical, petroleum-based) inputs, however difficult this may seem to economists trained in conventional ways of thinking" (GO, 1991). Agriculture must be our base and industrialization must be based on agriculture. "Within agricultural, emphasis on (and subsidies for) tractors used substantially for inefficient haulage-and concentration on animal development as rich man's food rather than poor man's drought power-means that advances in marketing tend to benefit big farmers producing cash crops for the towns, rather than small man selling in nearby village markets" (Lipton, M., 1976. Why Poor People Stay Poor: a Study of Urban Bias in World Development. Temple Smith, London: Cited in Jha, 1988).

It is often said that education and awareness is required to solve a problem like conservation of biodiversity, control of pollution, and so on. But education does not mean only formal education at school, college or university. True education does not need all this. The problem is 'tragedy of the commons' (Hardin, 1968), or it is the problem of empathy, attitude and perception. Traditionally our system of education (formal and informal) makes us to become an individualistic rather than pluralistic. Also as an instinct we think of immediate gain, thus fail to foresee the future in broader perspective. We need to be aware about these issues. Conventional education intended to make one aware that "water is precious so we must use it judicially and conserve it" will not be of much help. Nowadays we are concentrating on recycling; recycling of water, recycling of wastes, and so on. But it is not an innovation. As nature has been taking care of us since time immemorial, nature has taught us to conserve, use, and recycle its resources on which we survive. The traditional mixed livestock-crop farming in India is a good example of conservation, recycling and sustainable use of resources. In fact recycling is an essential phenomenon of the universe. The star from which planetary system and life develop takes its birth from huge-massive cloud of star dust, and after millions and billions of years dies to form star dust to give birth again to a new star. Thus, nothing goes waste in this universe; everything is recycled (Bhaumik, 2008). So, principle of recycling is not a new thing or innovation; it is integral to the universe. Fact that we have forgotten the ultimate purpose and philosophy of life and living-live and let live, care for others, think for future, and the like. It is high time to shape our thought and action in the desirable direction to pave the way for true development in mind, body and spirit.

7. Conclusion

Therefore, there is no valid reason to cheer so much about the monumental increase in food grain production. Mere increase in production is not the panacea for all rural social problems. An honest retrospection and introspection is needed. Without a reform in agricultural tax policy, land ownership, credit service, structure and function of society and above all good will of the people, policy makers and politicians, no technology, innovation, idea and policy can bring prosperity in the countryside.

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