

The green revolution as a development strategy: Lessons from Asia and Latin America

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Abstract

The Green Revolution programme launched by the Federal Government aims at achieving self-sufficiency in food production for Nigeria. The paper argues that the programme should not only be concerned with productivity increases but should be designed as a development strategy to create the capacity to sustain growth, to distribute the benefits of growth equitably, to induce the willing and energetic participation of the people at the grassroots and to provide income and employment opportunities for both big-time and the small - holder farmers. The experience from Asia and Latin America are used as lessons.

Introduction

In spite of the fact that Nigeria is basically an agricultural economy, the problem of food shortage has assumed increasing proportions since the past one decade. In order to meet the shortage, the government has embarked on food imports as revealed in Table 1. This, indeed, is a paradoxical situation because the country is endowed

TABLE 1: NIGERIA'S IMPORT OF FOOD, 1970-79

Year	Imports (N million)
1970	57.7
1971	88.3
1972	95.1
1973	126.3
1974	154.8
1975	298.8
1976	441.7
1977	780.7
1978	1108.2
1979	1105.8

Source: Central Bank of Nigeria, *Economic and Financial Review*,
December 1975-79.

with abundance of physical and human resources to produce enough food for its growing population. For example, Johnson *et. al* (1969) rightly asserted that the thousands of Nigerian small - holder producers can be relied upon as a driving force for the transformation of the agricultural sector because they are willing to accept new crops and new technology, and are also responsive to favourable prices and opportunities to earn income by producing and working. The physical resources are also quite abundantly available. The Third National Development Plan, 1975-80 indicated that of the 71.2 million hectares of cultivable land, only 34 million hectares (47.7 per cent) are under cultivation. It is therefore obvious that given suitable motivation and political will on the part of the government, Nigeria could be self-sufficient in food production.

To achieve this desirable objective of self-sufficiency in food production, the Federal Government has launched the Green Revolution programme. The strategy of the programme is to provide land clearing services as well as inputs such as fertilizers, credit, etc. to increase productivity.

The thesis being advanced in this paper is that the Green Revolution can and should be designed as a development strategy which aims at not only achieving growth in the per capita output of agricultural products, but also achieving an overall system of agricultural economy with the capacity to sustain growth, to distribute the benefits of the Green Revolution in an equitable manner, to induce the willing and energetic participation of the grass-root people, and to provide income and employment opportunities for both the large and small farmers.

Drawing on the experience of Asia and Latin America, an attempt is made to suggest measures that will make the Green Revolution programme achieve the development objectives enunciated above so that the programme can be spread to benefit a much wider portion of the rural population.

The Agronomy of Green Revolution in Asia and Latin America

The term "Green Revolution" is used to describe the development and dissemination of 'miracle' seeds, and the supply of critical inputs such as chemical fertilizers, irrigation water and pesticides, to the farm operator. The new seed technology, which is purely the result of several years of adaptive research is called 'miracle' because of its capacity to double, or sometimes, triple the yields obtained from local varieties, given appropriate management. Such revolutions have occurred recently in Mexico with respect to wheat and maize, then in the Philippines with regard to rice, and subsequently in a number of Asian countries

including India, Pakistan, Sri Lanka and Burma. The breeders of these new seed varieties have developed crop varieties that are not only more responsive to fertilizer application but are also adaptive to a wide variety of soil and climatic conditions. These seeds are also bred for improved resistance to insects and diseases as well as for better consumer acceptance. They are almost all short-stemmed, so that they can absorb large quantities of fertilizers without lodging; they are also early maturing so that where climatic factors permit, they can be grown more than once per annum. Moreover, these seed varieties are insensitive to the length of daylight and thus can be planted at any time of the year if the prevailing temperature and water supply permit. With adequate water, farmers can harvest two or more crops per year (Brown, 1968).

However, some of these new varieties (for example, the Mexican wheats) have a pronounced yield advantage over local varieties only when they are grown under irrigated or high-rain conditions. Under dryland conditions where little or no fertilizer can be used, they offer little, if any, advantage. The dwarf rices, conversely, perform poorly and sometimes fail completely in conditions of natural flooding or in rainfed fields where they may be submerged for sometime (Dalrymple, 1974). Thus, for the Green Revolution seed – fertilizer technology to thrive, there is need for complementary inputs such as controllable water and infact suitable institutional framework.

Lessons from Asia and Latin America

From the experiences of Asia and Latin America, it is now widely known that a wide range of socio-economic, institutional and welfare issues are raised which bear directly on the success of the Green Revolution programme as a development strategy in developing countries. This means that it is not sufficient merely to provide seeds for planting and to clear land for a few big time farmers; it is also necessary to ensure that the whole system of economy be alligned toward the achievement of economic development as eluciated in the introductory section of this paper.

For example, inspite of the provision of the Green Revolution seeds, Falcon (1970) revealed that throughout Asia one of the most severe constraints to the spread of the Green Revolution was inadequate or lack of controllable water supplies. In the case of wheat, it is the higher rainfall coastal area of Turkey where the new varieties have flourished. In India and Bangladesh the same point holds for wheat and rice. Gossman (1964) had earlier pointed out that availability of controllable water determined the spread of fertilizer use especially in India where, for example, about 80 percent of total fertilizer consumed in 1968 was concentrated in 25 per cent of the districts having potential facili-

ties for irrigation systems.

Barker (1970) and Falcon (1970) have both recorded that in Asia inadequacy of pesticide program and the problem of getting the right spray, the right equipment and the right information to farmers at the right time posed a big constraint on the adoption of the new seed-fertilizer technology. Thus, the deficiencies in pest and disease control have been one of the important limitations on the technology supply side.

Efferson (1969) pointed out that in the regions of Asia where the production revolution occurred, the impact on marketed surplus was tremendous. This raised serious marketing problems. For example in Sind (West Pakistan), large uncovered piles of rice accumulated at railroads and large quantities of farm crops perished because of inadequate marketing facilities. The machinery to change government policy to permit trucks, more rail cars to deliver the rice was very slow. The mills also were inadequate to cope with the paddy output not only because these mills were limited in number but also because most of them were old fashioned and were unable to handle increased supplies (Falcon 1970). The net effect was that prices fell in certain regions while in the other regions consumers had to pay higher prices on account of localized scarcity caused by the breakdown in the distributional system. This was particularly true in Burma, Philippines, Ecuador, Mexico and Turkey (Schertz, 1970).

Perhaps of more perplexing dimensions are the problems relating to equity, welfare, and employment generally. Thiesenhusen (1972) pointed out that in Latin America unemployment rose from 11 to 35 per cent and that 1.8 per cent of the farm population received nearly 20 per cent of farm incomes while the bottom 67 per cent got only 28 per cent of the income during the heydays of the Green Revolution. The problems of equity and social justice arose basically from the unequal regional growth and unequal political and economic power that seemed to be a concomitant of the Green Revolution. For example, in Asia and Latin America, it is the larger farmers who obtained fertilizer, improved seeds and have access to irrigation water. Moreover, with the prevailing prices and technology, agricultural incomes of large farmers rose dramatically while the small farmers have no access to all the new inputs and technology. Land prices rose rapidly as big-time farmers sought to expand size and to find new outlets for their increased incomes (Thiesenhusen, 1972).

Even more important is the drive that these windfall gains provided for certain types of mechanization. There existed powerful forces (large farmers, foreign and indigenous corporate bodies, politicians)

with vested interest in promoting various types of implements including tractors and combines. Some of these are labour— displacing in societies with high population growth and limited nonfarm employment (Shaw, 1970). The net effect has been to make small-holders into labourers and to increase unemployment, underemployment and rural-urban migration (Falcon, 1970).

Havens and Flinn (1973) declared that, in Latin America, problems which have diminished the positive contributions of the Green Revolution include:

- (i) the costs of the adoption package (improved varieties, irrigation, intensive application of fertilizers, and pesticides),
- (ii) erosion,
- (iii) increased storage, distribution and marketing costs,
- (iv) the lack of awareness of their existence by lower income farmers, resulting in the expulsion of some microplot owners from their land, hastening farm-to-city migration and generating adverse effects on employment.

They maintain that 'if community action programme, which introduces green revolution technology, is to raise the socio-economic levels of the majority of the people, it must provide for more equal access and control of institutional resources.' They conclude that "if broad access to productive resources is not feasible, induced changes may have negative consequences for certain segments of the population who are structurally blocked from institutional resources. Thus, green revolution technology may be exacerbating what is already a bad situation— increase rural-to-urban migration, increase income gap between the rich and poor, and trade underemployment for unemployment."

Implications for Nigeria

Based upon Asian and Latin American experiences, this section draws attention to some weaknesses in the Nigerian economic system which are capable of dampening the full realisation of the benefits of the country's Green Revolution programme as well as restraining the spread of the benefits to a larger proportion of the rural population.

A. Farm Resources:

The new seed varieties with their potential for multiple-cropping places a premium on fast preparation of seedbeds. Farmers planning to double-crop their land may no longer have several weeks to prepare the land wholly by using the services of family labour. They may now

have to use either hired labour on a greater scale or some power-driven farm equipment for timely preparation of land to plant the next crop.

In many parts of Nigeria today, the supply of farm labour is already a critical constraint on food crops expansion, and this situation is likely to be aggravated further (Adesimi 1976), Bath (1966). Yet the country cannot just rush into full farm mechanisation because this will displace much more labour than the nonfarm sector can absorb, and will aggravate an already undesirable situation of city congestion. A balance has to be struck between encouraging labour intensive programmes and adopting some form of mechanisation. In the rice-producing areas of the Philippines, for example, tractors are used principally for land preparation because of the adverse effects of mechanisation on labour employment. Nigeria may take a cue from this since both countries suffer from high rate of population as well as high unemployment rate.

Examples of latifundias in Latin America have shown that the advent of a Green Revolution also spurs some wealthy urban people to acquire land¹ for speculative purposes. They either become absentee landlords or alternatively sell off the land at very high prices. In either case, not only does land tend to concentrate in a few hands but also it is only the well-to-do that gain access to agricultural land. The net

1 For details of land tenure system and problems in Latin America, See Dorner (1964).

effect is that a class of landless rural people will emerge and this may increase the rate of farm-to-city migration.

To prevent this happening in Nigeria, the government must show greater interest in land use patterns. Much has been said and written about the Land Use Decree of 1978 and land policy in Nigeria (Igbozurike, 1974, 1981). Specifically, the government must act to prohibit speculative purchase of land. As of now, the Land Use Decree, 1978, provides that individuals can be granted up to 500 ha for crop production and 5, 000 ha for grazing. We consider these to be too large and to be capable of encouraging speculative acquisition. Some wealthy urban people can decide to take undue advantage of this provision by applying for rural land in several locations in the community, thus robbing the small-scale peasants of the opportunity to get access to the land available for agricultural production. The government should therefore reduce the maximum amount of land under this provision to about 50 ha for crop production and 100 ha for grazing and ensure

that no individual gets allotments in more than one place.

This recommendation is likely to have the following favourable effects on the economy:

- (a) slow down the rate of rural-urban migration by ensuring that both the poor and the rich who are interested in agricultural production can be productively employed on the farm,
- (b) increase the demand for simple consumer goods, since the economy would then rest on a broader base by permitting the Green Revolution to benefit a wider spectrum of the people,
- (c) lessen the disparity of income distribution in the farm sector which may arise in the absence of such control and,
- (d) create more jobs or deter the displacement of labour by machines since wealthy larger-farm owners are likely to use machinery indiscriminately to displace labour.

B. Non- Conventional Inputs

(i) Fertilizers.

Although there is a relatively higher level of fertilizer use in the North than in the South (Norman, 1973) the current level of fertilizer use by Nigerian farmers is generally very low. Distributional problems² in the country have slowed down not only the rate of use by existing users but also the spread to non-users.

The Green Revolution programme is going to make it imperative for Nigerian farmers to use more fertilizers. This will greatly increase the demand for fertilizers. It calls for the formulation of a bold fertilizer programme to make fertilizer easily available to the farmers. For example, more fertilizer plants should be set up in order to use the wasted by-products of petroleum oil, and distribution centres should be increased in the country.

(ii) Pesticides.

Although the disease resistance ability of new strains is being improved, the problem of post-harvest crop losses due to insect and pest attack is still with us. Adesuyi (1973) estimated that losses in maize due to insect infestation amount to about 35 to 70 per cent after six months in storage. Empirical evidence also shows that most Nigerian

2. See, for example, Laurent (1969) and Chuke (1977).

farmers have not readily adapted to the use of pesticides (Idachaba 1976).

On economic grounds, it is anticipated that the use of pesticides will increase with the adoption of the new varieties of high-yielding seeds. As Brown (1968) noted in Asia, "high rates of return on investments in production inputs, reflecting a more favourable economic climate due to better prices for farm products and more efficient new technologies, can mobilise rural savings not previously available for production purposes. Investment will rise in those things which increase output in the short run and in those which boost food-producing capability over the long run. Growth in demand for pesticides will be closely associated with the spread of the improved seed".

(iii) Water.

The need for a regular supply of water all the year round is crucial in view of the possibilities for multiple cropping offered by the early-maturing equality of the new seed varieties. Moreover, responsive as the new seeds are to heavy fertilizer application, they demand a more intensive use of water if their pronounced yield advantage over local varieties is to be realised.

Since the provision of water is a critical input for the Green Revolution, it becomes inevitable that positive steps must be taken, as a matter of priority, to ease the agricultural water shortages felt in different parts of the country. The unprecedented sahelian drought which occurred during the 1972/73 crop season causing extensive crop failures and severe food shortages, is still a living memory.

The use of tubewells as an irrigation scheme may be a way out of this kind of dilemma. Apart from the relative cost advantage of tubewells vis-a-vis large irrigation works, this source of water will be under the farmer's personal management and thus he is able to control very precisely the amount and timing of the water to be delivered to his crops.

Indian and Pakistani farmers increasingly turned to tube-wells because large irrigation works, often the by-product of multipurpose hydro electric dams, proved ineffective as a source of agricultural water. The problem is essentially that the effective delivery of irrigation water to millions of peasant farmers from a large centralised system requires a degree of communication between the farmer and the administering government agency that is still far beyond the competence of most developing countries.

Apart from India and Pakistan, other Asian countries where the Green Revolution has occurred have also turned to small — scale system of irrigation. For example, farmers in the delta areas of Thailand and South Vietman have invested heavily in pumps to lift water from

low-flowing streams and canals to field levels during the dry season (Brown, 1970).

(iv) Credit

The supply of credit to small farmers is another critical factor in the success of a Green Revolution. Traditional sources of credit which consist principally of local money lenders, relatives and middlemen quickly become inadequate as agriculture becomes modernised and purchased inputs become essential to farm business. Institutional lending then assumes an important role as the only source of credit that can provide loans on a scale large enough to satisfy the requirements of commercialised agriculture. The role of government in the provision of this kind of service is very vital particularly to small scale farmers. Our suggestions include the establishment of small rural banks as separate institutions, the creation of mobile bank units, the use of cooperatives and other farmers' organisations in extending small-holder loans, improved farm planning and supervision of credit financed projects and agricultural insurance program to reduce the risks of agricultural lending.

In grappling with its own problem, the Philippines instituted an Agricultural Guarantee Loan Fund in the Central Bank. Money from the fund together with insurance against losses on loans was distributed through 179 widely separated private rural banks which, in turn, was relent to small-scale tenant farmers without the usual collateral requirements and at much subsidised interest rates. It was largely in this way that farm inputs for the new rice varieties were able to reach the small farmers in that country.

Nigeria has also instituted an Agricultural Credit Guarantee Scheme Fund adjunctant to the Central Bank. Coupled with this is the newly reconstituted Nigerian Agricultural and Cooperative Bank. institutions along with commercial banks and state cooperative and credit agencies should be able to move into the countryside on a large scale and provide an incentive for modernised agriculture.

C. Infrastructural and Supporting Facilities

(i) Marketing.

The Green Revolution will call for a greatly expanded network of marketing facilities. To be able to cope efficiently with increased intra-state and inter-state movements of farm crops, existing road networks will have to be improved greatly. With an ineffective transport system, there is the danger that farmers' marketable surplus would

accumulate and possibly rotten away at the farm gates and at the rail heads. Storage facilities should be built at strategic places in all local government areas.

The need for grading and storage facilities will also be much more felt than before. Existing market places will have to be restructured and reorganised. Already most of the existing market places are congested and in bad conditions. When the volume of farm commodities to be handled is doubled as a result of the seed technology, the situation might become unbearable. To avoid this, more market places will have to be built and sanitary conditions in existing ones improved as the Lagos State Market Development Board is attempting to do now.

All the commodity Marketing Boards should be decentralized to be nearer to the rural areas and their roles should include storage, processing, preservation, designing standardized grades, weights and measures and fixing commodity prices that would be remunerative enough to the farmer at subsidized rates and these prices should be revised regularly in light of changes in demand and supply conditions.

(ii) Extension and Research

The smooth adoption of the new technology is also crucially dependent upon the availability of extension workers. The issuing of the new seeds to the farmer, his gradual initiation into the cultural practices of the new seed varieties to avoid some of the problems involved in introducing an innovation, and providing a liaison with research stations, are all the proper functions of the extension worker.

Unfortunately, the number of extension workers in Nigeria is pitifully small. It is estimated that the ratio of extension workers to farm families in Nigeria is in the order of one to five thousand. This paucity of extension workers makes effective contact with the farmer difficult. Williams (1981) asserts that there is "lack of trained extension personnel both in quantity and quality and the few that are available are spread too thinly to be effective." The need is therefore urgent to step up the training of extension personnel and to employ them in the area in which they are trained. The training of Agricultural Assistants and Superintendents should be stepped up so that they can provide the corps of the extension workers that is needed.

Finally, when the Green Revolution gathers momentum, there will be need for expanding research activities on various aspects of agriculture including the impact of the new technology on rural life. Farm surveys will need to be undertaken on the economic yield potentials of different areas, on identifying constraints to higher yields, on the

employment effects of the new seed technology, on changes in factor productivities, on the optimum combination of farm resources, on growth trends in the use of the new inputs, and on changes in farm size and tenurial systems, and income distribution and regional disparities.

Summary and Conclusion

We have argued in the paper that the Federal Government's programme of Green Revolution with the basic objective of self-sufficiency in food production by achieving increases in output and productivity through provision of production inputs and land clearing services may achieve growth but not development. In order to achieve both growth and development, we have suggested various strategies bordering on the problems of sustained growth, welfare, equity, unemployment, underemployment, income distribution and widespread participation.

Using the experiences drawn from Asia and Latin America, the constraints that may diminish the developmental benefits of the programme are discussed and measures are suggested to remove these constraints. The constraints include inadequacy of controllable water, inefficient fertilizer distribution network, marketing inefficiency, small-holders' lack of access to production inputs, the inadequate supply of pesticides and the problems of distribution, the question of remunerative pricing policy, the problems of land tenure and land use, appropriate mechanization and the supply of sufficient extension personnel.

To achieve the various suggestions Nigeria needs to develop institutional arrangements which will permit better and more secure access to future incomes for all the people in agriculture, big-time and small-holder farmers alike. There is no reason for Nigeria to repeat the mistakes that occurred in the reference countries if the country can learn lessons from history. If these lessons are fully learnt, the production gains from the Green Revolution programme can be shared by all categories of rural people, thus ameliorating adverse effects of a worsening income distribution, unemployment, etc. After all, it is these peasant farmers that were the driving force behind the huge agricultural surpluses that were exported in the 1950's to the 60's.

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