

Historical study of Green Revolution in the globe and in India

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Abstract— “Food is the moral right of all, who are born into this world. Without food, man at most can live but a few weeks; without it all other components of social justice are meaningless” these lines were uttered by the Nobel laureate Norman Borlaug, who is considered as the “Father of Green Revolution”. He received the Nobel Peace prize in 1970, for having saved over a billion people from starvation. The term “Green Revolution” was first used by William S. Gaud, the administrator of the U.S. Agency for International Development (USAID), in a speech on 8 March 1968. Land area is perfectly inelastic, it cannot be artificially created, instead, it is a free gift of nature. On the other hand, population of a county and the world consistently increases. Therefore, every new born baby comes with a mouth, which needs to be feed. As a result, the pressure on the existing land, mounts up every year, forcing it to produce more food grains for the growing population. Today, if population of the world is getting enough food grains and not suffering from malnutrition, entire credit must go to one scientific research outcome, namely, “Green Revolution”. It is a set of research technology transfer initiatives, occurring between 1950 and the late 1960s, that increased agricultural production worldwide, beginning most markedly in the late 1960s. The initiatives resulted in the adoption of new technologies, including high-yielding varieties (HYVs) of seeds for different crops, especially dwarf wheat and rice. It was associated with chemical fertilizers, agrochemicals, controlled water-supply and newer methods of cultivation, including mechanization. All of these together were seen as a ‘package of practices’ to supersede ‘traditional’ technology of farming and to be adopted as a whole. This paper attempts to find out the genesis of green revolution across globe.

Index Terms- Food scarcity, population growth, HYV seeds, food security, mechanization.

I. GENESIS OF GREEN REVOLUTION IN MEXICO

During twentieth century two ‘revolutions have transformed Mexico. The first one is Mexican

Revolution (1910 – 1920) and the other one is Green Revolution (1950 – 1970). Mexico is called as the ‘birth place of the Green Revolution’. Both the Ford foundation and the Rockefeller foundation were heavily involved in its initial development in Mexico. For U.S. government, its neighbor Mexico was an important experimental case in the use of technology and scientific expertise in agriculture that became the model for international agricultural development. Mexico made a concerted effort to transform agricultural productivity, particularly with irrigation rather than dry-land cultivation in its northwest, to solve its problem of lack of food self-sufficiency. In the center and south of Mexico, where large-scale production faced challenges and its ultimate effect was seen in agriculture, due to which, agricultural production languished. Increased agricultural production was inevitable as it promised food self-sufficiency in Mexico to feed its growing and urbanizing population with the increase in number of calories consumed per Mexican. The technology was seen as a valuable way to feed the poor and would relieve some pressure of the land redistribution process. Mexico was the recipient of knowledge and technology of Green Revolution and it was an active participant with financial support from the government for agriculture and Mexican agronomists. Agriculture in Mexico had been a socio-political issue, a key factor responsible for some regions’ participating in Mexican Revolution. It was also a technical issue enabled by a group of trained agronomists, who advised peasants how to increase productivity. In the post-second World War era, the government sought development in agriculture that bettered technological aspects of agriculture in regions, not dominated by small-scale peasant cultivators. This drive for agricultural transformation would have the benefit to Mexico on self-sufficiency in food and in the political sphere during the Cold War. Technical aid can also be seen as serving political ends in the international sphere. In 1943, the

Mexican government founded the International Maize and Wheat Improvement Center (CIMMYT), which became a base for international agricultural research. The government also created the Mexican Agricultural Program (MAP) to be the lead organization in raising productivity. One of their successes was in wheat production with varieties dominating wheat production as early as 1951 (70%), 1965 (80%), and 1968 (90%). Mexico became the showcase for extending the Green Revolution to other areas of Latin America and beyond, into Africa and Asia. New breeds of maize, beans and wheat produced bumper crops with proper inputs (such as fertilizer and pesticides) and careful cultivation. Many Mexican farmers who had been dubious about the scientists or hostile to them, came to see the scientific approach to agriculture as worth adopting. Mexico was able to produce more wheat than was needed by its own citizens, leading to them becoming an exporter of wheat by the 1960's. Prior to the use of these varieties, the country was importing almost half of its wheat supply.

- Adoption by Philippines:

In 1960, the Government of Republic of Philippines, with the Ford Foundation and the Rockefeller Foundation established 'International Rice Research Institute (IRRI)'. In 1966, one of the breeding lines became a new cultivar, IR8. IR8 required the use of fertilizers and pesticides, but produced substantially higher yields than the traditional cultivars. Annual rice production in the Philippines increased from 3.7 to 7.7 million tons in two decades. The switch to IR8 rice made the Philippines a rice exporter for the first time in the 20th century.

- India's adoption of Green Revolution:

After independence remarkable changes have taken place in Indian agriculture. Government made various efforts to encourage the application of science and technology in agriculture. In 1961, India was on the brink of mass famine. Norman Borlaug was invited to India by then the adviser to the Indian minister of agriculture, Dr. M. S. Swaminathan. Despite bureaucratic hurdles imposed by India's grain monopolies, the Ford Foundation and Indian government collaborated to import wheat seeds from the International Maize and Wheat Improvement

Center (CIMMYT). Punjab was selected by the Indian Government to be the first site to try the new crops because of its reliable water supply and a history of agricultural success. India began its own Green Revolution program of plant breeding, irrigation development and financing of agrochemicals. As a result Indian agriculture witnessed significant changes between 1961-69. A new strategy of agricultural production was introduced. According to this new strategy the government identified 16 districts and introduced Intensive Agricultural District Programme (IADP) in 1960-61. Later on in the year 1964-65, this programme was extended to several other parts of the country in the form of Intensive Agricultural Area Programme (IAAP). Under these programme the government aimed at applying modern technology to agriculture. The new strategy consisted of a package of inputs like HYV seeds, fertilizers, irrigation, plant protection, mechanisation, soil conservation was offered to the farmers.

Added to this, the government established Indian Council of Agricultural Research (ICAR) in the year 1965. Several agricultural universities and research centres were also promoted and the National Seeds Corporation (NSC) was set up in 1963. The main responsibility of this organisation was to develop the HYV seeds, improving the quality of seeds, providing irrigational facilities...etc. High Yield Varieties Seeds absorbs more nitrogen-absorbing potential than other varieties. As a result, the yield will be more compared to traditional crop.

India soon adopted IR8 – a semi-dwarf rice variety developed by the International Rice Research Institute (IRRI) that could produce more grains of rice per plant when grown with certain fertilizers and irrigation. In 1968, Indian agronomist S. K. De Datta published his findings that IR8 rice yielded about 5 tons per hectare with no fertilizer, and almost 10 tons per hectare under optimal conditions. This was 10 times the yield of traditional rice. IR8 was a success throughout Asia, and dubbed the "Miracle Rice". IR8 was also developed into Semi-dwarf IR36. In 1960s, rice yields in India were about two tons per hectare; by the mid-1990s, they had risen to six tons per hectare. India became one of the world's most successful rice producers, and is now a major rice exporter, shipping nearly 4.5 million tons in 2006.

As a result of all these efforts, there has been an increase in agricultural productivity and production in the economy. Green Revolution has occurred in India in 1967-68.

There are several factors, which have contributed to the Green Revolution. Some of them are:-

- **Supply of improved seeds:** The government has made sincere efforts to supply improved seeds to farmers. Indian Council of Agricultural Research and the National Seeds Corporation have been established to develop and to distribute HYV seeds. In 1966-67, only 2 million hectare of land has been brought under HYV seeds. In 2003-04, HYV seeds are used in around 80 million hectare of land. As a result of using HYV seeds, productivity has increased tremendously, which was just 827 kg/per hectare to 2,806 kg/per hectare. Due to this the per capita food availability has increased from 395 grams (in 1951) to 439 grams (in 2010).
- **Mechanisation:** we were using traditional sources of powers – animal and human power for contemplating agricultural operations. A time has come where we need to shift from human power to machine power. Studies have proved that a mechanized farming has increased the productivity by 30%. Application of machineries like Tractors, Pump sets, Harvesters into agriculture have increased. Now in Punjab on an average every 5th farmer has a tractor. The government announced various incentives and subsidies for the development of mechnanisation.
- **Subsidies:** To encourage modern methods of cultivation and application of science and technology to agriculture, the government is providing huge subsidies. In the year 2008-09, the fertilizer subsidy alone given by the government was 99,456crores.
- **Mixed Farming:** Several methods like mixed farming, crop rotation were promoted to increase fertility and to prevent soil erosion. Double cropping (where perennial supply of water available) and Multiple Cropping has been promoted. Crops are so mixed that soil nutrients removed by some are replaced by others.
- **Soil Conservation:** the government in almost all the states has undertaken Several soil conservation

schemes. The government has set-up the Central Soil Conservation Board in 1952 to arrange, co-ordinate and to start research on soil conservation.

- **Fertilizers and Pesticides:** The government has encouraged the usage of fertilizers and pesticides to protect the crops.
- **Credit and Irrigational facilities:** Various specialised financial institutions like NABARD, RRB's have been established. In order to provide sufficient credit facility to agriculture, the government has nationalized 14 commercial banks on 19th July 1969. In addition, the government has provided irrigational facilities. As a result the irrigation potential has increased to 108.2 mh. Introduction of the "Farm Credit Package" in 2004. As a result of this package the flow of credit to the farm sector has more than tripled during 2003-04 to 2008-09. Kisan Credit Card scheme was started in 1998. More than 800 lakh credit cards have been issued till date.
- **Incentives:** Government gave various types of incentives to the farmers to encourage them to adopt Science and Technology to agriculture. Special prizes, Concessions, Awards, Honors, certificates are given to agriculturists. As a result of all these endeavors the food production of India which was 51 Million tonnes during 1950's has increased to 252 million tonnes by the end of 2010-11. During 2013-14 Union Budget, the government has allotted Rs. 27,049 crore for the development of agriculture and allied activities and out of this Rs.3,415 crore will go for agricultural research.
- **Brazil's adoption of revolution:**
Before the 1960's Brazil's huge land region was considered to be unfit for agricultural activities because the soil was too acidic and poor in nutrients. To correct this problem and to increase the nutrients in the soil and to convert a barren land into arable land, from the 1960s, vast quantities of lime were poured on the soil to reduce acidity. The effort went on for decades; by late 1990s, around 14 million and 16 million tonnes of lime was being spread on Brazilian fields each year. The quantity rose to 25 million tonnes in 2003 and 2004, equalling around five tonnes of lime per hectare. As a result, Brazil has become the world's second biggest soybean exporter. Soybeans are also

widely used in animal feed and the large volume of soya produced in Brazil has contributed to Brazil's national income.

CONCLUSION

The creators of the Green Revolution seemed to have had the best intentions at heart-- they were working to develop technologies that would increase productivity of farms in developing countries to combat hunger and poverty. They were not completely unsuccessful, either, the modern varieties of seeds that they produced did increased yields and increased profits for farmers as well as reduced prices of food grains to feed the hungry. However, a coin has two faces. Likely, green revolution also has certain set backs. Some of them are listed as follows.

The lack of a stable agrarian system in India has made it difficult for Green Revolution technology to impact everybody positively. This is because of a rigid social structure which makes it difficult for those without money to improve their social conditions. Those with more money, can afford the seeds and chemicals necessary to compete in the Green Revolution market. Farmers with less money cannot afford to buy the necessary technology and resort to money-lenders to purchase on credit. As a result, small farmers find themselves in debt and paying exorbitant interest rates. Small farmers buy the technology on credit to keep up with large farmers and stay competitive in the market, but the debt alone negates any possible financial success they can achieve by adopting Green Revolution technology. Once a farmer does acquire the tools necessary to compete in the post-Green Revolution market, he or she is then trapped in a cycle that is nearly impossible to break. The modern varieties of seeds that were developed for the Green Revolution require heavy irrigation and applications of chemicals to be successful. Once a farmer applies these chemicals to the soil, the soil degrades and is left depleted of essential nutrients. To make up for that loss, the farmer needs to use even more fertilizers to make up for what is lacking. Additionally, the use of pesticides leads to the creation of pesticide-resistant pests. This vicious cycle leads to the need for more chemicals to keep up with the changing chemistry of pests and pesticides.

To be truly effective at eliminating poverty and hunger worldwide, researchers need to develop a system that works with the land, rather than against it. It is impossible for technology to ever completely control the land and as humans, are not able to completely control nature. The vicious circle, the farmers enter into when they start practicing Green Revolution, cannot be easily broken. Once the farmer enters into the trap, raising incidence of indebtedness and impoverishment is often observed.

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