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THE GREEN REVOLUTION IN INDIA: IMPACTS AND THE PATH AHEAD

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ABSTRACT

The Green Revolution enhances a lot if development in the nation. This policy gave a new way to seek the development in the agricultural sector. This consists of two important words i.e. Green + Revolution, which means reforming of agricultural practices resulting in dramatic increases in crop yields. The initiatives, led by Norman Borlaug, the "Father of the green revolution "who received the Nobel peace prize in 1970, credited with saving over billions of life from starvation, lead a great impact and help in fulfilling the needs of the peoples. This paper mainly discusses about the green revolution, its impact and helping in framing a new agricultural policy.

Keywords: Agriculture, crop yields, Economy, Green revolution, Production.

I.INTRODUCTION

Food problems have haunted mankind since time immemorial. With few technological breakthroughs to increase yields, the food needs of growing populations were historically met by expanding the cultivated area. As the most fertile land became scarce, further expansion meant bringing poorer and lower yielding land into cultivation. By the 19th century, there was growing pessimism about the possibility of feeding ever-growing populations, as exemplified in the writings of Thomas Malthus (1766–1834). The task seemed even more daunting as advances in medicine and public health led to longer life expectancies and more children born.

The current financial and economic crisis drew attention away from the food crisis, but the latter still remains a threat to the achievement of the Millennium Development Goals (MDGs) and sends a warning of the dangers of low investment and poor policies in the agricultural sector.

The causes of the food crisis lie partially in the specific conditions of the 2008 price spike, which included climatic conditions, such as drought, and widespread speculation in commodity markets. But the food crisis reveals also an underlying and persistent crisis of development in some countries agricultural sectors. Addressing the long-term threat of food insecurity will require nothing short of a Green Revolution.

As pressures on land availability grow, countries will have to depend more on yield gains than on the expansion of cultivated land. Yet there is also the potential for rapid increases in yields if better access can be provided to fertilizers and technology -not necessarily sophisticated biotech solutions, such as genetically manipulated plant varieties, but new crop varieties, tractors, ploughs and irrigation systems.(Ref.3)

As is now widely accepted, the relative neglect of the agricultural sector in many developing countries has led to disinvestment in supply capacities, such as extension services and infrastructure. In the past, market reforms, including structural adjustment programmes, have also played a role in undermining agricultural productivity: SAPs encouraged the dismantling of extension services, marketing boards, special agricultural banks and caisses

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de stabilization (price stabilization boards). The role of the State in agricultural development was significantly reduced. The result: private investment, both domestic and foreign, was diverted more into cash crops for export than into food for local consumption.

These advances were much slower in reaching developing countries. The colonial powers invested little in the food production systems of these countries, and by independence, their populations were growing at historically high rates. By the mid-1960s, hunger and malnutrition were widespread, especially in Asia, which increasingly depended on food aid from rich countries. Back-to-back droughts in India during the mid-1960s made the already precarious situation worse, and a 1967 report of the U.S. President's Science Advisory Committee concluded that "the scale, severity and duration of the world food problem are so great that a massive, long-range, innovative effort unprecedented in human history will be required to master it." The first investments were in research on rice and wheat, two of the most important food crops for developing countries. The breeding of improved varieties, combined with the expanded use of fertilizers, other chemical inputs, and irrigation, led to dramatic yield increases in Asia and Latin America, beginning in the late 1960s. In 1968, U.S.Agency for International Development (USAID) Administrator William S. Gaud coined the term "Green Revolution" to describe this phenomenal growth in agriculture. Borrowing from rice-breeding work undertaken in China, Japan, and Taiwan, the International Rice Research Institute (IRRI) in the Philippines developed semi-dwarf varieties that met most of these requirements. Similar achievements were made for wheat after Norman Borlaug (later awarded the Nobel Peace Prize for his work) crossed Japanese semi-dwarf varieties with Mexican wheat at what is now known as the International Center for Maize and Wheat Improvement (CIMMYT) in Mexico. Although the term Green Revolution originally described developments for rice and wheat, high-yielding varieties (HYVs) have since been developed for other major food crops important to developing countries, including sorghum, millet, maize, cassava, and beans.(Ref.5)

II. Data and Methodology

The paper of study mainly based on the secondary source of data. The data mainly taken from the Stastical abstracts books, newspapers, magazines etc. The research techniques are used. The paper includes the tables and diagrams to elaborate and explain the impacts of green revolution.

III.OBJECTIVE

The paper has following objectives:

- To know about the Green Revolution
- To know the impacts of green revolution on social,economic and agricultural aspects
- To know about the role played by green revolution in shaping future of the nation
- To suggest the suggestions and draw the conclusions

IV.IMPACT OF GREEN REVOLUTION ON AGRICULTURE IN INDIA

Green Revolution adopted in our country since 1960s has paid rich dividend as farmers of our country were able to enhance food production of the country not just to satisfy our needs but for earning valuable foreign exchange as well. India has achieved a remarkable growth in agriculture, increasing food grain production from 83 mt in

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1960-61 to about 252.7 mt (fourth estimate) in 2014-15. Fertilizer consumption likewise has been showing a continuous upward trend, with consumption from less than 1 million tons of total nutrients in the mid sixties to almost 25.6 million tons in 2014-15. The Department of Agricultural Research and Education in documents submitted to the Committee have stated that fertilizers have played a prominent role in increasing food grain production of the country. About 50 percent increase in agricultural production in the post Green Revolution era is attributed to the use of fertilizers. The Ministry have further added that fertilizers are going to be crucial input in future as well, given the increasing food demands of growing population and insufficient availability of alternative nutrient sources. The country will require about 300 MT of food grains by 2025 to feed its teeming millions. This would necessitate use of about 45 MT of nutrients. While about 6-8 MT of nutrients could be supplied through existing organic sources, the rest has to come from chemical fertilizers. Therefore, the fertilizer industry has to keep pace with the growth of population and increasing food demands in the country. (Ref.2)

State-wise details regarding decadal growth rate of agriculture (food grain production) since 1960-61,the Department of Agricultural Research and Education submitted that decadal growth rate of agriculture (food grain production) vis-a-vis growth in Net Area sown in the country since 1960-61 are as follows:-

TABLE (1): State-wise decadal growth rate in food grain production (000' tonnes) from 1960 onwards

STATES	1960-70	1971-80	1981-90	1991-00	2001-02
Andhra Pradesh	-0.53	3.78	1.93	2.26	4.61
Assam	2.75	1.37	2.17	1.59	1.99
Bihar	12.27	0.39	5.58	2.14	0.95
Chhattisgarh	Na	Na	Na	Na	3
Goa	Na	0.45	47.73	2.55	-2.52
Gujarat	14.66	17.25	-10.89	-1.77	6.26
Haryana	14.59	4.96	4.54	3.82	3.39
Himachal Pradesh	5.17	1.32	3.18	-0.35	-0.42
Jammu and Kashmir	13.48	3.13	0.73	-1.55	1.22
Jharkhand	Na	Na	Na	Na	3.76
Karnataka	9.94	2.03	3.83	2.27	5.76
Kerala	4.3	-0.66	-2.56	-5.71	-2.26
Madhya Pradesh	11.08	-0.51	3.34	-2.09	2.99
Maharashtra	1.44	11.07	3.31	-0.56	2.74
Manipur	-10.95	4.12	0.74	1.82	3.91
Meghalaya	Na	3.15	-0.94	4.76	1.02
Mizoram	Na	-7.71	32.97	2.3	-9.98
Nagaland	1.35	-1.92	34.21	2.91	3.72
Odisha	4.78	1.46	5.28	-4.67	2.4
Punjab	14.49	6.01	3.88	2.54	1.64
Rajasthan	11.5	1.32	2.26	2.74	4.8

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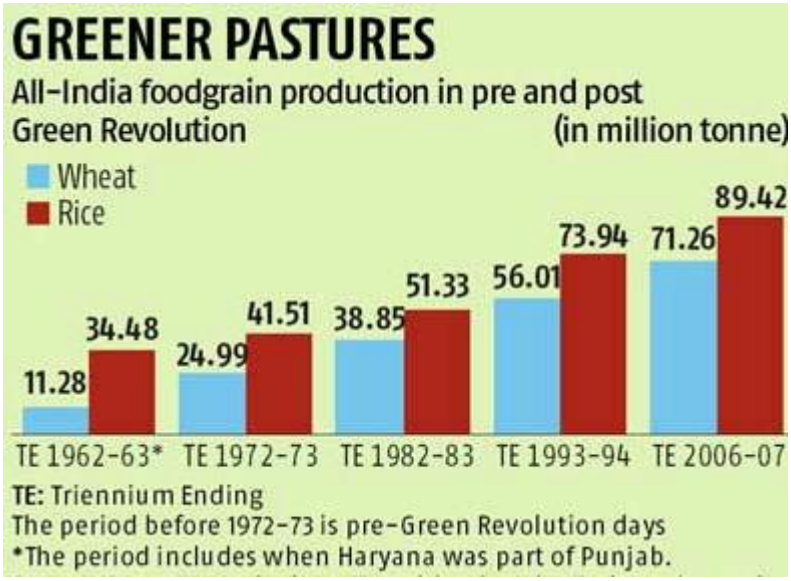
Sikkim	Na	Na	9.02	-1.01	1.29
Tamil nadu	4.62	-0.1	3.35	-0.07	5.09
Tripura	6.04	4.75	3.4	0.88	2.39
Uttar Pradesh	11.02	3.14	4.11	2.01	1.74
Uttarakhand	Na	Na	Na	Na	1.15
West Bengal	9.56	1.1	7.37	1.47	-0.39
All India	8.37	2.78	3.49	1.44	2.61

Source: Directorate of Economics and Statistics

(Ref.6)

Following diagram (1) shows the impact on wheat and paddy crops before and posts green revolution:



Source: Paper on Agriculture transition in Asia: Trajectories and challenges(Ref.5)

V. IMPACT ON ECONOMY OF INDIA

The GR, the average yield per hectare of all food grains increased from 710 kg in 1960-61 to 1734 kg in 2001-02 while wheat production rose from 851 kg to 2,762 kg by the same period and declined to 2,671 kg in 2006-07. On the other hand, productivity of rice was low even up to the end of Sixth Plan. It went up to 2093 kg per hectare in 2005-06 as against, 1,336 kg. in 1980-81. It increased further to 2127 kg in 2006-07.

On the contrary, productivity of coarser varieties of food grains remained almost stationary during this period. Definitely, production and yield per hectare have gone up under the impact of the GR. But, there is another side of the picture which tells a shocking story.

For instance, per capita availability of food grains has declined from 510.1 gm. (1991) per day to 422.4 gm. (2005) per day. However, it marginally increased to 444.5 gm. per day in 2006.

The production of rice, which received a setback in the early year of the GR, has started picking up of late. In 2001-02, a record production level of 93.3 million tonnes was achieved and declined to 92.7 million tonnes in 2006-07. Performance of other cereals like jawar, bajra and maize is not remarkable though they increased

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between 1990-91 and 2001-02 and Jawar output remained stationary at 6.5-7.5 million tonnes between 2001-02 and 2006-07. (Ref.4)

VI. SOCIOLOGICAL IMPACT OF GREEN REVOLUTION

The green revolution has pushed up the level of income in the rural sector of the economy. The increase in production has generated larger incomes in the rural sector and has also widened regional disparities.

1. Inter-Personal Inequalities**:** The green revolution has promoted inequalities and has widened the already existing gulf between the rich and the poor in the rural sector. A large part of the benefits of the green revolution has gone to a privileged section of rich farmers who are in a position to afford the new strategy which is a package programme. The new strategy needs substantial investments which are generally beyond the means of a majority of the small and marginal farmers.
2. Regional Inequalities**:** The new agricultural strategy has restricted to only a few regions. As a result, the benefits of the new strategy have remained concentrated in this area only. Two-thirds of the total cultivable land areas have been kept outside the influence of the revolution.
3. Change in Attitudes**:** One encouraging feature of the green revolution is the change in the attitudes of farmers in areas where new agricultural strategy has being practiced. Increase in productivity has raised the status of agriculture from a low-level subsistence activity to a money-making activity. The Indian farmers have accepted technical change in the pursuit of profit thus belaying the criticism against them that they are backward, traditional, conservative and unresponsive to price and productivity incentives.(Ref.1)

VII. ACHIEVEMENTS OF THE NEW AGRICULTURAL STRATEGY

Let us now turn our analysis towards the achievement of new agricultural strategy adopted in India. The most important achievement of new strategy is the substantial increase in the production of major cereals like rice and wheat.

TABLE (2):- Shows increase in the production of food crops since 1960-61 in million tonnes.

Item	1960-61	1980-81	2008-09
Rice	35	54	99.2
Wheat	11	36	80.6
(a)Total cereals	69	119	219.2
(b)Total Pulses	13	11	14.7
(c)Total food grains(a+b)	82	130	233.9

Source: Director of economics and stastics (Ref.6)

The **TABLE** (2) reveals that the production of rice has increased from 35 million tonnes in 1960- 61 to 54 million tonnes in 1980-81 and then to 99.2 million tonnes in 2008-2009, showing a major break-through in its production. The yield per hectare has also improved from 1013 kgs in 1960 to 2,186 kg in 2008-09.(Ref.6)

Again the production of wheat has also increased significantly from 11 million tonnes in 1950-51 to 36 million tonnes in 1980-81 and then to 80.6 million tonnes in 2008-09. During this period, the yield per hectare also increased from 850 kgs to 2,891 kgs per hectare which shows that the yield rate has increased by 240 per cent

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during the last five decades. All these improvements resulted from the adoption of new agricultural strategy in the production of wheat and rice.

Total production of food grains in India has been facing wide fluctuations due to vagaries of monsoons. Inspite of these fluctuations, total production of food grains rose from 82 million tonnes in 1960-61 to 130 million tonnes in 1980-81 and then to 213.5 million tonnes in 2003-04 and then increased to 233.9 million tonnes in 2008-09.The new commercial crops like sugarcane, cotton, jute, oilseeds could not achieve a significant increase in its production.

TABLE (3): Production of Cash Crops in India from 1960-61

Item	1960-61	1970-71	1980-81	2008-09
Sugarcane(m.tonnes)	110	126	134	273.9
Cotton(m.bales)	6	5	7	23.2
Jute and Mest(m.bales)	4	6	8	10.4
Oilseeds(m.tonnes)	7	10	9	28.2

Source: Director of economics and stastics (Ref.6)

The TABLE (3) reveals that the production of sugarcane and other cash crops recorded some increase during the last four decades but this increase cannot be termed a significant one. Thus, the green revolution was very much confined to mainly wheat production and its achievements in respect of other food crops and cash crops were not at all significant.

VIII. CONCLUSION

The impact of Green Revolution in India is favorable. Because of the Green Revolution production per hectare increased. Green Revolution in Wheat took place in Punjab, Haryana, Uttar Pradesh, Rajasthan and other states of India. Wheat revolution also took place in West Bengal. Agricultural Revolution took place in other parts of India also. The overall development of agriculture during Five Year Plans is known as green revolution.

After 1952-53 agriculture has been included in our national planning. Agriculture remains no more the earning of living of the farmers. Government, banks and other institutes, businessmen, industrialist have also taken interest for the development of agriculture.

Because of HYV seeds, fertilizers irrigation water, agricultural machinaries, pesticides, agricultural knowledge of the farmers have brought a remarkable change in the field of agriculture and India became self-sufficient in food-front. This remarkable change in agriculture is technically known as Green Revolution or Agricultural Revolution.

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