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Impact of Green Revolution on Rural Society: With Reference to West Bengal

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ABSTRACT

The Green Revolution in West Bengal, reached its peak between the 1980s and early 1990s, converted the state from an underperforming agricultural area into an important producer of rice and food grains. The increase in agriculture, rice, and potato production was driven by High-Yielding Variety (HYV) seeds, enhanced irrigation, and subsidized farm inputs. The yearly growth rate of foodgrains increased from 1.7% in the 1970s to 3.4% in the 1980s, and subsequently to 4.6% in the early 1990s. The main emphasis was on rice, particularly Boro rice, along with a considerable concentrate on potatoes and oilseeds. The swift agricultural expansion was correlated with a decline in poverty rates and an elevation in rural wages. The Green Revolution in West Bengal, although augmenting rice output, resulted in significant adverse effects such as acute groundwater depletion from irrigation, diminished soil fertility, and environmental degradation due to the overuse of chemical fertilizers and pesticides. It led to the depletion of indigenous crop diversity (monocropping), exacerbated economic inequalities favoring rich farmers, and resulted in health risks due to pesticide exposure.

Keywords: *High-Yielding Variety (HYV) Seeds, Green Revolution, Agricultural Output, West Bengal.*

I. INTRODUCTION

The phrase "green revolution" was initially coined by William Gaud. The origins of “Green Revolution” are usually attributed to Norman Borlaug, an American agricultural scientist. Norman Borlaug is recognized as the progenitor of the Green Revolution. In the 1940s, he commenced research in Mexico and cultivated novel disease-resistant, high-yield wheat varieties. Through the integration of Borlaug's wheat varieties with advanced mechanized farming technology, Mexico surpassed its domestic wheat requirements, ultimately established itself as a wheat exporter by the 1960s. Before the adoption of these types, the nation was importing about fifty percent of its wheat supply.

The success of the Green Revolution in Mexico facilitated the global dissemination of its technologies during the 1950s and 1960s. In the 1940s, the United States imported over fifty percent of its wheat; however, following the adoption of Green Revolution technology, it achieved self-sufficiency in the 1950s and transitioned to an exporter by the 1960s.

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To sustain the application of Green Revolution technology for augmenting global food production, the Rockefeller Foundation, the Ford Foundation, and several governmental agencies globally financed enhanced research efforts. In 1963, with the assistance of the funds, Mexico established an international research organization known as The International Maize and Wheat Improvement Center.

The Green Revolution denotes the improvement of agricultural output through the integration of modern instruments and methodologies. It pertains to agricultural productivity and reflects the transformation of the agriculture into an industrial system where the contemporary technologies and techniques, including the application of high-yield variety seeds, tractors, irrigation systems, pesticides, and fertilizers are used. Until 1967, the government primarily focused on the expansion of agricultural land. The rapidly growing population outpaced food supply, necessitating urgent measures to enhance yield, which materialized as the Green Revolution.

Method of green revolution emphasized on three basic elements namely- "High Yielding Variety seeds", "Double cropping in the existing farmland" and "Expansion of farming areas

Green Revolution in India:

In 1965, Our government initiated the Green Revolution, aided by geneticist M.S. Swaminathan, recognized as the "father of the Green Revolution" in India. The green revolution was a significant success, reconstruct the country from a food-deficient economy to one of the world's foremost agricultural nations. It commenced in 1967 and concluded in 1978.

This resulted has enhanced agricultural output. Significant achievements in this endeavor were the creation of a high-yielding wheat seed variety and rust-resistant wheat strains.

Features of the Green Revolution:

The inaugural implementation of HYV in Indian agriculture. These seeds demonstrated greater efficacy and were particularly successful in areas with adequate irrigation. At the beginning, the Green Revolution concentrated on regions with superior infrastructure, such as "Punjab and Tamil Nadu".

In the subsequent stage, the HYV seeds were distributed to different areas of the country. Additionally, crops other than wheat were incorporated into the plan.

A fundamental prerequisite for HYV seeds is sufficient irrigation. Crops cultivated from highyield variety seeds require varying quantities of water throughout their growing cycle because farmers cannot rely on monsoons.

The Green Revolution significantly enhanced the inland irrigation systems of agricultural lands in India.

- The plan primarily focused on staple crops, specifically wheat and rice. Cash crops and commercial crops such as cotton, jute, and oilseeds were excluded from the plan. Increased availability and use of fertilizers to enhance the productivity of the farms.
- Utilization of insecticides and herbicides to mitigate crop loss or damage.

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Government Schemes under Green Revolution in India:

- "Mission for Integrated Development of Horticulture (MIDH)"
- "National Food Security Mission (NFSM)"
- "National Mission for Sustainable Agriculture (NMSA)"
- "Submission on Agriculture Extension (SMAE)"
- "Sub-Mission on Seeds and Planting Material (SMSP)"
- "Sub-Mission on Agricultural Mechanisation (SMAM)"
- "Sub Mission on Plant Protection and Plan Quarantine (SMPPQ)"
- "Integrated Scheme on Agriculture Census, Economics, and Statistics (ISACES)"
- "Integrated Scheme on Agricultural Cooperation (ISAC)"
- "Integrated Scheme on Agricultural Marketing (ISAM)"
- "National e-Governance Plan (NeGP-A)"

II. REVIEW OF LITERATURE

Ahmed, B. & Rahim, A. (2024). The Green Revolution happened when the famed agro-scientist Norman Borlaug and his team were able to make new dwarf wheat in Mexico in the 1950s. This made Mexico self-sufficient in wheat in just a few years. They brought these varieties to Pakistan and India in the 1960s, and within a few years, they doubled production. The Green Revolution was introduced when Pakistan was under dictatorship with a one-unit governance mechanism. There weren't many officials from Sindh in Lahore, which was the capital of West Pakistan's provincial administration. In Punjab, the Green Revolution had a bigger and better effect than in Sindh. But the farmers and producers didn't benefit as much from the new technologies that came with the Green Revolution. The effects of genetically engineered crops, mechanical farming, and a permanent system helped things get better and grow. This research aims to examine the effects of the Green Revolution on the agricultural development of Sindh, as well as the good and negative consequences of pesticides, herbicides, fertilizers, water contamination, salinity, waterlogging, and climate change. It is more important to deal with the bad impacts and work toward better productivity through long-term planning and improvement for the future.

Malhotra, R. et al. (2024). This study evaluates the Indian economy by analyzing the environment, economy, and society. It finds out how the Green Revolution affects sustainability. Sustainability analysis is broad, and it shows that sustainability prospects are not the same in all areas. For example, the South region has more environmental resilience than the North and East regions. In the South area, the environmental indicators, such as soil management, water management, and biodiversity, are only fairly excellent or good. But the East and North areas have different levels of environmental damage. Different measures are used to highlight the differences in living standards and market access between smallholders and large-scale farmers. This signifies that smallholders have a lower standard of living and can't go to the market. Social indicators highlight the ideas of inequality and insecurity in the North and East regions. These policies call for the creation of broad policies and specific programs to fix the differences in income and wealth. Consequently, the study reiterates the crucial importance of region-specific solutions, alongside the implementation of contemporary technologies and innovative developmental techniques, in facilitating the ongoing transformation of Indian agriculture.

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Hans, V.B. & Seema, P.S. (2024). This paper gives a full look at what the Green Revolution has done, what problems it has faced, and what its future holds in India. It looks at the historical background and the reasons behind the Green Revolution, as well as how it affected farming production, rural livelihoods, and social and economic dynamics. The Green Revolution did help increase food production and reduce hunger at first, but it also brought a lot of problems. Problems like environmental degradation, loss of soil fertility, lack of water, and differences in social and economic status have become major issues that threaten the Green Revolution model's long-term viability. In conclusion, the paper says that we should have a more nuanced view of the Green Revolution's legacy and that India should recommit to sustainable agricultural growth.

Kumar, V. (2023). Seventy-five percent of the people in India rely on farming for their living. One makes a life by working on a farm. About 51 percent of India's land is used for farming, 4 percent for pastures, 21 percent for forests, and 24 percent for barren land. There are two types of agriculture: irrigated agriculture and rainfed agriculture. This is because the main way that crops obtain moisture is through irrigation or rain. In irrigated agriculture, the production of agriculture is supplied by means of irrigation, and in rainfed agriculture, the production of agriculture has to depend on rainwater. Agriculture is important for India. The monsoon is what Indian farming is dependent on. There isn't enough water for irrigation here. The Green Revolution made it possible to grow a lot more food grains, especially rice and wheat. The Green Revolution, which happened between 1967 and 1978, changed India from a country that didn't have enough food grains to one of the best agricultural countries in the world.

Gaikwad, P.G. (2023). In the 1960s, the green revolution in India used contemporary instruments and methods to boost agricultural production. M.S. Swami Nathan was a key figure in this movement. The green revolution has completely changed how farming is done in India. This dissertation endeavors to elucidate the historical context of the Green Revolution and its socio-economic, political, and environmental ramifications from an Indian perspective. This paper examines the adverse effects of the Green Revolution and the causes that contributed to its proliferation in India. The green revolution in India has made a lot of progress in the country's farming sector, but it has also had an effect on the country's political, social, and economic aspects. Consequently, the primary focus of the present study is to investigate the impacts of the Green Revolution on the socio-economic, political, and environmental dimensions in India.

Kumar, N. (2022). The green revolution suggests that agricultural production has improved a lot in a short amount of time and will continue to improve over a long length of time. Wonderful seeds and dwarf and early-maturing types have caused a big revolution in Indian farming. Intensive farming during the Green Revolution period has caused agricultural productivity to steadily rise because of the usage of large amounts of pesticides and fertilizers. The use of several contemporary farming methods has made the agriculture sector in Haryana even more important for economic growth and job creation. Haryana has the highest agricultural intensity of any Indian state. The Green Revolution made main crops far more productive and increased their production. But because the state has only been able to adapt to the new farming method, it can only grow wheat and rice. In addition, it results in diseased soils, pest-infested crops, overexploitation of groundwater, and waterlogged deserts.

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Stepha, G.E.J. (2022). The Indian economy has always depended on farming since ancient times. The Bengal Famine was a horrific food crisis that happened in India in the 1950s. Planning for agriculture has also led to a relative rise in agricultural yields. This progress is called the "Green Revolution," which is a new stage in the growth of farming. The green revolution refers to a rise in agricultural output through the use of high-yielding seed varieties (HYVS), water management, chemical fertilizers, insecticides and herbicides, and high-tech tools, among other things. The Green Revolution had a big, good effect on the state's farming business. Even while there are a lot of good effects, most people in India are unhealthy, malnourished, and use too much fertilizer. This study seeks to examine the beneficial and detrimental effects of the Green Revolution.

Kumar, S. & Kumar, M. (2021). From the 1940s to the 1960s, a succession of technological studies began in agriculture, which led to a rise in global agricultural production. This is known as the "Green Revolution". The green revolution was a big success because it increased the amount of food that could be grown and the types of food that could be grown. The Green Revolution has had both positive and negative effects. For example, land degradation, which includes loss of soil fertility, soil erosion, and soil toxicity, as well as deforestation, pollution, and salinity of water resources, loss of biodiversity, an increase in greenhouse gas emissions and global warming, and an increase in the number of diseases in humans and livestock, are all negative effects of farmers using too many agricultural technologies to make the Green Revolution work. So we can say that while the Green Revolution has made a positive impact by increase the production food resources, on the other hand, it has also created a negative relationship between human beings and environment. The current study sought to investigate the detrimental effects of the Green Revolution on the environment.

Yadav, S. & Anand, S. (2019). India had to import food because of droughts and famines that made it hard to grow enough food. The agriculture industry was under more and more stress since the population was rising quickly, and the country was short on food grains in 1950. Back then, there were more people, yet less food was being made and less work was being done. The Green Revolution has made us feel more confident in our ability to grow food and find a balance between population increase and food grains production. The Green Revolution's most impressive accomplishment is that it greatly increased the production of two important crops: rice and wheat. The first Green Revolution had both good and bad effects on people and the environment. The effects of the present are highly bad for human health. Even though the country grows a lot of food, there are still some worries regarding how safe the food supply is. We need to plan the second Green Revolution for the country right away. To increase food production and make it more diverse, we need to promote and provide a nutrient-dense, improved range of seeds for the most important crops. This study examines the characteristics of agricultural policies, the effects of the initial phase of the Green Revolution, and the challenges to food security in India.

Rahman, S. (2015). The Green Revolution has turned India from a country that didn't have enough food grains to one that does. The Green Revolution has had a bigger effect on the social and economic growth of the people than any other endeavor. Over the years, farming has become more intensive, which has caused the fragile agro-ecosystem to get worse overall. The high cost of production and low economic returns from farming are hurting the farmers' social and economic

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situation. Some of the bad effects of farmers using too many agricultural technologies to make the Green Revolution work are loss of soil fertility, soil erosion, soil toxicity, a decrease in water resources, pollution of underground water, salinity of underground water, more cases of human and livestock diseases, and global warming. Using chemicals too much and in the wrong way pollutes the soil, air, water, and food and water given to animals. This could be one of the main reasons why animals are having more problems with their health and reproduction. Urea, a nitrogen-rich fertilizer, is utilized far more than the allowed 4-to-1 ratio to potassium; this is making the world warmer. We need to figure out how much damage the Green Revolution did to the soil, groundwater, and ecology. If the harm done by the Green Revolution is not fixed in a timely, appropriate, and long-lasting way, it could have effects on the lives of the individuals who benefit that cannot be undone.

III. IMPACT OF GREEN REVOLUTION IN INDIA

- ***Increase in Agricultural Productivity***: Food grains in India saw a great rise in output. It was a remarkable increase. The biggest beneficiary of the plan was the Wheat Grain which increased to 55 million tonnes in 1990 from just 11 million tonnes in 1960.
- ***Increase in per Acre Yield:*** Along with total agricultural output, the Green Revolution also boosted agricultural output per unit area. For example, in the case of wheat, the yield per hectare was 850 kg in 1960, which increased to an astonishing 2281 kg/hectare by 1990.
- ***Less Dependence on Imports:*** During Post Green-Revolution Era, India had transformed into a self-sufficient nation, with production levels high enough to meet the demands of the population, and store levels rising in case of emergencies. India was able to both diversify trade and begin importing agricultural products.
- ***Employment:*** Concerns surrounding commercial farming have been centred on the risk of the entire workforce becoming redundant. Alternatively, rural employment opportunities have increased, due to the basic industries. New jobs were created in irrigation, transport, food processing and in the marketing of these services.
- ***Benefit to the Farmers:*** The Green Revolution provided great benefits to farmers. It resulted in a tremendous increase in their incomes. They weren't just surviving; they were thriving. It even allowed them to transition to commercial farming as opposed to just sustenance farming. This movement's impact on India's agricultural sector is significant, diversified, and historically unprecedented. It moved India to the top echelon of agricultural producing countries in the world.

After a long period of struggle, India is now self-sufficient in food grains. The Green Revolution has helped farmers boost their income which in turn has improved their standard of living. Those with over 10 hectares of land were able to benefit even more from this as they could invest more into high yielding variety seeds, fertilizers, machines, etc. This also promoted capitalist farming. The Revolution created large scale farming industrialization and mechanization which created a demand for new types of farming. It also increased the demand for diesel engines, pumping sets, combines, motorized threshers, and harvesters in addition to the previously unmet mechanical demands. The demand for chemical fertilizers and pesticides also increased significantly.

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IV. GREEN REVOLUTION IN WEST BENGAL

The Green Revolution in West Bengal transformed the state from a low-performing agricultural region into a leading producer of rice and potatoes, with foodgrain growth rates jumping from 1.7% to 4.6%. It was driven by high-yielding varieties (HYVs), expanded irrigation, and subsidized inputs, which significantly reduced poverty and boosted rural wages. However, it also led to environmental degradation, including soil depletion and increased water stress.

BGREI program in West Bengal is implemented in eleven districts viz., Siliguri Subdivision (Darjeeling), Dakshin Dinajpur, Malda, Murshidabad, Nadia, North 24-Parganas, Hooghly, Burdwan, Bankura, Birbhum and Paschim Medinipur. Rice yield and income of the farmers showed an increasing trend since the inception of the Program due to introduction of several interventions, regular visits by scientists and extension officers and awareness meeting.

As a sub-scheme of the Rashtriya Krishi Vikas Yojana (RKVY), the 2024 BGREI program will continue enhancing rice-based cropping systems in the states of Assam, Bihar, Chhattisgarh, Jharkhand, Odisha, Eastern Uttar Pradesh, and West Bengal. It aims to increase productivity through assistance with cluster demonstrations, high-yielding varieties of seeds, agriculture equipment, and water management.

Features of the BGREI program for 2024 are:

- Concentrates on the eastern region, namely those exhibiting significant potential yet poor production, including Assam, Bihar, Chhattisgarh, Jharkhand, Odisha, Eastern Uttar Pradesh, and West Bengal.
- The initiative attempts to enhance rice and wheat yields, encourage cultivation in rice-fallow regions, optimize water harvesting, and advance post-harvest technologies.
- Support includes cluster demonstrations, distribution of improved seeds, nutrient management, soil health enhancement (like liming for acidic soil), and providing farm machinery and irrigation devices.

The state witnessed a massive, rapid growth in foodgrain production and yields, transforming its status from a laggard to a top performer in India.

Impact of Green Revolution in West Bengal:

- **Agricultural Productivity & Growth:** The state witnessed a massive, rapid growth in foodgrain production and yields, transforming its status from a laggard to a top performer in India.
- **Crop Transformation:** There was a rapid shift towards, and increased adoption of, high-yielding rice varieties, alongside significant increases in potato production.
- **Irrigation and Technology:** The period was characterized by the development of new irrigation facilities and increased mechanization, such as the use of pump sets and shallow tube wells.
- **Socioeconomic Effects:** The revolution resulted in a significant decline in headcount poverty metrics and an enhancement in rural employment. Nonetheless, the advantages were frequently disproportionate, with larger agricultural producers obtaining more significant benefits than smaller or, notably, female-led households.

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- **Environmental Challenges:** The excessive usage of chemical fertilizers, pesticides, and heavy irrigation resulted in soil degradation, pollution, and heightened water stress in certain areas.
- **Input Subsidies:** The state government significantly contributed by supplying subsidized minikits that included seeds, fertilizers, and insecticides to farmers.

Impact of Green Revolution on Rural Society of West Bengal:

Advantages on Rural Society:

The initiative has achieved success in the designated area. The eastern area of the country has been experiencing tragedies such as fatalities resulting from starvation, malnutrition, and the lack of sufficient balanced nutrition. The initiative has transformed the region into a food surplus area.

It has enhanced the per hectare production of rice crops among marginal farmers and elevated the overall productivity among small farmers.

The income disparities of the beneficiary farmers before and after the implementation of the scheme shown a notable increase. The revenue has risen by approximately Rs 15,000 within a year.

Percent wise increase is highest in the case of the small farmers (65%), followed by large farmers (62%), marginal farmers (48%), and medium farmers (29%).

- **Increased Agriculture Oiutput and Income:** The implementation of High-Yielding Varieties (HYV) and intensive cultivation of boro rice augmented productivity, resulting in enhanced, if occasionally inequitable, income for farmers.
- **Poverty Reduction:** Increased agricultural activity resulted to higher demand for labor, increased rural wages and reduced overall poverty levels.
- **Class and Social Stratification:** The advantages flowed predominantly to affluent, resource-rich farmers capable of investing in inputs like fertilizers, herbicides, and irrigation, hence exacerbating the economic disparity between them and small or marginal farmers.
- **Shift in Technology:** The landscape transformed on account of the heightened utilization of tube wells, irrigation systems, and chemical inputs.
- **Rise of Commercial Farming:** Traditional subsistence agriculture transitioned to commercialized, market-driven farming.
- **Environmental and Social Concerns:** The transition to contemporary, intensive agriculture has resulted in environmental issues, including soil deterioration, while fostering a more capitalist agricultural framework.

Disadvantages on Rural Society:

The Green Revolution in West Bengal's rural society, although enhancing rice production, resulted in considerable drawbacks, such as exacerbated income inequality, heightened landlessness among smallholders, and substantial environmental destruction.

Socio-Economic Disparities: The technology-driven agriculture favored affluent farmers capable of purchasing high-yield variety seeds, fertilizers, and machinery, hence rendering small and marginal farmers landless or indebted.

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Environmental Degradation: The widespread application of chemical fertilizers and pesticides diminished soil fertility, contaminated water bodies, and lowered the water table due to excessive groundwater extraction.

Unemployment and Mechanization: The development of tractors and harvesters diminished the need for manual labor, resulting in unemployment among rural agricultural workers.

Loss of Biodiversity: The emphasis on monoculture, particularly high-yielding variety (HYV) rice, resulted in the eradication of indigenous crop types and restricted agricultural diversity.

Health and Social Issues: The excessive application of chemicals has been associated with health risks, while escalating agricultural costs and diminished yields have led to farmer indebtedness and financial hardship.

V. CONCLUSION

The Green Revolution in West Bengal significantly enhanced agricultural output and food security by the adoption of high-yielding varieties, advanced farming practices, and augmented input use, despite presenting environmental and social obstacles. Reports suggest that the BGREI program has substantially augmented the income of small and marginal farmers, by approximately Rs. 15,000 annually for some individuals, and facilitated the transition of rice farming to areas with ample water supplies. Due to the Green Revolution, in West Bengal rural earnings and employment rose, the advantages primarily accrued to affluent, land-owning farmers, widening the disparity between the wealthy and the impoverished in rural societies.

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