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# An Overview of the Ecological Impacts of Green Revolution in Haryana and the Way Forward

Surender Kumar<sup>1</sup> and Rambir Singh<sup>2</sup>

*Department of Geography, Ch. Bansi Lal Govt College For Women, (GCW) Tosham, Bhiwani, Haryana, India*

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## ABSTRACT

The agricultural sector contributes significantly to the state's production and employment while also playing a significant role in the structural foundation of Haryana's economy. Haryana's cropping intensity increased as a result of the adoption of new agricultural techniques, and the state's agriculture totally transitioned from traditional to modern agriculture. After the Green Revolution, the state's cropping patterns underwent serious modifications that had a significant impact on both input demand and production. The state of Haryana made significant strides in agricultural output, but at the expense of degrading the land and water resources. Due to soil degradation from overuse of groundwater and soil contamination from the use of excessive doses of fertilizers and pesticides, intensive agriculture during the Green Revolution has caused considerable concerns with land and water resources and their sustainability. The disruption of the soil balance caused by growing the same crop year after year and the constant application of chemical fertilizers have had negative effects on the soil's organic composition. These effects resulted in a decrease in agricultural yield, a decrease in groundwater levels, a loss in soil fertility, a decrease in biological diversity, and agronomic issues such as water logging, soil salinity and alkalinity. Severe ecological problems are being caused due to inefficient farming methods and the irrational usage of agricultural inputs. Eventually, the developments during Green Revolution and the subsequent use of new agricultural methods have resulted in increased production in Haryana but at the cost of some serious ecological degradation that now presents potential risk to future sustainability unless and until it is comprehensively identified, monitored and addressed.

*Key words : Agricultural Development, Ecological Impacts, Green Revolution, Sustainability, Haryana.*

## Introduction

In comparison to other major Indian states, Haryana has well-developed agricultural and industrial sectors, and its economy is expanding quickly (Sharma, 2014). The Green Revolution is mostly responsible for Haryana's exceptional agricultural success. It was started between 1967 and 1978, and as a result, agriculture was expanded and intensified in many emerging nations, including India, where it was extremely effective (Singh, 2000). The adoption of two

crop seasons each year, high-yielding varieties of genetically enhanced seeds, and the development and expansion of agricultural landholdings were key components of the Green Revolution. These procedures still influence how land is used in Haryana today. Haryana was a less developed agricultural region of the erstwhile Punjab before it was formed in 1966. The commencement of the Green Revolution coincides with the formation of Haryana state. Green revolution was primarily a technological innovation that propagated and intensified the use of

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(<sup>1,2</sup>Extension Lecturer)

modern technology in agriculture (Chakravarti, 1973). The expansion of irrigation, which was its most necessary precondition, was stimulated by this event. Due to the introduction of new seeds productivity and yield increased pretty significantly (Parayil, 1992). The traditional method of production in Haryana's agriculture has been entirely displaced by the adoption of these new technologies introduced during Green Revolution (Sinha *et al.*, 2019). Progressively, modern, commercial agriculture replaced traditional farming and Haryana rapidly emerged as a nationwide pioneer of the revolution alongside Punjab.

Without a doubt, the new technology has brought the State and the nation many economic benefits in the form of increased production and productivity, as well as increased irrigation coverage in Haryana (Nimbrayan and Bhatia, 2019). However, the Green Revolution faced harsh criticism in the 1970s for its socio-economic and ecological impacts despite its clear success (Glaeser, 2010). The Green Revolution's success was primarily criticized for its high yield, which could not be obtained until certain ideal requisites are fulfilled including adequate irrigation water, application of fertilizer, adoption of monoculture for the most efficient use of machinery and agricultural equipment and chemical pesticides for pest control (Das, 2002). The development of agriculture resulted in increased saline and alkaline water concentration, deforestation, soil erosion, decline in fresh water availability, water log in low lying areas and along water streams, and a drastic drop in water table especially in tube well irrigated areas (Conway and Barbie, 1988). These environmental issues first surfaced in the 1980s and have been getting worse over time. The paper primarily focuses in this context to demonstrate the serious ecological issues that have resulted from the introduction of technical and chemical inputs during the green revolution in the intensively cultivated state of Haryana and have since presented significant challenge to the state's overall socio-economic and ecological sustainability.

### The Impact Discourse

The rise in food production was sufficiently significant to be referred to as the "Green Revolution." The revolution is now heavily criticized for failing to emphasize enough how increasing production, the ecology, public health and welfare must all be sustained (Davis *et al.*, 2019). Activities to promote

high-yielding grain varieties frequently needed significant inputs of water, pesticides and fertilizers, placing enormous pressure on agro-ecological systems and posing risks to ecology and public health (Pray, 1981). These agricultural operations undoubtedly had an effect on the ecosystem. Pollution of the soil, water, and air are effects that have been noted. It has also been seen to have indirect effects on human and even animal life. The environmental quality has decreased as a result of these effects (Evenson and Gollin, 2003).

Using excessive water for irrigation and employing numerous chemicals that reduce soil fertility, agriculture has since been a significant source of pollution to water and land resources (Rickson *et al.*, 2015). The importance of enhancing land productivity during Green Revolution was stressed in order to increase food production and as a result, different fertilizers, pesticides and insecticides were added to the soil. Although they produced good results since production grew significantly, their excessive and ongoing use has reduced soil fertility (Rosset *et al.*, 2000). Agricultural contaminants include fertilizers and pesticides that have caused significant deterioration in water quality. When pesticides enter the food chain, they threaten human health as well as the health of other living beings critical to the life cycle and bio-diversity of an area (Sharma and Singhvi, 2017).

With the introduction of modern agriculture in the Haryana state, cropping patterns are constantly changing, with economic factors being the main driving force (Jodhka, 1994). The availability of inputs, especially high yielding cultivars, increased irrigation infrastructure and procurement policies all had an impact on the change in cropping patterns. With the expansion of water system resources, the state has quickly changed its farming system. The overall outcome shows that the region has paid more attention to reliable and income-generating crops, particularly rice and wheat (Chand and Haque, 1998). As the area planted to coarse grains and pulses continues to decline, the state is moving more and more toward a monoculture of wheat and rice. Additionally, this has led to crop pattern imbalance and the eradication of pulses from the cropping system in irrigated agro-ecosystems (Rani, 2019). The use of these cropping patterns too frequently is having a negative impact on soil and water resources. Currently, the capacity to raise the area under these cultivations has been attained for both

the production of wheat and rice. Consequently, the state's agro-economic structure has unavoidably become energy and resource intensive, disrupting agriculture's traditional environmental strength and now posing risks to severely impacting the ecological balance through the depletion of valuable and limited natural resources.

### Impacts on Major Ecological Parameters

It is widely acknowledged that the development of agriculture has been significantly influenced by contemporary technologies. India's ability to produce food grains on its own was increased. Farmers in India are able to implement Green Revolution technologies attributable to the government's supportive policies (Somvanshi, *et al.*, 2020). However, others have criticized its lack of dispersion across a variety of crops due to the imbalanced use of resources in agriculture that resulted from the Green Revolution (Rena, 2004). Because land and water resources are being overused in agriculture, crop output and productivity occasionally decline. Producers exploited water and land resources to increase production, which had an adverse effect on people and the environment (Chaudhary and Aneja, 1991). Severe ecological issues including soil erosion, loss of bio diversity and contamination of ground water are the result of inefficient farming methods and the unscientific use of agricultural inputs.

The green revolution helped farmers increase cultivated area, net sown area; area seeded more than once, thereby, shift cropping patterns. It also helped to achieve self-sufficiency in food production. Farmers only started using the monoculture-cropping pattern, as seen by the impressive growth in productivity and output of food grain crops (Gupta, *et al.*, 2003). While the monoculture crop pattern has increased the productivity of the rice and wheat crops, it has also led to an environmental imbalance because these are the only two crops that are ploughed into the ground, necessitating extensive irrigation and fertilizer infrastructure. Due to the constant, unchanging depletion of a specific nutrient from the soil, monoculture can result in the widespread spread damage to the fertility of the soil (Shukla, *et al.*, 2015). Continuous monoculture has also caused problems with soil degradation, increasing salinity, ground water table depletion and loss of soil fertility. Significant environmental degradation has mainly resulted from the extensive use of pesticides and other agrochemicals and injudicious

use of water and land resources.

### Degradation of Land Resource

Land resources in Haryana are under a great deal of stress (Datta and De Jong, 2002). Agriculture has a negative impact on the ecology and the condition of the soil. Currently, the issue is being observed throughout India as well. Prior to the Green Revolution, the issue of land degradation was not as severe as it is today. Due to increased strain on land resources after the Green Revolution, followed by widespread use of high yield variety seeds and irrigation facilities, the problem of soil degradation began to worsen (Bhushan, 2017). In addition, the depletion is majorly attributed to increase and widespread adoption of rice and wheat crops, a way towards mono-cropping that has extensively required and added stress to the limited land resources (Singh, 2018). A lack of micronutrients and an imbalance of the available nutrients in the soil are both effects of the wheat and rice rotation. Significant environmental problems have also surfaced, such as soil erosion and soil compaction brought on by large machinery (Agrawal, 1991). It is impossible to preserve the health of the land if it is degrading at such a quick rate, and agricultural sustainability is not achieved. Land degradation affects more than half the Haryana's entire geographic areas.

### Degradation of Soil Resources

The two most essential components for an intensive agriculture system and raising agricultural output are fertilizers and insecticides (Yadav and Rai, 2001). However, the ecosystem has been seriously threatened by the over use of these inputs. The application of fertilizers in an unbalanced manner has an impact on agricultural production growth as well as long-term harm to the soil's physical and chemical composition (Senapati, 1976). The two primary crops, rice and wheat, account for roughly two thirds of all chemical fertilizer usage, which is concentrated in these two crops (Kumar, *et al.*, 1998). More than half of the state's total fertilizer consumption is concentrated in just 7-8 districts, according to a review of fertilizer usage in Haryana (Panwar & Dimri, 2018). A significant issue with fertilizer application is the uneven proportioning of chemical nutrients. Heavy use of chemical fertilizers and pesticides has been found to have significant effects on soil fertility, human health, biodiversity, and the ecology, which has a negative influence on the sustainability of agricul-

ture.

### Degradation in Water Resources

The development of groundwater irrigation systems and canals has made it possible to achieve consistent agricultural expansion (Dagar, *et al.*, 2020). However, inadequate irrigation systems and drainage have led to the issues of alkalinity, water logging and salinity in a number of locations in Haryana (Mailk, 2022). Ground water irrigation supplies 60 to 65 percent of the total irrigation requirement, with irrigation from canals providing the remaining 35 to 40 percent. The ground water issues are a result of this extensive exploitation (Ravish, *et al.*, 2021). The groundwater table in areas where water logging is a widespread issue has fallen to a critical level. The annual rise in the water table is between 30 and 80 cm, according to the Haryana Operational Pilot Project Report (Raheja, *et al.*, 2019). The water table is declining by 3 to 10 meters in many areas of Haryana's rice-wheat farming region. According to Haryana Kisan Ayog, the state's land is severely salinized in 4 lakh hectares, substantially flooded in 40 hectares, and has an alkalinity issue in 86,000 hectares (Kamra and Sharma, 2016). The joint utilization of the state's brackish and canal water supplies is thus urgently needed to support planned, sustainable development in the future.

### The Way Forward

Due to the expansion of irrigation facilities in the state, wheat has replaced crops like barley and gram during the winter cropping season, and rice has replaced crops like jowar and bajra during the summer cropping season (Sihmar, 2014). This shift in cropped area and cropping pattern makes it clear that monocultures are the dominant systems. Although barley and gram are still farmed in rain-fed areas, people prefer high yielding and more lucrative crops like wheat and rice. Wheat and rice, which have the highest growth yields per hectare and the highest economic returns, will continue to remain dominant notwithstanding some diversification and the productivity and profitability of crop husbandry (Kumar, *et al.*, 2019). In light of this, incentive programmes should be utilized to stimulate efforts to stop ecological deterioration brought on by the expansion of these crops.

Focusing on issues like data collection and effective use of land and water resources for land use planning, fertilization, enhanced nutrient uptake

and need for diversifying, revitalization of innate soil productivity and re-vegetation, relative humidity preservation and the recharging of ground water reservoirs in areas of declining water table and many more similar practices is necessary for integrated and sustainable management of agriculture and also the natural resources of the region. To increase the physical quality and productivity of the soils, possible rejuvenation strategies must be implemented. Understanding the ecological consequences of agricultural expansion in this way aids in illuminating the extent and complexity of the negative processes during the transformation and developments while ensuring continued ecological sustenance alongside socio-economic productivity and growth.

### Conclusion

Agricultural production that managed to keep up with increasing population was enhanced by the Green Revolution. Farmers have been driven to embrace growing agriculture practices and a greater usage of high yielding crop types in order to sustain high levels of production as a result of the increasing demands for crop output. The introduction of input-responsive cultivars, which leads to a sharp increase in fertilizer use, extension of irrigation, higher cropping intensity, and increased use of pesticides, is associated with the Green Revolution. In addition, farmers chose single crop strategies for growing rice and wheat for financial gain. Consequently, the monoculture cropping system increased overuse of natural resources, posing grave risks to sustainability. Numerous issues, including the depletion of land and water resources, have emerged eventually. Monoculture and overuse of chemicals in agriculture have been shown to have long-term negative effects on the ecosystem. The disruption of the soil caused by growing the same crop year after year and the constant application of chemical fertilizers have negative effects on the soil's organic matter. Potential decrease in agricultural productivity alongside drop in groundwater levels, loss of soil fertility, loss of biological diversity and other agronomic problems such water logging, salinity and alkalinity have been the repercussions of these impacts. In order to reduce resource consumption and ensure agricultural sustainability through environmental preservation, action must be taken. The ecosystem must be more inclusive and

sustainable in order to maintain the balance between productivity and the ecology. While maintaining increased production, it should be ensured to boost output without further depleting the natural resources. To boost output and ensure ecological sustainability, it is essential to maintain the yield of various crops while making wise and sustainable use of natural resources.

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