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The Effect of Green Revolution on Gross Domestic Product in Haryana

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Abstract: The Green Revolution in Haryana has achieved much progress in agricultural productivity but at the cost of land and water degradation. Intensive agriculture during the Green Revolution period has brought continuous environmental degradation, particularly of soil, vegetation and water resources due to the use of high doses of fertilisers and pesticides. The adaptation of various modern agricultural techniques has further strengthened the role of agricultural sector in the economic development and employment generation of Haryana. The cropping intensity in Haryana is one of the highest among the Indian States; and the production and productivity of major crops increased several times due to the advent of Green Revolution. But the adaptation of new cultivation strategy has restricted the state to have only two crops, i.e., wheat and paddy. Further it has resulted in diseased soil, pest infested crops, overexploited groundwater and water logging deserts.

Keywords: Economic benefits; Ecological cost; Green Revolution.

Introduction: The term 'economic development' was rarely used before 1940s. Before its formation in 1966, the Haryana territory was agriculturally a less developed part of the former Punjab. Its net area irrigated was 35.54 per cent against 58.48 per cent in Punjab. Its compound annual growth rate of agriculture in the ratio 1:2 with Punjab. One may recall the formation of the state coincide with the here that the formation of the state coincide with the beginning of the Green Revolution in parts of India including the Haryana territory. The advent of the Borlaug seed fertiliser based technology heralded a new era in agricultural transformation in mid-sixties. Green revolution was a technology innovation. This event provided a stimulus to the extension of irrigation which was its single most important prerequisite. But this advancement in agriculture caused scarcity of fresh water, deforestation and soil erosion on the Shiwalik hills and the Aravalli outliers; water logging in canal irrigated and low-lying areas in the east-central region and along the streams; a critical fall in water table in the tubewell irrigated area in the north-east (Singh, 1998:176-182). In the age of Green Revolution, Haryana achieved fastly growth of the productivity by the use of HYV, fertilisers, pesticides etc. But this picture of development is not beautiful as it seen. The pressure of land and water resources is increasing by the use of fertilisers and pesticides and also caused land degradation and extent of saline areas and waterlogging areas. Water depletion is also occurred due to the excessive use of water for irrigation (Haryana Encyclopaedia, 2008). The history of mankind has witnessed some significant agricultural revolutions. A notable agricultural change on political lines took place in the post-1917 revolution of Soviet Union. Agricultural land was nationalized and organized into collective or State farms. The same socialistic spirit guided the formation of communes in China. Around the middle of the present century, the world saw another major agricultural revolution associated with the cultivation of high-yielding varieties of wheat and paddy famously named as Green Revolution (Brar, 1999). The credit to develop this new technology went to Norman Borlaug who innovated the new varieties of dwarf wheat for which he was awarded the Nobel Peace Prize.

Objectives of the study:

i. To identify the pattern of regional variations in intensity of the Green Revolution in Haryana.
ii. ii. To examine the growth of agricultural activities and the consequent environmental problems in Haryana.
iii. iii. To examine the degree of spatial correspondence between the economic benefits and the degree of degradation of soil, water and unsustainable cropping pattern.
iv. iv. To provide overall linkages between the Green Revolution and environment with empirical findings from Haryana.

GSDP and Employment: The production structure of Haryana is heavily dominated by primary sector activities. Due to the advent of modern methods of cultivation, the agriculture sector of Haryana becomes the leader in economic development. In the case of Haryana, agriculture is the mainstay of economy. It absorbed 60.79 percent of the working force in 1981, as cultivators and agricultural laborers. No less than about 86 percent of its total area is under plough. The all India figure is 46.31 per cent. About 60 per cent of the net area sown is irrigated in comparison to about 30 per cent in India. Agriculture contributed about 44.48 per cent of the state's domestic product in 1985-86 as compared with 27.30 per cent in India at current prices (Singh, 1998:36-37). Haryana's agriculture sector constituted 46 per cent in GSDP in 1980-81 which slowly came down to 28.47 per cent in 2001-02 and 19.03 per cent in 2013-14. On the other hand agriculture consisted of 95.23 per cent of the primary activities income in 1980-81 and at present it consists of 93.19 per cent of total output of the primary activity. But if we compare the share of agriculture sector with the share of industrial or dynamic sector it is still an important part for the state's economy. It is pertinent to note that despite rapid mechanization of agricultural activities in Haryana since the early sixties the agriculture sector is still playing an important part in employment generation. In 1971, out of the total workforce 62.67 per cent was working in the agriculture sector and after one decades period it decreased to 60.79 per cent in 1981. The share of agriculture sector in employment is still high. After the period of four decades of the advent of Green Revolution and capital intensive techniques of production in rural economy of Haryana a substantial proportion of workforce still depend on the agriculture sector for their livelihood. So, it is the agriculture

sector which has not only the growth driver of the GSDP of the State but also a major source of income for a large proportion of the total population.

Table 1: Yield of Principal Crops in Haryana (Kg/hectare)

Crops	1966-67	1970-71	1980-81	1990-91	2000-01	2010-11	2016-17
Wheat	1359	2011	2390	3546	4286	5013	5241
Rice	1021	1780	2526	2734	2511	3013	3124
Jower	195	284	322	454	203	485	512
Bajra	585	912	587	865	1279	1895	2041
Maize	954	1045	1123	1521	2301	2658	2814
Barley	1240	1145	1560	2165	2689	3541	3614
Gram	489	712	609	744	620	932	835
Rapeseed and Mustard	459	589	654	1285	1321	1352	1385
Cotton A	258	325	385	458	1021	2256	2143
Cotton D	280	298	252	285	352	408	445
Sugarcane	3338	4389	4041	5162	5721	7256	7356

Source: Statistical Abstract of Haryana, Various issues

The total increase in production is highlighted in Table 2. All crops except maize, grams, rapeseed & mustard and groundnut have shown an increase in production. The production of wheat and rice has been much higher in comparison to other crops.

Table 2: Increase in Total production of Principal crops (Thousand Tonnes)

Crops	1966-67	1970-71	1980-81	1990-91	2000-01	2010-11	2017-18
Wheat	1154	2124	3390	6566	9669	12556	13858
Rice	213	479	1559	1944	2695	3675	3956
Jower	45	58	43	66	24	36	39
Bajra	365	852	458	534	687	1058	1254
Maize	82	125	85	42	35	31	28
Barley	237	130	185	120	112	145	156
Gram	523	785	452	465	542	741	775
Rapeseed and Mustard	78	89	172	622	678	754	778
Cotton A	128	185	478	1041	1085	2542	2987
Cotton D	146	187	171	123	289	54	58
Sugarcane	512	702	456	752	814	685	745

Source: Statistical Abstract of Haryana, Various Issues

The production of wheat has increased from 1154 thousand tonnes in 1966-67 to 13858 thousand tonnes in 2017-18 Similarly, the production of rice also increased from 213 thousand tonnes to 3956 thousand tonnes during the same period. It is due to the reason that effective support price is available for the paddy and wheat crops. The production of other crops like bajra increased from 365thousand tonnes in 1966-67 to 1254 thousand tonnes. The production of American cotton has increased from 128 thousand tonnes to 2987 thousand tonnes in the same study period. But on the other hand the production of Desi cotton has increased only 146 thousand tonnes in 1966-67 to 289 thousand hectares in 2000-01 but has decreased 58 thousand tonnes in 2017-18

Intensity of Cropping: Intensification is a process that characterises all modern agriculture. The same is true in the case of Haryana. The net area sown didn't increase as much as the area sown more than once. In 2010-11 the intensity of Green Revolution was highest in the Panipat, Bhiwani and Jind districts. In the Mewat, Rewari and Gurgaon districts measure the low intensity of the Green Revolution. On the other side in 2017-18 the highest intensity of Green Revolution was in Jind,, Karnal, Panipat, and Hisar districts. The lowest intensity measured in the Gurgaon, Mewat,Panchkula and Yamunanagar. The lowest intensity region is the industrial belt and sugarcane belt of Haryana where the Paddy-Wheat rotation plays a smaller role. By contrast, Rewari district emerged as the one with only a small increase in area sown more than once. The same was true of Yamunanagar and Panchkula district. The intensity of the Green revolution has been low in both cases. The lack of irrigation, associated with undulating topography and deep water table, limited the scope of multiple cropping (Table 3)

Table 3: Haryana: Intensity of Cropping, 2010-11 to 2017-18

District	2010-11	2017-18	Difference in Points
Ambala	188	199	11
Panchkula	165	171	6
Yamunanagar	167	172	5
Kurukshetra	184	190	6
Kaithal	188	193	5
Karnal	197	219	22
Panipat	199	212	13
Sonipat	186	201	15
Rohtak	179	187	8
Jhajjar	174	182	8

Faridabad	178	188	10
Palwal	182	189	7
Gurgaon	145	153	8
Mewat	148	156	8
Rewari	162	176	14
Mahendragarh	168	172	4
Bhiwani	201	219	18
Jind	203	224	21
Hisar	194	208	14
Fatehabad	189	192	11
Sirsa	182	195	13

Source: Computed from the data of Statistical Abstract 1990 and 2013. In the high Green Revolution intensity areas, the increase in multiple cropping is significant but not as eastern part of Haryana. Under reference here are the districts of Sonipat, Panipat and Rohtak and Bhiwani from the south-western region. Multiple cropping, associated with an assured base of irrigation, was of a relatively high order her even in 1966- 67. This limited the scope of further intensification. The decrease in land left fallow and an increase in intensity of cropping are putting a tremendous strain on the soil fertility. The soil now gets no time to recuperate its strength, farmyard manure is scarce and the practice of green manuring is impossible due to lack of time between harvesting of one crop and sowing of the next. Soils consequently, are suffering from several deficiencies, as discussed earlier.

ECOLOGICAL COST OF GREEN REVOLUTION: The Green Revolution, beginning in India around the mid-sixties and involving the use of high-yielding variety of seeds, chemical inputs and irrigation, has also aroused a lot of academic interest in terms of its economic and ecological implication. The ecological fallouts of the Green Revolution, which have started surfacing with the passage of time, are now attracting the attention of the government and the academician. It is quite difficult to calculate the monetary values of all types of environmental degradation. But it is possible to know that how much environmental quality is being given in the name of agricultural development. India achieved self-sufficiency in food production only due to Green Revolution. However, this was achieved at a great cost to the nation, both environmental and social (Ramakrishnan, 2008). Agricultural economists in India have been interested essentially in the economic benefits of crop production. Their interest in rural ecology has been negligible (Rao, 1988). In intensive cropping system, the excessive and inappropriate use of agrochemical pollutes waterways, poisons people and upsets eco-system (World Development Report, 2008). Even, after the four decades of Green Revolution, Haryana is neither a land of prosperity nor peace. It is a region ridden with discontent and violence. Instead of abundance, Haryana has been left with diseased soil, pest infested crops, groundwater depletion and water logging deserts (Singh, 2000). The adaptation of new strategy of cultivation has raised many social and environmental problems. The model of intensive cultivation gave birth to a number of ecological problems in Haryana.

Unplanned Canal Irrigation System and Problem of Water Logging: It is ironic that the water scarce state of Haryana suffers from the problem of water logging in parts. Water logging is a situation when the water table rises to an extent that the soil pares in the root zone of a crop become saturated resulting in restriction of the normal circulation of air, decline in the level of oxygen and increase in the level of carbon dioxide. The actual depth of water table when it starts affecting the yield adversely may vary from zero for rice to about 1.5 metres for other crops (Singh, 1998:170) The flood plains of the Yamuna, Ghaggar, Markanda, Dohan, and Sahibi remain waterlogged for varying durations during rainy season (July to September). The lowlying parts of the upland plain in Kurukshetra and Karnal districts also get waterlogged during the rainy season. Water logging is due to excessive use of water for short-term grain and failure to take step to drain excess water. The economists concentrated more on the impact of irrigation on productivity of land, rather than on water use efficiency (Nadkarni, 1987). Due to the unplanned canal irrigation system and inadequate drainage system the some districts of the State have been facing the severe problem of water logging and resultant soil salinity. Both salinity and water logging occur when agricultural land is over irrigated. As second or third crops were planned each year after the introduction of new agricultural strategy, the situation becomes worse in the State.

Conclusion: In the Haryana state much progress was made in agricultural productivity, but at the cost of land and water degradation. Intensive agriculture during the Green Revolution has brought significant land and water problems relating to soil degradation over exploitation of ground water and soil pollution due to the uses of high doses of fertilizers and pesticides. The above analysis provides that from the economic point of view the State of Punjab made spectacular progress after the introduction of new technology of cultivation. With 1.34 per cent of the total geographical area of the country, Haryana is contributing about 11.8 million tonnes of wheat and 3.4 million tonnes rice to the national pool. Agriculture sector is playing an important role in the structural composition of the economy and contributing a large proportion in GSDP and employment. The farmers of Haryana are using each and every part of the soil for cultivation purposes. That's why the net sown area in Haryana is higher than the other parts of the country. Similarly, after the introduction of new methods of cultivation the cropping intensity in Haryana reached its saturation level. The production relations in Haryana's agriculture completely transferred from traditional to modern agriculture. The extension of irrigation facilities and announcement of minimum support price

increased the productivity of wheat and rice about three to four times. The total production of principal crops (wheat and rice) also increased very sharply. All this progress establishes Haryana as one of the richest State in economic terms. But, on the other hand, Haryana has been suffering a lot from the ecological point of view. The heavy input based agriculture is affecting each and every aspect of the environment and human health, whether it's cropping pattern, access to groundwater, cost of cultivation and soil fertility. The intensive cropping changed the cropping pattern from multiple cropping pattern to monoculture dominated by wheat and rice. The new varieties of wheat and paddy need much more irrigation in comparison to desi varieties. It is one of the major reasons that the area under artificial irrigation (tubewells and wells) has increased very sharply. The overexploitation of groundwater due to the artificial irrigation system drastically depleted the groundwater table in Haryana.

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