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Spatio-Temporal Analysis of Area Under High Yielding Food Grains in Haryana's NCR Sub-Region

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Annotation: During the Green Revolution, High Yielding variety of food grains were introduced to boost agricultural productivity and help attain food security. However, it necessitated important changes in administration and required important agricultural inputs. This study aims to analyze the spatio-temporal trends in the area under high yielding variety of food grains in the NCR districts of Haryana. The time series data collected from secondary data sources from 1980-2020 revealed a continuing trend of increasing cropped area under high yielding variety of food grains. The production of major crops like rice, wheat, maize and Bajra are recorded to have been increasing with wide usage of high yielding variety of seeds. In addition, the close proximity to the National Capital has ensured timely availability of necessary agricultural inputs that have crucial parameters driving increased production. Along with that, the NCR region has provided an agglomerated market for the agricultural produce that has enabled farmers to gain increased remunerative benefits for their produce.

Keywords: Area, High Yielding Variety of Crops, Pattern, NCRRegion, Haryana.

Introduction

Traditional agricultural practices were replaced by modern high-intensity agricultural technologies during the 'Green Revolution' period in the mid-sixties, with the introduction of high yielding varieties (HYV) of crop, as well as necessary inputs such as increased use of fertilisers and chemicals, farm mechanisation, and supportive government policies that favoured maximum production (Singh, 2000). Haryana's main occupation is agriculture, which employs more than two-thirds of the population (Panwar&Dimri, 2018). As a result, the state's agricultural development depends on the long-term viability of production and productivity of major crops. Since 1980, Haryana's agricultural expansion has seen an increase in the area under specialized crops such as wheat, rice and cotton, while the area under pulses has fallen in practically all districts (Chaudhary & Aneja, 1991). As a result, the state's crop diversification fell. In the decades after the green revolution, Haryana's agricultural development exhibited a shift towards mono-cropping (Ninan&Chandrashekar, 1993).

The NCR sub region is made up of Haryana districts that are adjacent to the national capital territory. This region encompasses 13 of Haryana's districts in total. The growth of these districts has been impacted by their proximity to the national capital (Sharma, et al., 2013). Those districts that border the national

capital have seen an increase in the secondary and tertiary sectors, while those districts that are close by have seen an expansion in the agricultural sector. The region's expansion has been fueled by access to the national capital's marketplaces (Kumar and Singh, 2021). High productivity was required to meet the demands of both the state of Haryana and the national capital. High yielding variety seeds with high productivity possibilities were introduced for the first time in response to the developments of the green revolution. Farmers gradually adopted new high-yielding varieties of seeds and traditional subsistence farming was displaced by modern commercial farming, beginning in the NCR region (Devi & Mehala, 2016). As a result, high yielding variety seeds need agricultural inputs such as irrigation and fertilisers, as well as other machinery to assist farming activities. With the establishment of canal systems and tube well irrigation, the state government ensured irrigation facilities (Singh, et al., 2020). Simultaneously, the government established supportive programmes and farm finance to provide farmers with simple access to resources (Singh and Kumar, 2017). In this regard, the national capital has played a critical role in supplying agricultural inputs such as fertilizers and farm machinery. Eventually, agricultural development in Haryana's NCR region was strengthened.

The shift to more specialised cultivation than before was a significant characteristic of this growth (Panwar & Dimri, 2018). As a result, rice and wheat were the principal crops that were now being farmed. Maize and Bajra, on the other hand, continued to be planted in large amounts. Bajra and maize were the most popular options in areas with insufficient irrigation (Sihmar, 2014). With the addition of high yielding varieties of seeds and the appropriate farm inputs, all crops saw a rise in productivity. The move to high-yielding crop types is a prominent characteristic of the region's developments. This study attempts to determine the total area cropped with four key crops utilizing high yielding varieties of seeds in order to gain an understanding of the trends. The study is mostly focused on Haryana's NCR sub region, which is made up of 13 districts. The overall size of the National Capital Region (NCR) is 55,083 square kilometers. The state of Haryana comprises of the largest percentage of the overall territory covered by NCR, i.e. 25,327 square kilometers. The study's major goal is to learn more about the size of cropping based on high-yielding seed varieties. The study's key aims in this regard are as follows:

Objectives

- To assess the specialization of various districts in NCR sub region in terms of high yielding variety of crop production.
- To analyse the extent of usage of high yielding variety of crop in the NCR sub region of Haryana.

Database and Methodology

The data used in this study originates from secondary sources. Statistical Abstract of Haryana, Department of Economic and Statistical Analysis, Government of Haryana, Chandigarh, provided data on gross cultivated area and area under various crops at the state and district levels. Rice, Bajra, Maize and Wheat are the four main crops farmed in Haryana for the purposes of this study. The pertaining data related to high variety yields at district level calculated from 1980-81 to 2019-20. The obtained data are compiled and tabulated in m s excel. The thematic maps of high variety yields of Haryana's districts are prepared in ArcGis software.

Results and Analysis

The purpose to use land in a particular way derives from the profit goals and the optimal cropping pattern is that which is more remunerative to the farmer (Qureshi, et al., 2018). The introduction of high yielding seed varieties in the region, as well as the development of additional agricultural inputs, during the second phase of the green revolution in the 1980s, has been a defining time in the region's agricultural transformation (Chaudhary & Aneja, 1991). Farmers began to select high yielding varieties of rice, maize,

Bajra and wheat as their productivity and returns rose. Haryana's NCR subregion, which has easy access to Delhi's markets, has seen widespread production of rice, maize, Bajra and wheat (Meena, et al., 2021). The expansion was most noticeable in the wheat crop, which was more widely cultivated in the districts (Table 1). Rice and Bajra also saw an increase in acreage, but not nearly as much as wheat. Farmers' preferences for specific crops vary depending on the crop's remunerative capacity, government subsidies and schemes and the availability of irrigation and other agricultural inputs (Huh & Lall, 2013). In addition, the risk of crop failure connected with the crop plays a vital influence in the cropping decisions of farmers. This section examines the cropping area under four primary crops in terms of high yielding seed varieties sown. Table 1 shows the area under high yielding food grain varieties planted in the region during 1980-81.

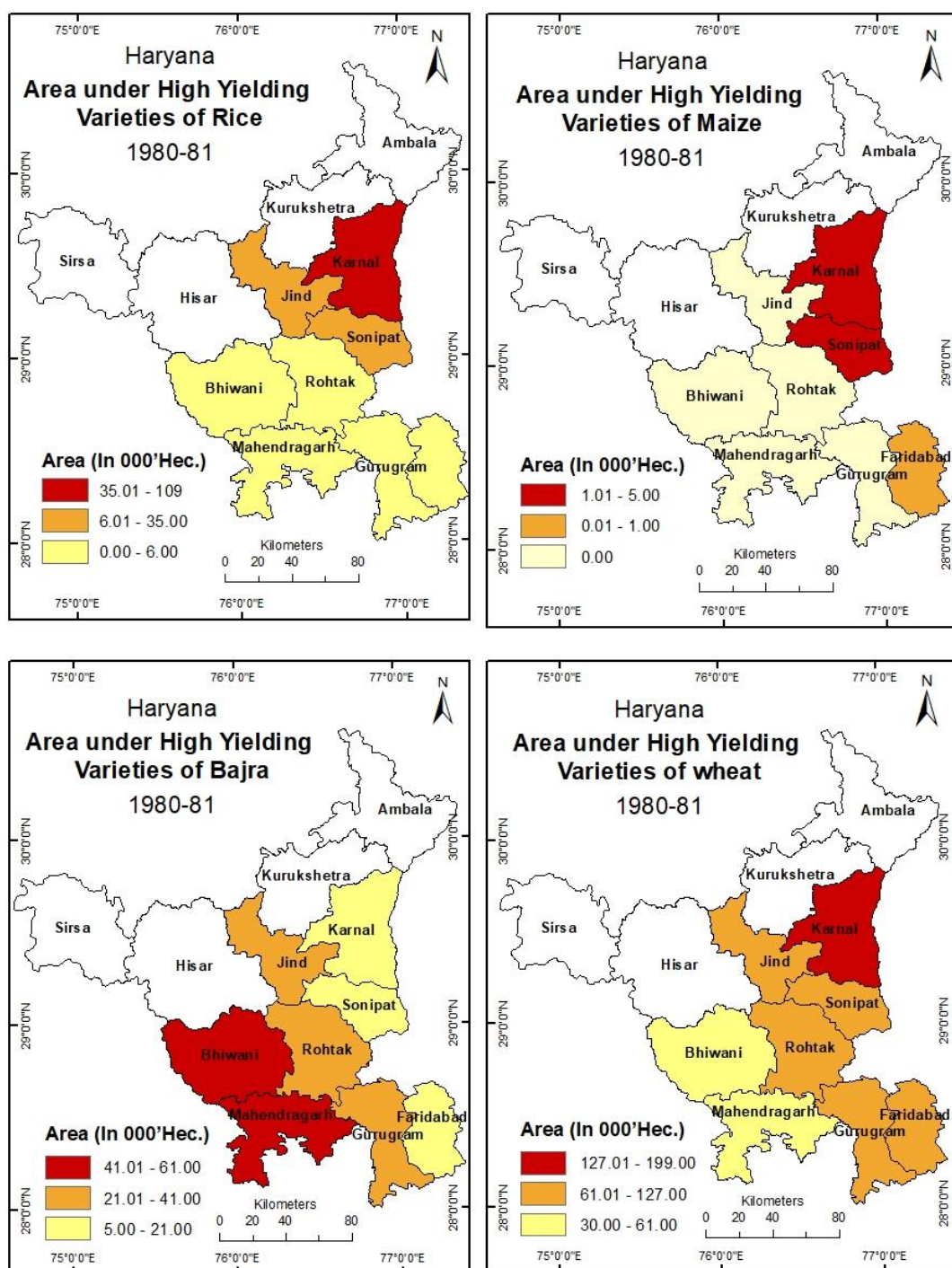
Table 1: Area under High Yielding Varieties of Food grains in Haryana: 1980-81

(In 000'Hec.)

Districts	Rice	Maize	Bajra	Wheat
Bhiwani	-	-	61	30
Gurugram	2	-	32	79
Faridabad	6	1	21	92
Jind	35	-	41	108
Mehendragarh	-	-	49	61
Karnal	109	5	5	199
Rohtak	6	-	31	127
Sonipat	19	3	15	105

Source: Director of Agricultural, Haryana, 1981-82

During the years 1980-81, the highest areas under high-yielding wheat varieties were found in Karnal, Rohtak, Jind, and Sonapat. More than 100,000 hectares of HYV wheat were planted in each of these three areas. The highest area under HYV wheat crop was in Karnal district, which covered 199 thousand hectares, followed by Rohtak district, which had 127 thousand hectares under HYV wheat cultivation. In the districts of Jind and Sonipat, vast tracts of high yielding wheat varieties were planted on more than 100 thousand hectares in each district.



Map 1

In the NCR sub region districts, Bhiwani had the lowest adoption of high yielding wheat varieties, with only 30 thousand hectares including HYV wheat. The Bhiwani district is a semi-arid area with few water resources. As a result, irrigation development in the district was restricted in the 1980s. Bhiwani, Mahendragarh, Gurugram and Faridabad are among the districts with a lower adoption rate of high-yielding wheat varieties. However, in two districts, Gurugram and Faridabad, there was a growing shift away from primary sectors, resulting in low agricultural development. During the 1980-81 with regards

to Bajra crop, there was a decline in farming rates, with more land being used for wheat, providing farmers with higher remuneration. With 61 thousand hectares under the HYV Bajra crop, Bhiwani had the most. Jind, Mahendragarh, Gurugram, and Rohtak were among the areas with moderate HYV Bajra crop coverage. The area under HYV Bajra crop in these districts ranged from 49 thousand hectares to 31 thousand hectares. The districts of Karnal, Sonipat and Faridabad, on the other hand, had the lowest acreage under HYV Bajra crop, with Karnal having the smallest acreage at only 5 thousand hectares.

During 1980-81, the HYV rice crop had the third greatest coverage in the NCR sub region. Karnal was the largest, with 109 thousand hectares. Jind and Sonipat had moderate HYV rice crop coverage, with 35 and 19 thousand hectares covered, respectively. The HYV rice crop was used the least in Gurugram, Faridabad and Karnal, covering a total of 14 thousand hectares in these three districts. Among the principal crops cultivated in the region, maize had the lowest use of HYV seeds. Only in Faridabad, Karnal and Sonipat has the HYV maize crop been used, with a total area under HYV maize crop of only 9 thousand hectares. Overall, the greater use of HYV variety seeds in terms of wheat was a distinguishing aspect of their use in 1980-81 (see map 1). Following the green revolution in the 1980s, the land under wheat and rice grew, while the area under the Bajra crop shrank.

The newest findings in Haryana's NCR sub region show an increased preference for HYV rice over HYV wheat. Rice pricing and returns, as well as improvements in irrigation facilities, were found to be very appealing to farmers, resulting in increased rice production. HYV wheat and Bajra cultivated acreage decreased in 2019-20, but HYV rice planted areas grew. In comparison to the previous decade, the area under HYV rice covered 615.6 thousand hectares, a 72 percent increase. As a result, the HYV wheat area has decreased to 1231.4 thousand hectares, while the HYV Bajra area has decreased to 394.6 thousand hectares. HYV Bajra was replaced as the region's second primary crop by HYV rice during this time period.

Table 4: Area under High Yielding Varieties of Food grains in Haryana: 2019-20

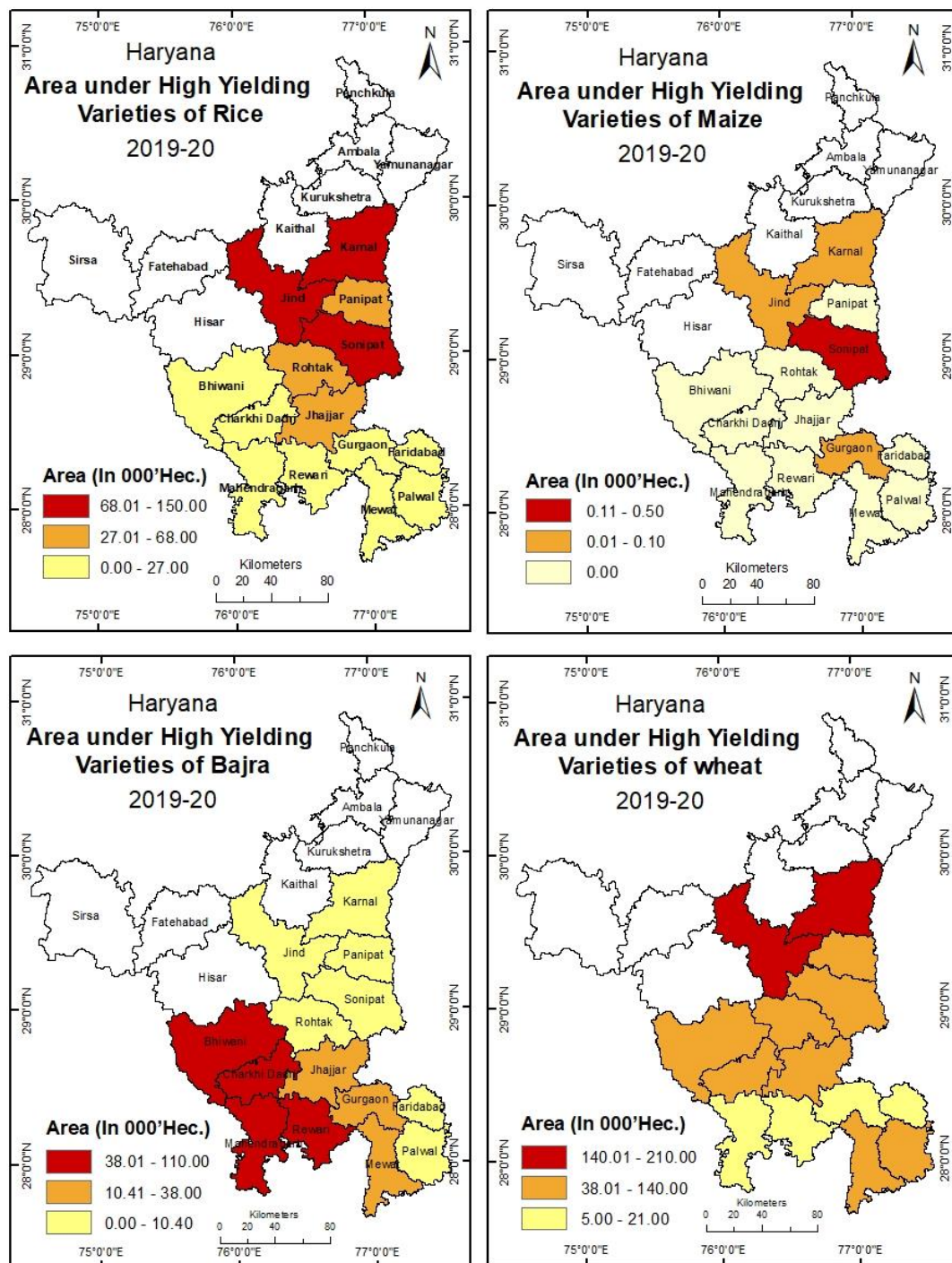
(In 000' Hec.)

District	Rice	Maize	Bajra	Wheat
Bhiwani	26.4	0.0	80.0	105.0
Faridabad	16.9	0.0	3.9	30.0
Gurugram	5.3	0.1	31.3	38.0
Jhajjar	48.0	0.0	38.0	98.0
Jind	97.0	0.1	8.0	210.0
Karnal	150.0	0.1	0.0	178.4
Mahendragarh	0.0	0.0	110.0	35.0
Nuh	10.0	0.0	30.0	76.0
Palwal	27.0	0.0	10.0	98.0
Panipat	68.0	0.0	0.3	87.0
Rewari	2.0	0.0	66.0	34.0
Rohtak	65.0	0.0	10.4	102.0
Sonipat	100.0	0.5	6.7	140.0
NCR sub-region of Haryana	615.6	0.8	394.6	1231.4

Source: Director of Agricultural, Haryana, 2021

Large portions of Jind, Karnal, Rohtak, Sonipat and Bhiwani were planted with HYV wheat. Jind district had the greatest area under HYV wheat cultivation, covering 210 thousand hectares, followed by Karnal district, which had 178.4 thousand hectares under HYV wheat cultivation. Sonipat district also has the

third-largest area planted with HYV wheat, with 140 thousand hectares. Each district in Bhiwani and Rohtak had a little more than a hundred thousand hectares. Palwal, Panipat, Nuh and Jhajjar districts had a relatively small amount of HYV wheat cultivated. Faridabad, Gurugram, Mahendragarh and Rewari are among the districts where HYV wheat is grown in smaller areas. Small sections of HYV wheat crop were documented in the districts that noted a trend away from primary activities and had extremely limited irrigation capabilities.



Map 2

In terms of HYV Bajra cropped area, Mahendragarh and Bhiwani districts had the largest cropped areas, covering 110 thousand hectares and 80 thousand hectares, respectively. The HYV Bajra crop was also planted on a larger area in Rewari district, which totaled 66 thousand hectares. Nuh, Gurugram and Jhajjar were among the districts with moderate coverage. Faridabad, Jind, Panipat and Sonipat, on the other hand, have the lowest acreage of HYV Bajra in 2019-20. Faridabad has already seen a decrease in cropping intensity as a result of growing urbanisation, but the fall in HYV Bajra area in Jind, Panipat, and Sonipat is due to an increase in HYV rice crop area.

In Karnal, the largest area under HYV rice cultivation was recorded in 2019-20. The HYV rice crop is grown on 150 thousand hectares of land in the district. Similarly, 100 thousand hectares of land in Sonipat are planted with HYV rice. Jind mentioned that the third largest area under the HYV rice crop was 97 thousand hectares. The increased area of the HYV rice crop is a clear indication of the region's irrigation development's favourable effects. Jhajjar, Panipat, and Rohtak are among the places with a moderate acreage of HYV rice crop. HYV rice was planted on 48 thousand hectares of land in Jhajjar, 68 thousand hectares in Panipat, and 65 thousand hectares in Rohtak, respectively. Bhiwani, Faridabad, Gurugram, Nuh and Rewari are among the districts on the bottom end of the scale. It is worth noting, however, that despite having the lowest HYV rice crop coverage in the region, all five districts have seen an increase in the area under HYV rice (see map 2). Rewari has shown the slowest growth within this time period. Pricing and irrigation infrastructure have both played key roles in the expansion of rice-growing areas. Rice crops, when combined with proper irrigation and easy access to critical inputs, provide farmers with better returns than other crops. Furthermore, the crops have easy access to the market because of their accessibility to National Capital.

Conclusion

With the developments of green revolution, the high yielding variety of seeds gained increased adoption which resulted in high productivity and as a result provided farmers with increased returns. However, the high yielding variety of seeds alone cannot be attributed to have driven the development. High yield varieties of crops have been a catalyst in the chain of developments that spurred the momentum of agricultural production in the region. Developments in agricultural inputs and access to markets have been a major factor that boosted farm production. It is clearly evident that in the NCR region of Haryana, the developments and specialization of crops have been in line with the demand from the capital region. The area under rice has especially increased as a result of increased demands. Wheat continues to cover larger areas which cater to the demands of both Haryana and national capital. Bajra is being cropped mostly in regions with limited irrigation facilities. The shift to rice cultivation has been indicative of change in farmer's preference to more remunerative crops along with supportive framework from the government. Therefore, two factors played a very significant role in the NCR region of Haryana that boosted agricultural productivity. High Yielding Variety of crops and proximity of national capital have been driving factors that continues to boost agricultural production.

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