



## **The Emergence of Rice-based Cropping Pattern After Green Revolution in Haryana: Some Aspects of Growth and Distribution**

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### **Abstract:**

Rice is the staple food for about 60 percent of the total population of the country. Cultivation of the Paddy requires special geo-climatic conditions, and in most of the area, paddy cultivation is limited by rainfall and temperature. The crop required in most instances a relatively high atmospheric humidity, an average temperature of 20° centigrade, and a well-distributed rainfall between 125 centimeters and 150 centimeters during the growing season. To the climatic requirement must also be added an abundant supply of fresh water for irrigation where the rainfall is less than 125 centimeters. Rice thrives well on a variety of soils widely ranging from slightly acidic to slightly alkaline particularly the heavy, compact, and acidic soils having the ability to hold water over the surface for a considerable period. Haryana is a traditionally wheat-producing region but the enterprising farmers of the plain have made full use of package technology including perennial irrigation by canals and tube wells, HYV seeds, and fertilizers. This has resulted in a widespread change in the cropping pattern of the state and the region has become a very important producer of rice. Over a short period, the spread of rice cultivation has enabled this region to occupy an important place among the rice-producing states of India. The area used for the cultivation of paddy, a highly water-intensive crop, has increased fourfold. In 1960-61 area under rice constituted only 3.8 percent of the total cropped area increased to 23.37 percent in 2020-21.

### **Key-Words:**

Cropping Pattern, Green Revolution, Cropping Intensity, Commercialization of Agriculture, Location Quotient

### **Introduction:**

Agriculture is a primary form of economic activity that provides food, fodder, raw material, and other necessary items for every on-earth surface. Agriculture is performed in all the countries of the world; some countries and regions have a higher inclination towards agriculture given the suitability of agroclimatic and agroecological conditions. Among these regions India is a country that is largely dependent upon agriculture for its employment creation and for providing thrust to the Indian economy. India is blessed with diverse conditions that suit all the crops that are grown around the world. Wheat, rice, fruits, and vegetables grown in India are like across the world for their diversity and taste.



Indian agriculture saw major changes to cope with the demands of the growing population and rapid urbanization in the early 1960s under which package technology was adopted. As a result of this India which was facing food scarcity before independence achieved the capacity to export food. Haryana, Punjab, and western Uttar Pradesh emerged as the front runner and torchbearers in the adoption of green revolution-based technology. Under this technology quality seeds and other quality farm implements were used under the presence of assured irrigation. The green revolution brought in many changes in the production method and the nature of agriculture therefore owing to its revolutionary changes, the green revolution is regarded as a very vital event in the economic history of India.

Among many changes that were brought in by the green revolution change in cropping pattern is regarded as the most far-reaching change. Under the influence of the green revolution cropping pattern of India in general and of Haryana state in particular shifted from millets to finer food grains. The finer food grains emerged victorious from the fight between millet and rice during the green revolution in the state. Rice emerged as the first preference of farmers and as a result of this rice spread from core areas of northern Haryana to non-core areas of southern Haryana. In this paper, an attempt has been made to understand the spread and dispersal of rice in the state of Haryana.

Haryana is dominantly an agricultural region. The state of Haryana came into existence on November 1, 1966, after the reorganization of the administrative boundary of composite Punjab. In a short period, this region has come to occupy a place of pride in the field of agriculture. Haryana, historically known for wheat production, has undergone a significant transformation in its cropping pattern, driven by the enterprising farmers of the region who have embraced modern agricultural practices. With the adoption of package technologies such as high-yielding variety (HYV) seeds, fertilizers, and perennial irrigation through canals and tube wells, the region has emerged as an important rice producer. The area dedicated to rice cultivation has experienced a substantial increase, with its proportion to the total cropped area rising from 3.8 percent in 1960-61 to 23.37 percent in 2020-21. The state made rapid progress in the field of agriculture since 1966-67 and holds a leading position among other agriculturally advanced regions of India. The state which constitutes only 1.44 percent of the geographical area and 2.4 percent of the total population of the country now contributes as much as about 7.2 percent towards the country's total food grains production. In Haryana, rice is not a native crop. Its cultivation started after the advent of the green revolution. But in the due course of time, rice has emerged as the second-ranking crop of the state after wheat.

### **Scope and Objectives of the Study**

The present study unfolds the spatiotemporal pattern of rice cultivation at the district level of Haryana state, covering a period of 61 years i.e., 1960-61 to 2019-22.

The objectives of the present study are:

- i. To examine the trends in the area of rice in the state.
- ii. To examine the spatial pattern of rice cultivation during post green revolution period in the study area.



- iii. identify core and non-core areas of rice cultivation in Haryana.

### Data Source and Methodology

The present study is based on secondary data drawn from published as well as unpublished sources. The time series data relating to various aspects of agriculture such as the area under rice crops and total cropped area in the state during the post-green revolution period at the state and district level have been obtained from the Statistical Abstract of Haryana for the period 1960-61 to 2020-21. In the present study, the data has been processed by using simple and suitable statistical techniques and presented in tables and diagrams. The area under rice cultivation in the state has been shown with the help of a trend line. Based on the concentration index the study area has been divided into four categories viz. core rice growing areas, peripheral rice growing areas, marginal rice growing areas, and non-rice growing areas. The concentration index of rice crop has been computed using location quotient with the help of the formula:

$$\text{Location Quotient} = \frac{\text{The area under crop (i) in the district}}{\text{Total cropped area in District}} \div \frac{\text{Area under crop (i) in the entire state}}{\text{Total cropped area in the entire state}}$$

### Findings and Discussions on State Level

In 1960-61, the area under rice cultivation was 175 thousand hectares. This value gradually increased to 193 thousand hectares by 1965-66, showing a slight growth in rice cultivation. The trend continued, and by 1970-71, the area expanded further to 269 thousand hectares. During the mid-1970s, there was a notable surge in rice cultivation in Haryana, as evidenced by the increase to 303 thousand hectares in 1975-76. This significant growth continued into the 1980s, with the area reaching 483 thousand hectares in 1980-81. The expansion of rice cultivation in Haryana continued throughout the 1980s and 1990s. By 1985-86, the area under rice cultivation grew to 584 thousand hectares and further expanded to 661 thousand hectares in 1990-91.

The trend of increasing rice cultivation persisted, reaching 830 thousand hectares in 1995-96 and 1054 thousand hectares in 2000-01. From 2000-01 to 2010-11, the area under rice cultivation remained relatively stable, with a slight fluctuation between 1047 and 1243 thousand hectares. However, in 2015-16, there was a noticeable increase to 1354 thousand hectares, indicating a resurgence in rice cultivation. The latest data point, for the year 2020-21, shows a further expansion of rice cultivation in Haryana, with the area reaching 1526 thousand hectares. Overall, the data demonstrate a general upward trend in rice cultivation in Haryana, with some fluctuations in certain years. This indicates the increasing importance and scale of rice production in the state over the analyzed period. The trend line drawn for time series data shows the rapid increase in the area under rice cultivation increase with time. Fig. 1.1 shows that the area under rice cultivation fluctuates from year to year. A glance at the line graph of the area under rice cultivation reveals that the area under rice cultivation over the years has been fairly high up to 2010-11 with few exceptions. From 1960-61 to 2020-21 the area under rice cultivation followed the trend line which shows the ideal increase in area under rice cultivation over the years. This increase in the area under rice cultivation is due to the spread of irrigation facilities, changing cropping patterns, and increasing cropping intensity. A remarkable downfall



in the area under rice cultivation occurred in 1987-88 due to a serious drought. After 1987-88 the area under rice cultivation increased smoothly till 1995-96. A remarkable increase occurred in 2000-01 due to the spread of rice cultivation in non-rice growing districts Rohtak, Jhajjar, Sirsa, Hisar, Gurgaon, Bhiwani, and Rewari districts of Haryana.

#### **Spatial Pattern of Rice Cultivation:**

It is not only the temporal, spatial pattern of rice cultivation that has also changed with time in Haryana. Table 1.1 shows the percentage of area under the rice to the total cropped area. In the 1960s rice occupied a very insignificant position in the state in terms of percentage to the total cropped area.

During the years 1960-63, the state reported only 175 thousand ha under rice cultivation. This accounts for 3.8 percent of the total cropped area. The cultivation of rice was mainly confined to the northeastern part of the state which enjoyed relatively better irrigation facilities. In 1966-67 important rice-growing districts were Karnal and Ambala occupying more than 12 percent of the total cropped area. The lowest area under rice cultivation was in Jind, Rohtak, and Hisar i.e. below 2 percent. Gurgaon and Mahendergarh reported a very negligible area under rice crops.

Analyzing the data for the year 2019-22, we can observe variations in the proportion of rice cultivation among the districts during this period. Karnal district had the highest percentage of rice area out of the total cropped area, with approximately 44.99%. This indicates that a significant portion of the agricultural land in Karnal was dedicated to rice cultivation during the specified period. Following closely is the Panipat district, where rice cultivation accounted for about 42.93% of the total cropped area.

This suggests that rice farming was also a prominent agricultural activity in Panipat. Kaithal district recorded a percentage of 42.7, indicating a significant contribution of rice cultivation to the overall cropping pattern in the region.

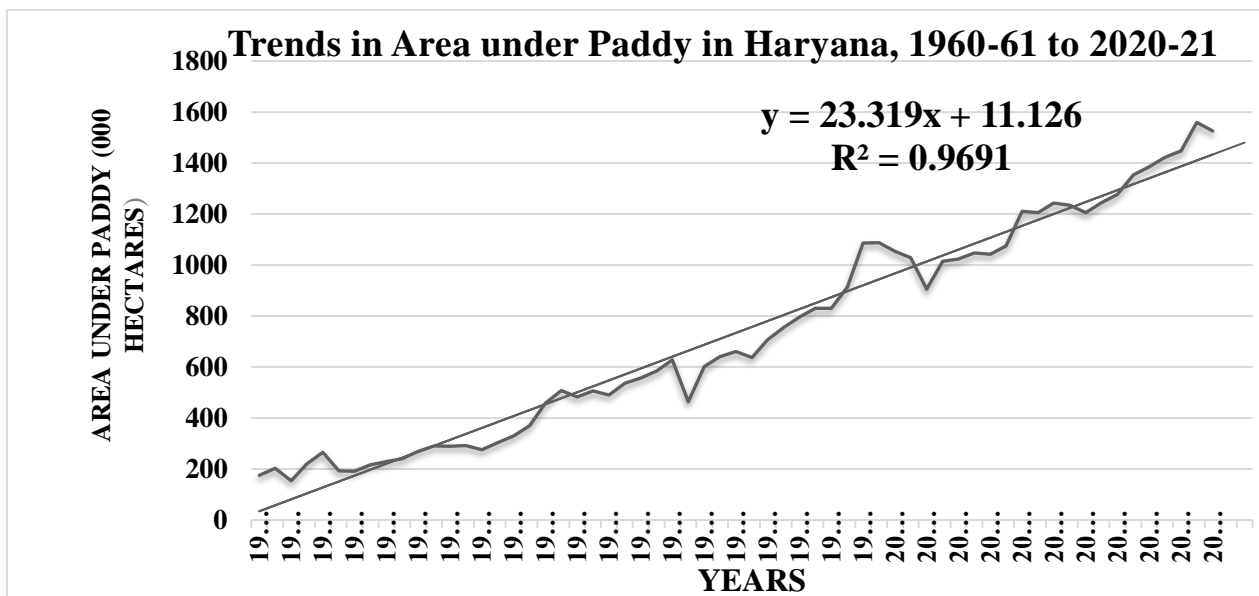


Figure 1.1

Table 1.1

Percentage of Area under Rice to Gross Cropped Area in Haryana, 1960-61 & 2019-22

District	1960-61	2019-22
Karnal	13.13	44.99
Panipat	-	42.93
Kaithal	-	42.7
Kurukshetra	-	42.36
Ambala	12.2	40.33
Yamunanagar	-	38.23
Sonipat	-	36.55
Jind	1.2	31.84
Rohtak	1	29.29
Fatehabad	-	28.97
Panchkula	-	27.01
Haryana	-	22.95
Palwal	-	21.26
Jhajjar	-	17.85
Faridabad	-	17.76
Sirsa	-	13.31
Hisar	1.73	12.39
Nuh	-	5.8
Gurugram	-Nil	4.81
Bhiwani	-	4.69
Charki Dadri	-	4.46
Rewari	-	1.2
Mahendragarh	Nil	Nil
Haryana	3.8	23.16



Source: Statistical Department Haryana

Other districts such as Kurukshetra, Ambala, and Yamunanagar had relatively lower percentages, ranging from 40.33% to 38.23%. These districts still demonstrated a considerable presence of rice cultivation but to a slightly lesser extent compared to Karnal and Panipat. On the other hand, districts like Nuh, Gurugram, Bhiwani, Charki Dadri, and Rewari had relatively lower percentages of rice area, ranging from 1.2% to 5.8%. This suggests that rice cultivation was not as prevalent in these districts, and other crops might have been more predominant in their agricultural practices. It's important to note that the percentage for Mahendergarh is listed as "nil," indicating that there was no recorded rice cultivation during this period.

Overall, the data provide insights into the distribution of rice cultivation among different districts in Haryana from 2019-22, highlighting variations in the importance of rice as a major crop across the region.

**Concentration Pattern of Rice Cultivation:**

Crop concentration refers to the degree to which a particular crop is prevalent in a specific area. It is typically measured using the location quotient, which helps identify areas with high and low intensity of a specific crop within a region. This concept refers to the aerial occupancy or dominance of a crop in a given region. The concentration of a crop is influenced by various factors such as terrain, climate, temperature, humidity, transport facilities, and demand for the crop. In the case of rice cultivation in Haryana, the spatial concentration pattern is primarily determined by the availability of irrigation facilities. Irrigational infrastructure plays a crucial role in determining the extent to which rice cultivation is concentrated in different parts of the state.

**Table 1.2:  
Concentration Index of Rice Cultivation in Haryana, 2019-22**

Category	Concentration Index Range	No. of Districts	Names of Districts
Core Rice Growing Areas	1.75 and above	5	Karnal, Panipat, Kaithal, Kurukshetra, Ambala
Peripheral Rice Growing Areas	0.75-1.75	9	Yamunanagar, Sonipat, Jind, Rohtak, Fatehabad, Panchkula, Palwal, Jhajjar, Faridabad
Marginal Rice Growing Areas	0.25-0.75	3	Sirsa, Hisar, Mewat
Non-Rice Growing Areas	Below 0.25	5	Gurgaon, Bhiwani, Charki Dadri, Rewari, Mahendergarh

Source: Compiled by the author using data obtained from various issues of the Statistical Abstract of Haryana.



The concentration pattern of rice cultivation in Haryana during the period 2019-22 can be classified into four zones based on the location quotient for each district:

**Core Rice Growing Areas:** This zone includes districts with a concentration index of 1.75 and above. There are five districts in this category: Karnal, Panipat, Kaithal, Kurukshetra, and Ambala. These districts exhibit a high intensity of rice cultivation, attributed to factors such as fertile soils and well-developed irrigation facilities.

**Peripheral Rice Growing Areas:** Nine districts fall under this zone, with a concentration index ranging from 0.75 to 1.75. These districts include Yamunanagar, Sonapat, Jind, Rohtak, Fatehabad, Panchkula, Palwal, Jhajjar, and Faridabad. Rice cultivation in these areas is moderately intense, and they are geographically adjacent to the core rice growing areas.

**Marginal Rice Growing Areas:** Three districts, namely Sirsa, Hisar, and Mewat, are categorized as marginal rice growing areas. These districts have a concentration index ranging from 0.25 to 0.75. Rice cultivation in these regions is relatively lower compared to the core and peripheral areas.

**Non-Rice Growing Areas:** Five districts in Haryana fall under this category with a concentration index below 0.25. These districts are Gurgaon, Bhiwani, Charki Dadri, Rewari, and Mahendergarh. Rice cultivation is not a significant activity in these areas, and other factors such as sandy soil may contribute to the limited presence of rice crops.

### **Conclusion**

Since its formation, Haryana emerged as one of the key agricultural states, and at the time of its formation, it was relatively less developed as compared to the rest of Punjab. The emergence of Haryana as a separate state coincides with the onset of the green revolution in the state underwent a significant change thereafter. In the present study, an attempt has been made to examine the spread of rice cultivation in Haryana during the period 1960-61 to 2018-21. During this period, in non-traditional rice-growing states like Punjab and Haryana, the strength of the area under rice vis-à-vis other crops has witnessed a sharp increase. Therefore, rice cultivation is often regarded as the by-product of the green revolution in Haryana state. At present it is the second major crop after wheat. The last four decades have witnessed a notable spread of area under rice in the state because large-scale package technology including H.Y.V. seeds, chemical fertilizer, and irrigation facilities was introduced during this period. It may be noted that just before the emergence of Haryana as a separate state in 1966 rice was grown only on a little about 4.2 percent of the total cropped area. This figure has gone upto 23 percent by the year 2018-21. The growth rate of the rice area in Haryana from 1960-61 to 2020-21 is approximately 6.72% per year. Rice cultivation was mainly confined to the northern and northeastern parts of the state. The spread of rice cultivation in the southern parts over the period



of forty-four years has been quite minimal. This is because of extremely unsuitable physical factors like topography and average annual rainfall. In addition, groundwater in this part is largely saline. Rice is a water-intensive crop and requires irrigation more frequently than other Kharif crops. Canal irrigation in the southern and southwestern parts provides water only at fixed intervals. As against this, groundwater is of better quality in the northern and northeastern parts, and tube wells, which are capable of providing water at any time it is required, are the main source of irrigation here. Thus, the difference between the two sources of irrigation seems to be an important limiting factor in the extent of the spread of rice in the state.

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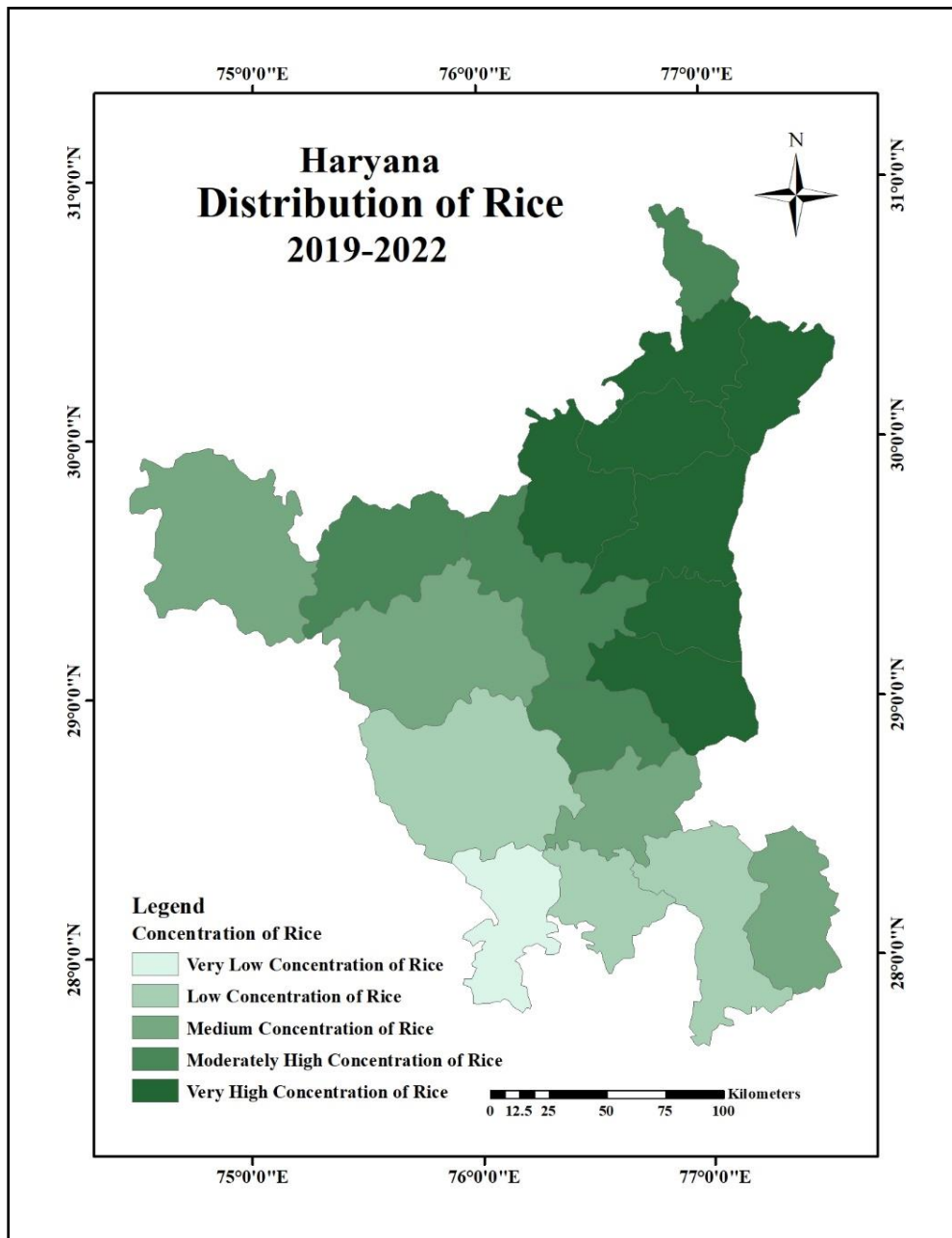
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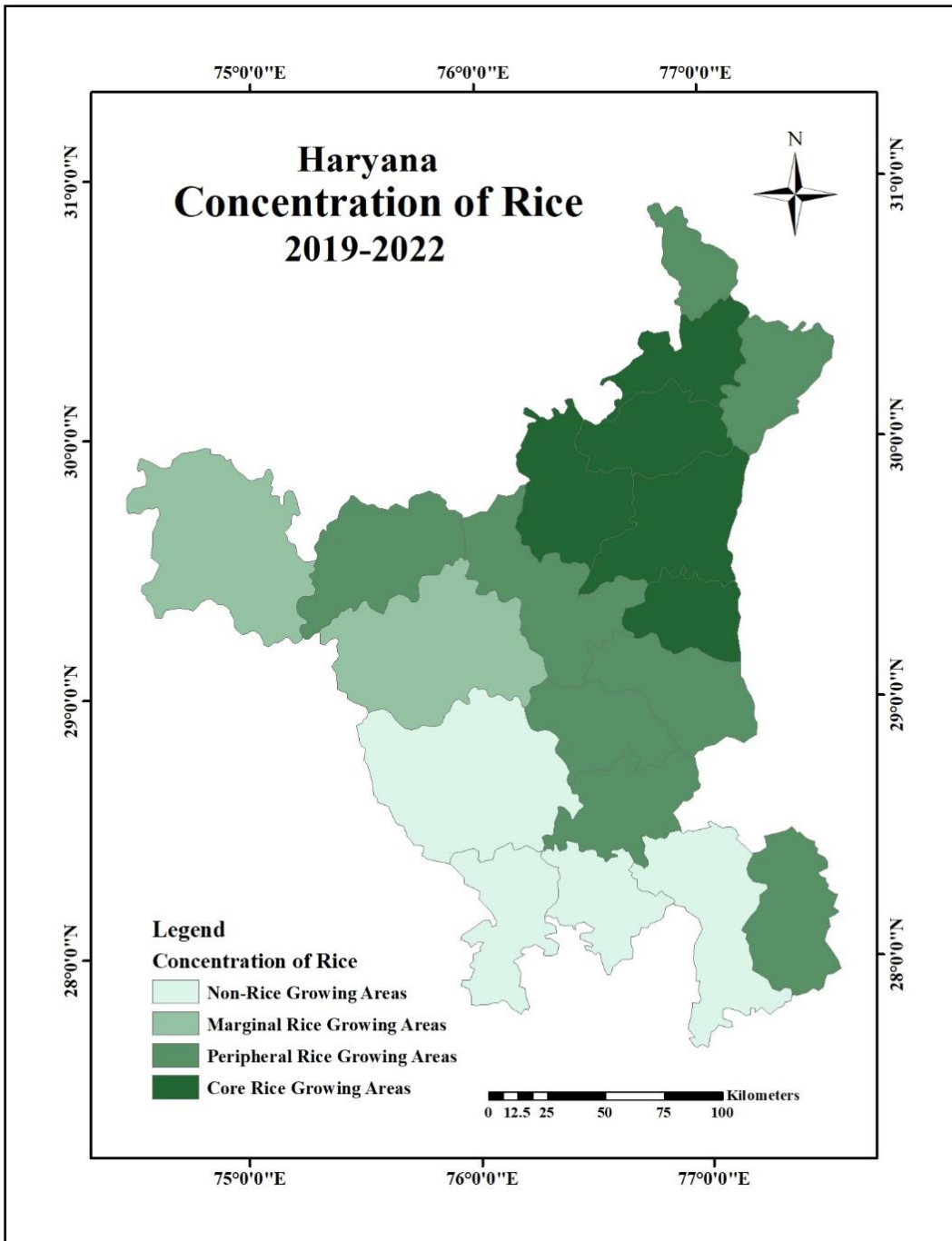
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**Figure: 1.2**

Source: Based on data collected from various issues of the Statistical Abstract of Haryana



**Figure: 1.3**

Source: Based on data collected from various issues of the Statistical Abstract of Haryana