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Rice and Wheat Cultivation in Haryana: A Spatial Temporal Analysis

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Abstract: *The present study discusses the trends and spatial pattern of area, production and yield of rice and wheat in Haryana. To carry out this research, data has been collected from Statistical and Economic Abstract of Haryana, for the period 1966-67 to 2011-12. The analysis of data reveals that the expansion of rice and wheat cultivation both at the spatial and temporal level. The acreage under rice and wheat has continuously increased in all parts of the state. Fast expansion of rice in over the north, north eastern and central parts has been observed than the southwestern parts of the state having limited irrigation facilities.*

Keywords: *green revolution, rice, wheat, yield, irrigation*

I. INTRODUCTION

India has made impressive progresses on the agricultural front during the past three decades. Agriculture continues to be the mainstay of the Indian economy because of its greater share in employment and livelihood, although its relative contribution to the nation's gross domestic product (GDP) has declined over the years (Sekar and Pal, 2012). After the introduction of green revolution, the scene has completely changed about the Indian agriculture has transformed from food shortage to self-reliance. The country became self-sufficient in food production within a relatively short span of time. Significant changes in cropping pattern have been witnessed after the advent of Green Revolution (Ohlan, 2012). This has become possible because of technological changes as well as the Government initiatives in form of various programme. The new method of agricultural practice brought a drastic change in the productivity and production (Ahmad and Haseen, 2012). Therefore the successful implementation of Green Revolution and Land Reform not only increases the productivity but also increases the area under cultivation that paved the way for a higher growth of the agricultural sector.

Haryana is the state which has large amount of fertile land, in India. About 70% of the population is engaged in agriculture, directly or indirectly. The state has achieved a remarkable growth in its agricultural sector, which not only has made it self-sufficient in foodgrains production but also has elevated it to the second largest contributor to India's central pool of food grains (GoH, 2016-17). Rice and wheat are the important food grains of the state. Therefore, in the present study, an attempt has been made to study the scenario of two major food grain crops (wheat and rice) after the formation of Haryana state.

II. OBJECTIVES

- A. To analyse the trend of area, production and yield of rice and wheat in the Haryana (1966- 2012).
- B. To study the spatial pattern of rice and wheat cultivation in the Haryana during 1966-69, 1986-1989 and 2009-12.

III. STUDY AREA

The present study relates to the state of Haryana, covering an area of 44,212 km² in north-western part of India. It is located between 27°39' N to 30°55'N latitudes and 74°27'E to 77°36' longitudes (Fig. 1). It is bordered by Punjab and Chandigarh in the north, Delhi and Uttar Pradesh in the east, Himachal Pradesh in north-east and Rajasthan in the south and west. There

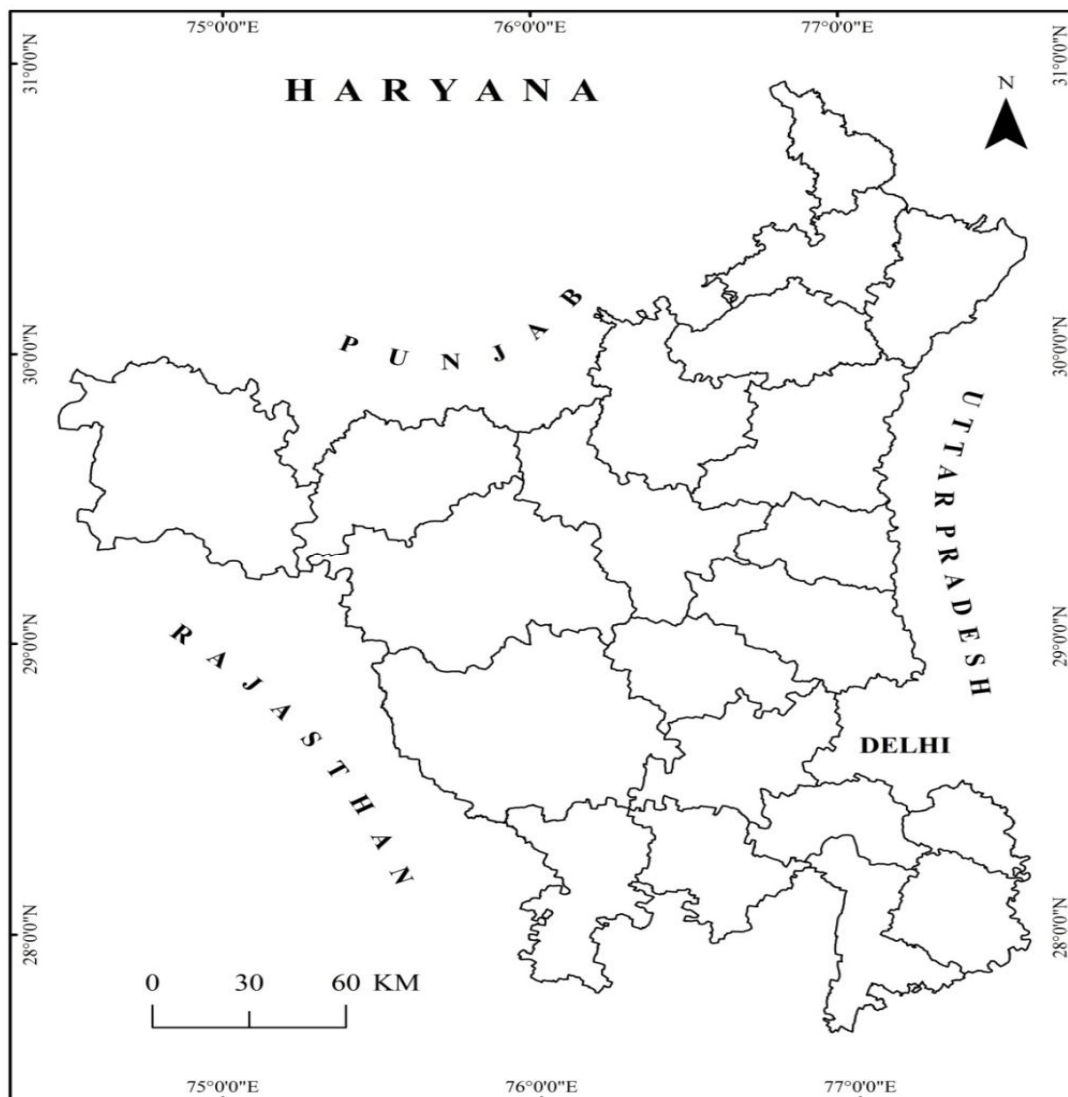


Fig. 1 Location of study area.

were seven districts in the state in 1966 which increased to twelve in 1986 but there are 22 districts at present. According to the Census of India 2011, the population of the state is 25,353,081 with a density of 573 persons per km². The state is self-sufficient in food production and the second largest contributor to India's central pool of food grains. It is one of the heavily irrigated states of the country with 85 percent cultivated land under irrigation. There is semi-arid monsoon climate found in the state.

IV. DATABASE AND METHODOLOGY

The present study is based on secondary sources of data. The study covers the period 1966-67 to 2011-12. The time series data related to various aspects of agriculture such as area, production, yield of rice and wheat and net irrigated area have been collected from Statistical Abstract of Haryana, Department of Economic and Statistical Analysis, Government of Haryana. Trend graphs have been drawn to show the temporal changes in area, production and yield of gram and competing crops for the period 1966-67 to 2011-12. To evaluate the change in spatial pattern of rice and wheat crops triennium average of parameters have been taken for the years 1966-69, 1986-89 and 2009-12. The collected data have been analyzed by using suitable statistical and cartographic techniques.

$$\text{Average yield} = \frac{\text{Average Triennium production}}{\text{Average Triennium Area}} \times 1000$$

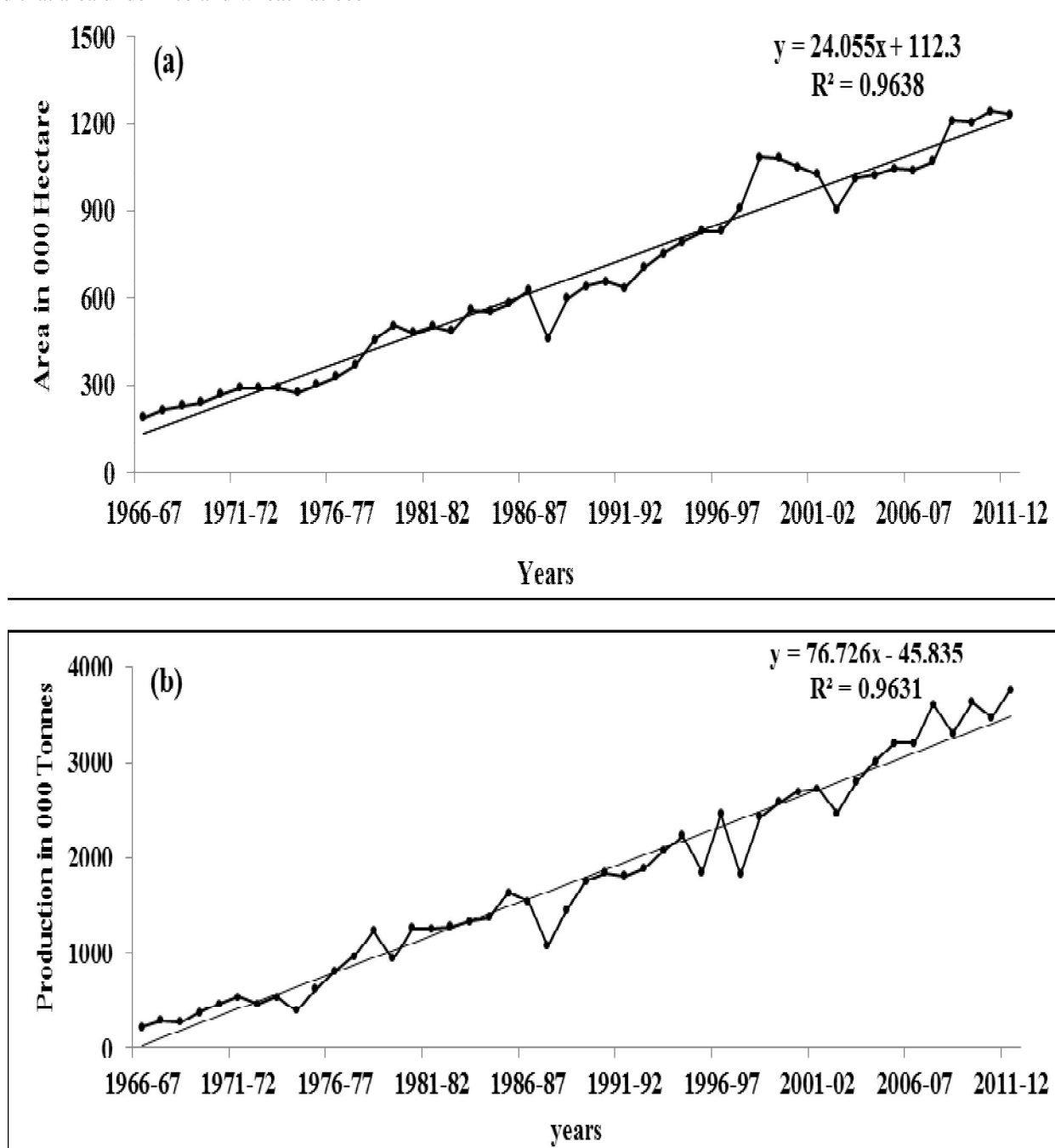
$$\text{Percentage of net area irrigated in net sown area} = \frac{\text{Average Triennium Net area Irrigated}}{\text{Average Triennium net sown area}} \times 100$$

The maps of different variables have been prepared to show their spatial distribution by using the Geographic Information System (GIS). In addition, correlation matrix has been prepared by using Statistical Package for Social Sciences (SPSS version 17.0) to study the relationship between different parameters.

V. RESULTS AND DISCUSSION

A. Temporal Variations in Area, Production and Yield of Rice and Wheat Crops

Fig. 2 (a-c) and Fig. 3 (a-c) showed the trends in total area, production and average yield of rice and wheat in Haryana. It has been observed that area under rice and wheat has been



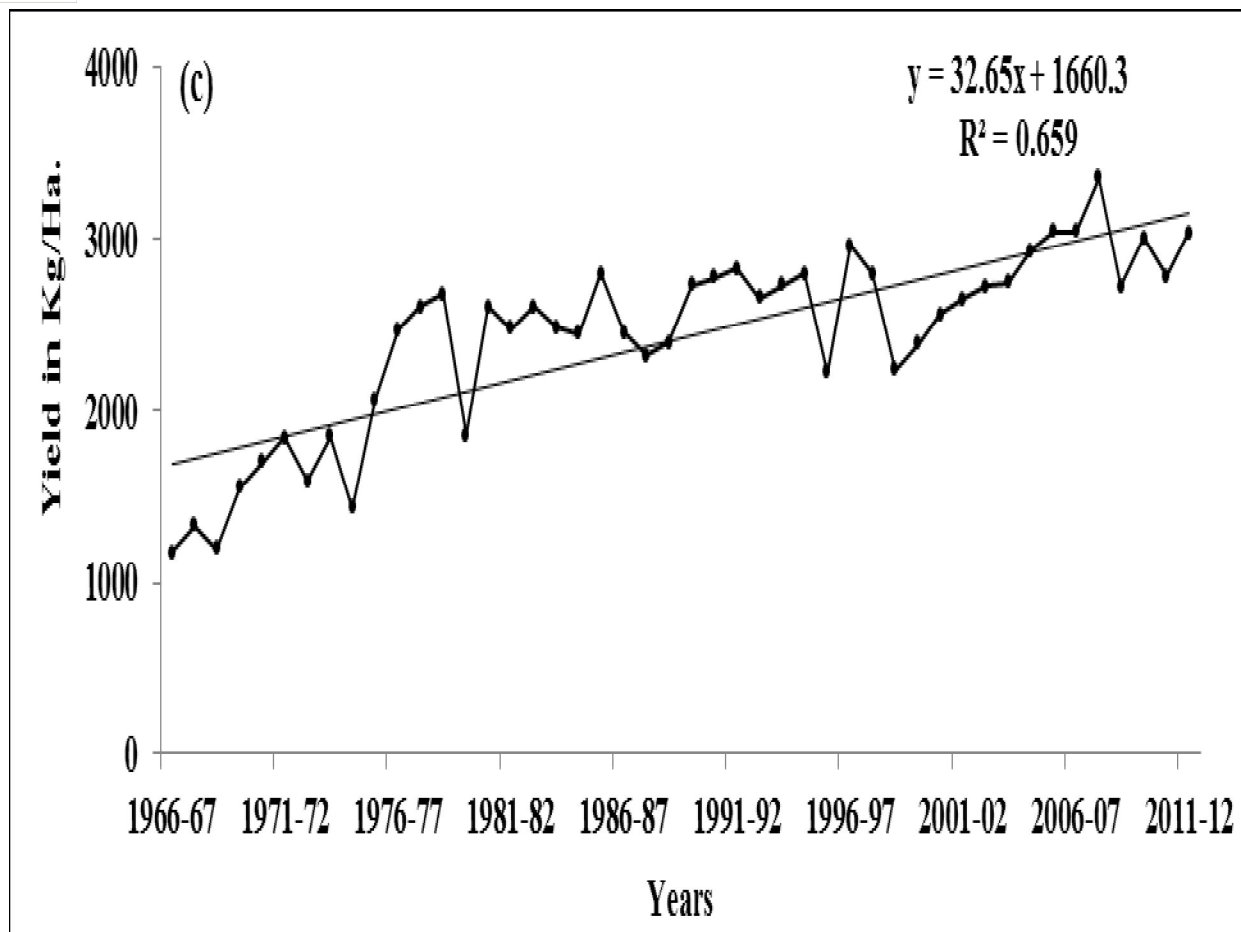
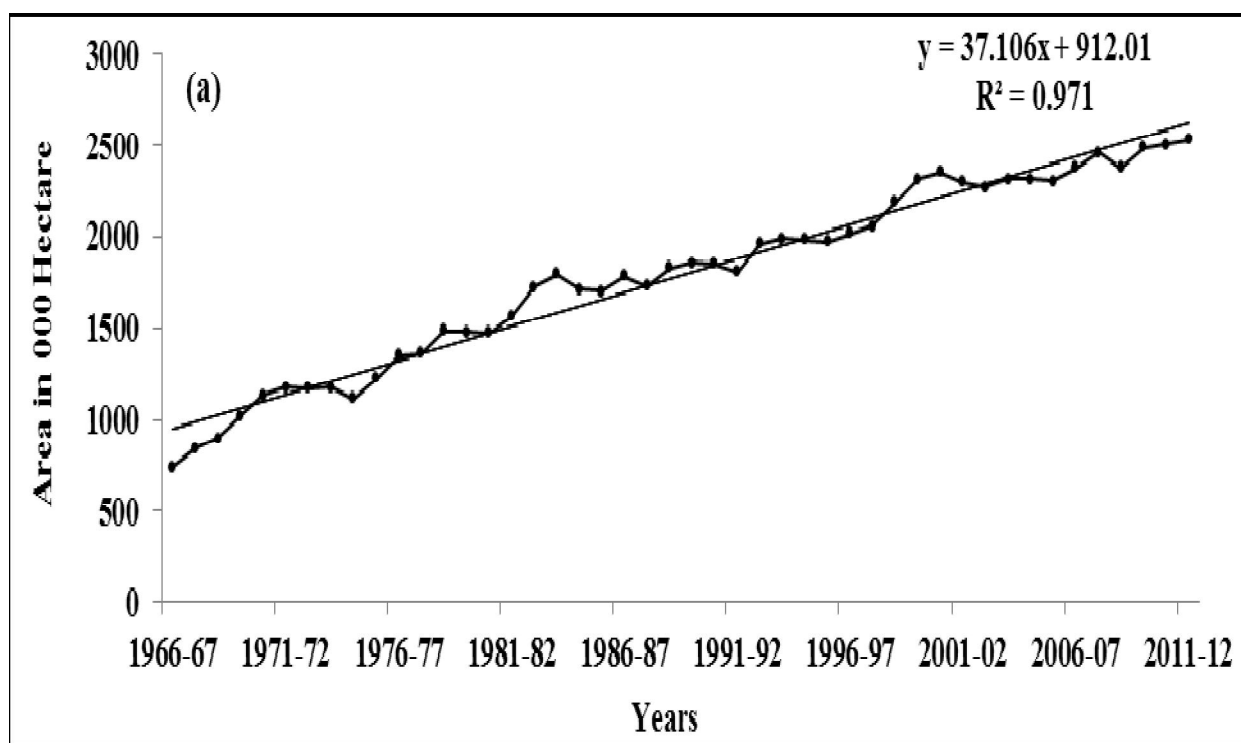


Fig. 2 Trends in the (a) area, (b) production and (c) average yield of rice in Haryana during the period 1966-67 to 2011-12.



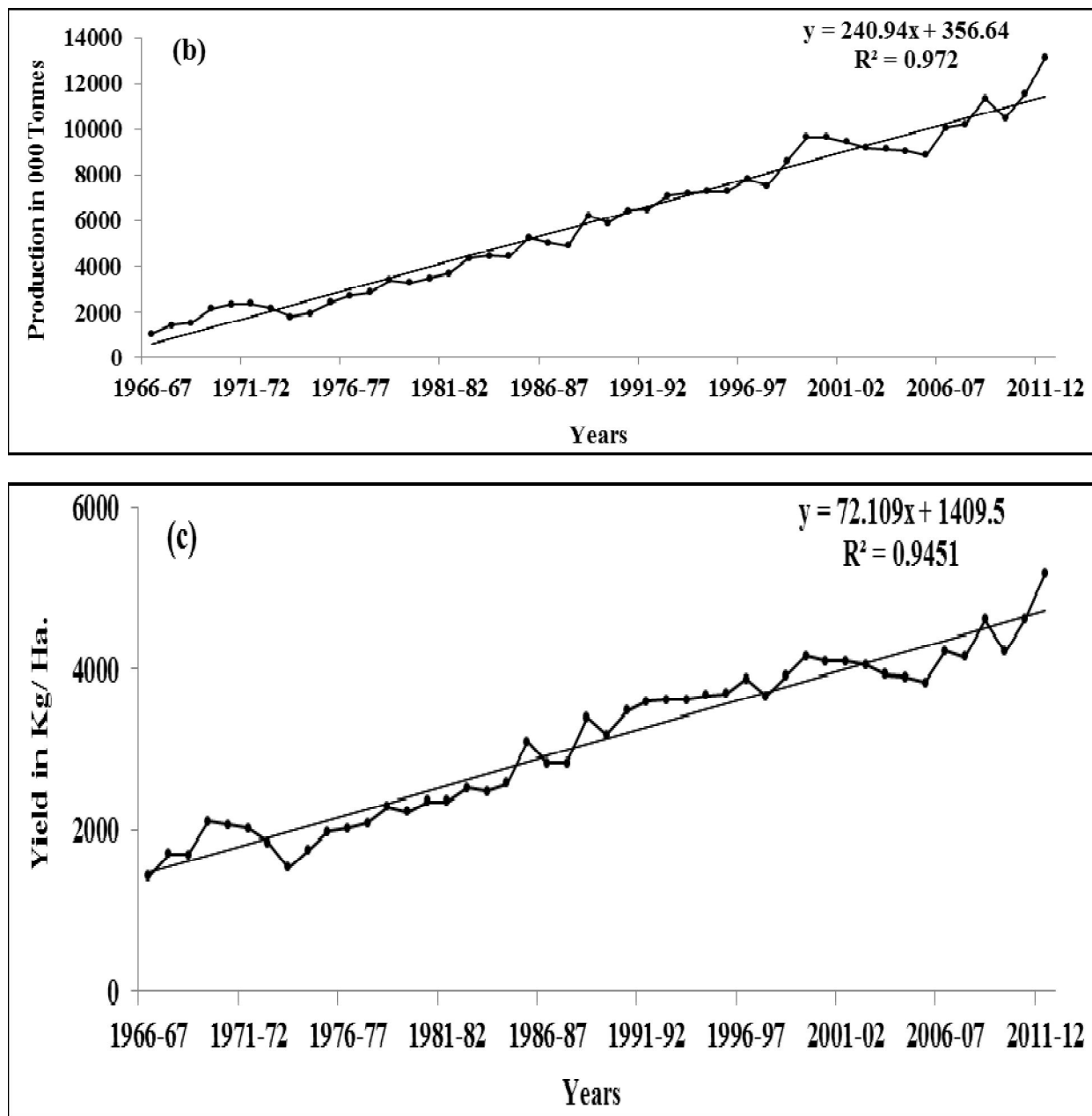


Fig. 3 Trends in the (a) area, (b) production and (c) average yield of wheat in Haryana during the period 1966-67 to 2011-12.

increased consistently over the period of time in the state (Fig. 2a and Fig. 3a). The trend showed that rice was a minor crop in 1966-67 and occupied only 192 thousand ha area. But its area increased to 1235 thousand ha during 2011-12. Similarly, in the mid-1960s area under wheat was 743 thousand ha which experienced almost fourfold increase (2531 thousand ha) by 2011-12. Expansion of area under rice and wheat has coincides with the introduction of new agricultural technology in the mid-1960s in the form of high yielding varieties of seeds, chemical fertilizers etc. The sharp increase in area under rice and wheat is also coterminous with the period experiencing increase in net area irrigated in the state. Furthermore, the production of rice and wheat has been increased significantly due to increase in area under these crops (Fig. 2b and Fig. 3b). The production of rice has increased from mere 223 thousand metric tonnes in 1966-67 to 3757 thousand metric tonnes in 2011-12. The yield level of rice was 1161 in 1966-69 and rapidly increased to 3044 in 2011-12 (Fig. 2c). Contrary to this production of wheat has increased from 1059 thousand metric tonnes in 1966-67 to 13119 thousand metric tonnes in 2011-12 on account of high growth of both area and yield of the crop (Fig. 3b-c).The yield level of wheat has increased by more than three times during the study period.

B. Spatial Pattern of Rice and Wheat Acreage

Fig. 4 exhibits a tremendous increase in acreage of rice in Haryana during study period. The area under cultivation of rice to total cropped area was only 4 percent in 1966-69 and it has increased from 10 percent in 1986-89 to 19 percent in 2009-12 (Fig. 4). In mid 1960s, Karnal and Ambala districts had comparatively higher acreage under rice. Rice acreage was found to be highest in Kurukshetra (55 percent) followed by Karnal (47 percent) and Ambala (24 percent) districts by mid-1980. The acreage of rice sharply increased all across the state during 2011-12.

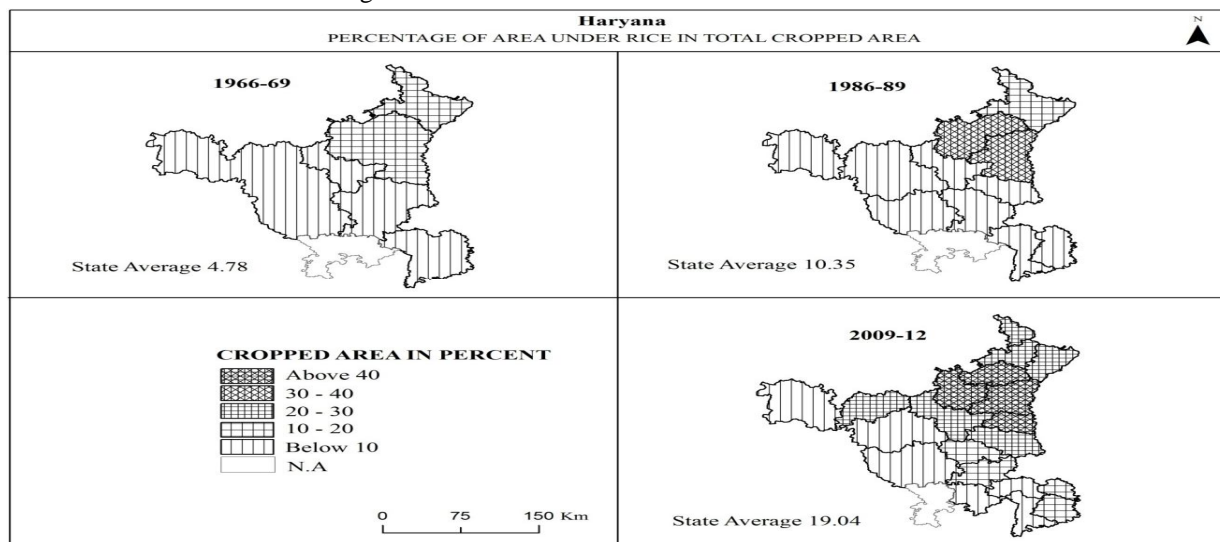


Fig. 4 Pattern of percentage of area under rice in total cropped area during the periods 1966-69, 1986-89 and 2009-12.

Further, sharp expansion in the acreage of rice has been observed over eastern and north-eastern districts of the state due to better irrigation facilities than south-western parts (Fig. 5). The south-western parts of the state have limited irrigation facilities.

The acreage of wheat has also recorded a significant increase in the state during the study period. During 1966-69, about 18 percent of total cropped area was occupied by wheat in the state (Fig. 6). Acreage of this fine cereal increased tremendously in the next two decades. It occupied 32.5 percent area in 1986-89 and about 39 percent area in 2009-12. Old Karnal, Rohtak and Ambala districts (eastern part of the state) had comparatively higher acreage under wheat in mid-1960s. By 1986-89 wheat emerged as most the dominant crop in the state. It occupied over

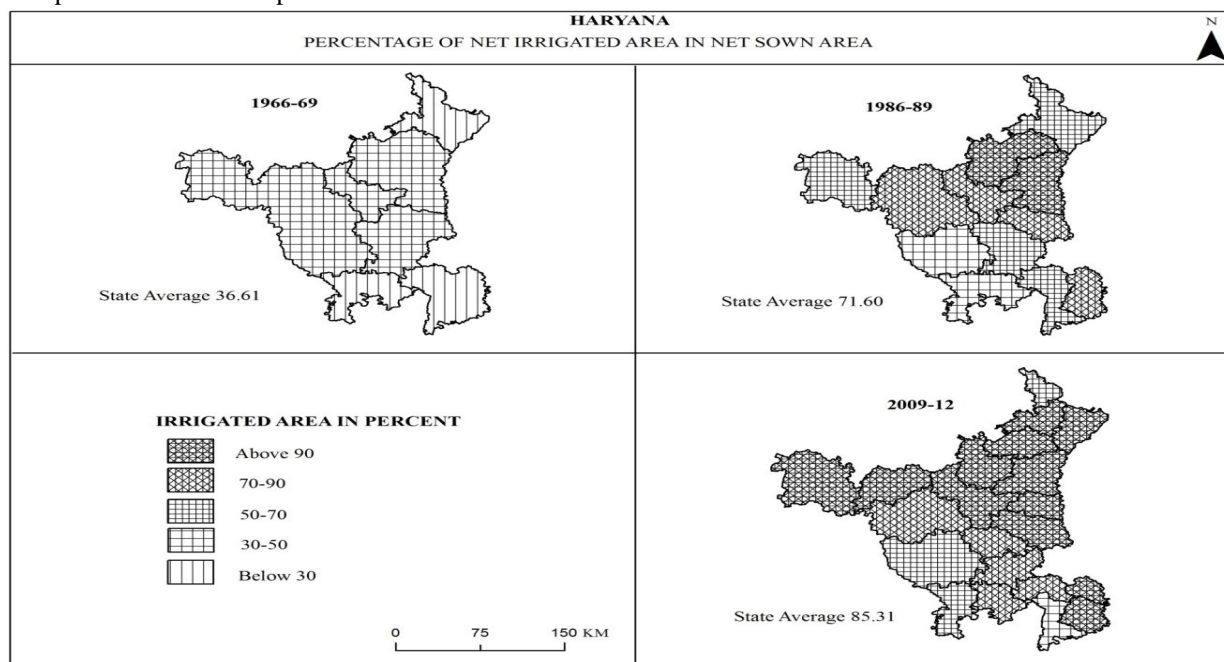


Fig. 5 Percentage of net irrigated area in net sown area during the periods 1966-69, 1986-89 and 2009-12.

35 percent of total cropped area in eastern parts of the state. But limited expansion of wheat crops in the less irrigated western and southwestern parts of the state. However, in 2009-12 spatial dominance of wheat stretched all over the state (Fig. 6). Though, in southwestern region it faced competition from rapeseed & mustard in areas with limited irrigation facilities. Therefore, it can be said that, proportion of area under rice and wheat to total cropped area has been increased attributed to the increase in area under rice and wheat due to increase in irrigation facilities. The farmers prefer the cultivation of rice and wheat on the irrigated land.

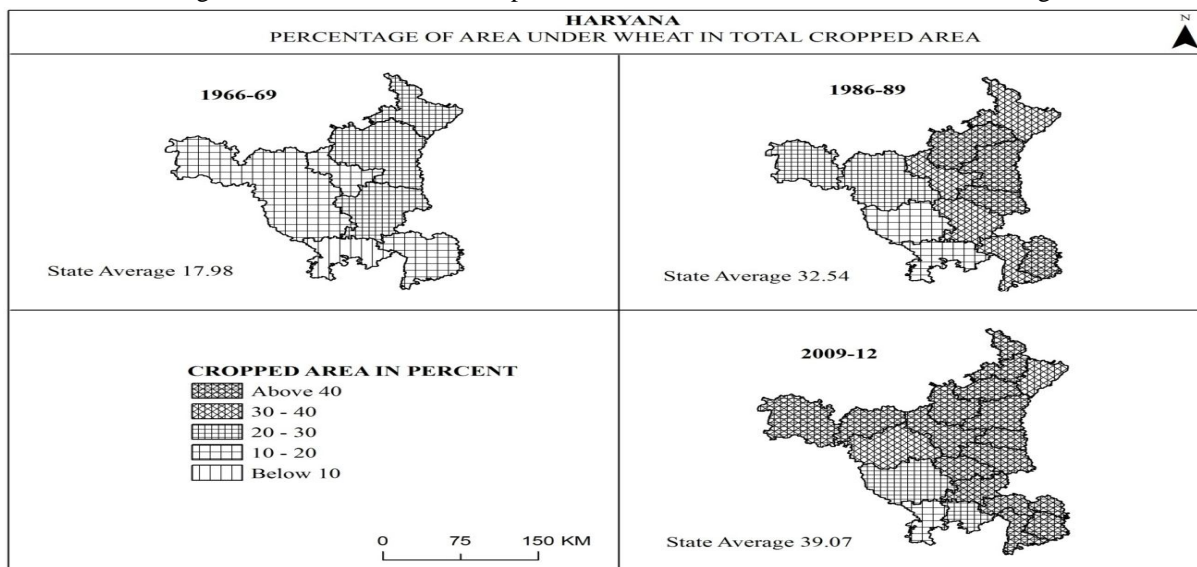


Fig. 6 Pattern of percentage of area under wheat in total cropped area during the periods 1966-69, 1986-89 and 2009-12.

C. Spatial Pattern of Rice and Wheat Yield Level

There are indications from the preceding discussion that sharp increase the acreage and production in rice and wheat cultivation in Haryana is connected to the initiation of Green Revolution and expansion of irrigation in the state. Fig. 7 and Fig. 8 shows district-wise pattern in the yield level of rice crop. There have been a drastic increase in the yield level of rice (1225 to 3014 kg per ha) over the period 1966-69 to 2009-12 (Fig. 7). During the same period, wheat yield jumped from 1622 to 4677 kg per ha (Fig. 8). It is evident that rice and wheat yield increased all over the state during the period 1966-69 to 2009-12.

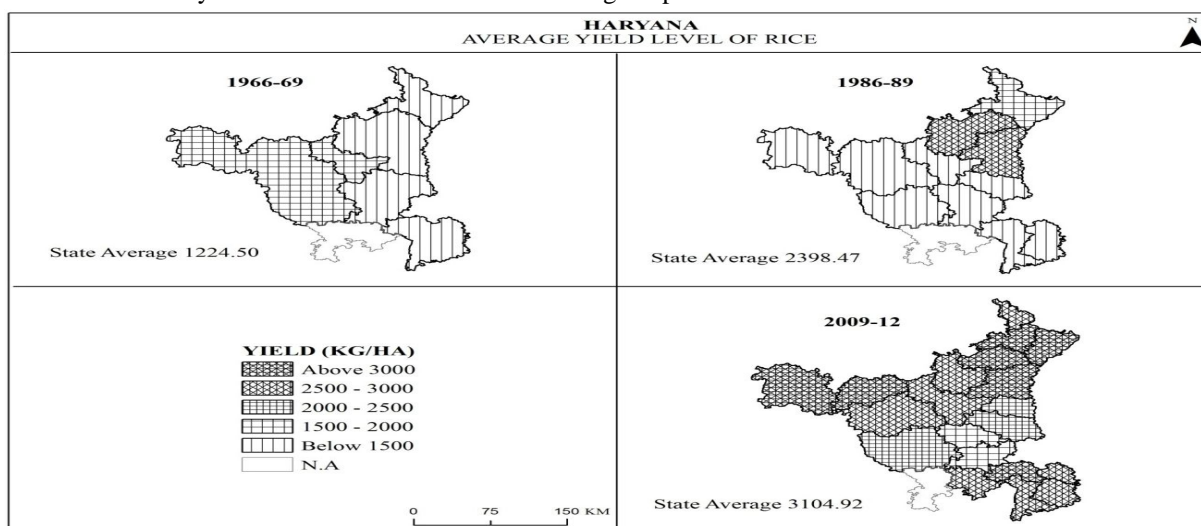


Fig. 7 Pattern of average yield level of rice in the state during the periods 1966-69, 1986-89 and 2009-12.

The wheat yield almost doubled during first two decades and it particularly picked up the momentum in the northern parts of the state. During next two decades wheat yield increased by one and half time and the trend was witnessed all over the state. Almost similar trend has been observed in case of rice yield. This agricultural transformation and rapid growth in yield level is attributed to

the release of several high yielding varieties along with, technological package, enhanced availability of improved seed, fertilizers, and better irrigation facilities.

In addition, Table 1 showed the correlation between different variables. It has been from the table that the net irrigated area is strongly associated with the area under rice and wheat and their yield level (significant at the 0.01 level).

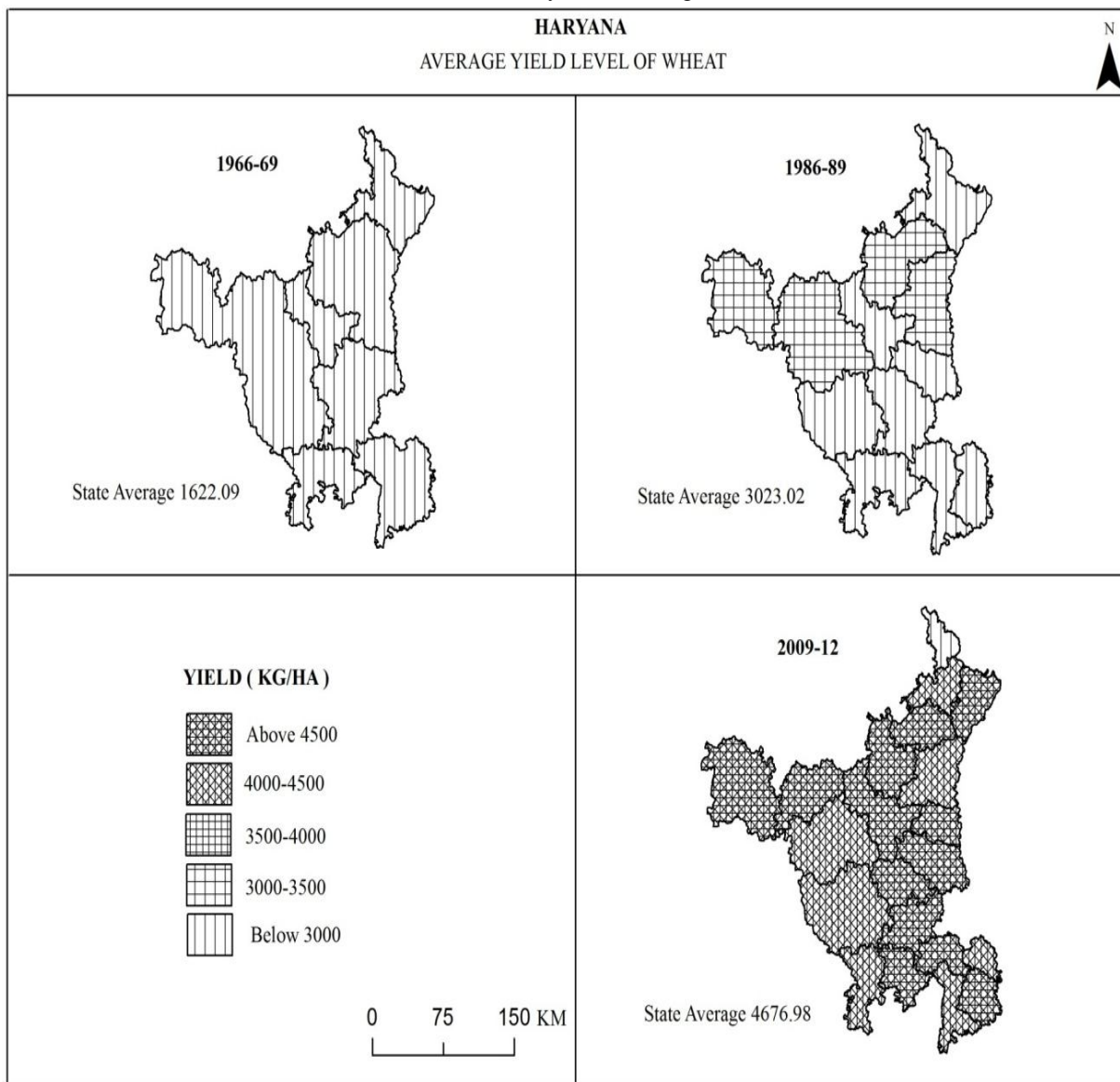


Fig. 8 Pattern of average yield level of wheat in the state during the periods 1966-69, 1986-89 and 2009-12.

Table 1. Correlation between different variables.

	Net area irrigated	Area under rice	Rice yield	Area under wheat	Wheat yield
Net area irrigated	1	.917**	.814**	.966**	.936**
Area under rice		1	.746**	.971**	.963**
Rice yield			1	.842**	.773**
Area under wheat				1	.960**
Wheat yield					1

** . Correlation is significant at the 0.01 level (2-tailed).



VI. CONCLUSIONS

The analysis has revealed a large temporal and spatial variation in area, production, and yield of rice and wheat after the green revolution. As a consequence of green revolution rice and wheat both are emerged as leading crops in Haryana. In mid 1960s wheat and rice were cultivated in some parts of the eastern Haryana. But the scenario has changed since the advent of green revolution. The area under rice and wheat has been increased with sharp increase over eastern and north-eastern parts of the state. This increase in the acreage of rice and wheat is directly attributed to the increase in irrigation facilities. The yield of rice and wheat have increased rapidly after the introduction of new agricultural technology in the mid 1960s in the form of high yielding varieties seeds, chemical fertilizers, pesticides etc. It can be concluded that the rice and wheat are two dominant crops in the state of Haryana.

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