

**ORIGINAL ARTICLE****An Analysis of Crop Concentration and Ranking of Crops in North-Western India****Sanjay Parihar**Department of Geography,
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Email: sanjai_parihar@yahoo.inReceived: 5th Feb. 2017, Revised: 28th Feb. 2017, Accepted: 8th March 2017**ABSTRACT**

Crop concentration means the variations in the density of any crop in an area or region at a given point of time. In the present research paper the crop concentration followed by the ranking of crops in north-western India is discussed. Bhatia's method is used for concentration of rice, bajra and wheat crops. The present study is an attempt to analyze the changes in crop concentration and crop ranking in the north-western India. The indices of crop concentration area calculated for two periods i.e. 1980-81 and 2010-11. There has been a significant variation in the patterns of the crop concentration in the study region. The spatial variations in the degree of crop concentration and crop ranking are the result of the different interaction such as physiographic, climatic, hydrological, socio-economic and technological factors. Crop ranking method reveals that wheat and rice are dominated crops in Punjab and Haryana; whereas Bajra and wheat enjoyed prime position in Rajasthan during the study period.

Key words: crop concentration, crop ranking, indices, variation

INTRODUCTION

Crop concentration means areal density of individual crop or crop concentration reveals the variation in the density of any crop in a given region at a point of time (Chouhan, 1987). The concentration of a crop in an area largely depends on its terrain, temperature, moisture and pedological conditions. Each crop has a maximum, minimum and optimum temperature. It has a tendency to have high concentration in the areas of ideal agro-climatic conditions and the density declines as the geographical conditions become less conducive. It is because of the suitability of agro-climatic conditions that wheat dominates in Punjab and Haryana and Bajra in Rajasthan. Knowledge of crop concentration help in ascertaining the areas where a particular crop grows well even with the help of minimum inputs and thus has a great significance for agricultural development and planning (Husain, 1996)

Ranking of crops is given as insight in the geographical reality of cropping structure. The %age of total cropped area with the aerial strength of a particular crop reveals the agricultural operation involved period of peak labors demand and the opportunities of employment to the farmer's families as well as to the labor depending on them. Ranking of crops also indicates the nature of enterprise i.e. whether the particular aerial units one of traditional subsistent or partly subsistent and partly market oriented farmers.

STUDY AREA

North-Western India is extended between 23°3' N to 32°32' N latitudes and 69°30' E to 78°17' E longitudes, comprising 72 districts of Punjab, Haryana and Rajasthan states with 4,36,813 square kilometers area which accounts for 13.29% of the total geographical area of India. The study area is inhabited by 12,16,78,329 persons (2011) which accounts for 10.05% of India's population; out of which 6,37,60,035 are males and 5,79,18,294 are females. Density of population is 279 persons per square kilometer.

OBJECTIVE

The present study is an attempt to analyze the crop concentration and ranking of crops in the north-western India.

DATA SOURCE AND METHODOLOGY

The present study is based on secondary data. The data obtained for the period of 1980-81 and 2010-11 from Statistical Abstracts of the States. To avoid the fluctuations, three years' data is averaged and used for analysis. Crop concentration data have been classified into three categories i.e. Low, Medium and High. In order to determine the district wise concentration of crops, Bhatia's method is used for the calculation of the location quotient. The following formula is used to work out the concentration of crops in the study area.

$$\text{Index of Concentration} = \frac{\frac{\text{Area of crop X in the component area unit}}{\text{Area of all crops in the component area unit}}}{\frac{\text{Area of crop X in the entire region}}{\text{Area of all crops in the entire region}}}$$

With the help of above formula, district wise concentration of rice, Bajra and Wheat crops have been calculated and have been placed all districts in three categories according to index of concentration and exhibited by maps.

For the ranking of crops, the first three leading crops in each of the districts have been arranged for 1980-81 and 2010-11 in descending order and their result have been mapped for ascertaining their relative area's strength and regional dominance

CROP CONCENTRATION

The detailed analysis of crop concentration is as follows-

RICE CONCENTRATION:

Rice is an important crop in Punjab and Haryana but it is not much important in Rajasthan. According to table 1 and map 1, in 2010-11, 20%, 40% and 75% districts of Punjab, Haryana & Rajasthan respectively made low concentration category. 30% districts of Punjab, 20% districts of Haryana and 12.5% districts of Rajasthan were in moderate concentration category whereas these percents were 50, 40 and 12.5 in high concentration category. In 1980-81, 8.3 % districts of Punjab, 58.3% district of Haryana and 65.4% districts of Rajasthan were under low concentration category. 41.7% districts of Punjab, 25% districts of Haryana and 11.5% districts of Rajasthan were under high concentration category. Moga, Patiala, Fatehgarh Sahib, Taran Taran, Amritsar, Kapurthala, Patiala, Firozpur, Sangrur, Gurdaspur, Ludhiana (Punjab), Karnal, Kurukshetra, Panipat, Kaithal, Kapurthala, Sonipat (Haryana) and Banswara, Dungarpur, Hanumangarh, Udaipur (Rajasthan) districts had high concentration of Rice crop.

Districts are having flat land; fertile soils, well developed agricultural infrastructure and developed irrigational facilities which are responsible factors for high concentration of rice crop in these districts. In western districts of Rajasthan Rugged topography, deep sub-soil water, poor irrigation facilities, presence of sandy soil, sand dunes, low rainfall are major responsible factors for minimizing area under rice. All these factors have compelled the farmers for cultivation of other remunerative crops in place of rice during Kharif season which consequently resulted into low concentration of rice cultivation.

BAJRA CONCENTRATION:

Bajra is an important crop in sandy region of the study. According to table 2 and Map 2, in 2010-11, there were 60%, 55% and 43.8% district of Punjab, Haryana and Rajasthan respectively under low concentration category; while these percents were 75, 41.7 and 50 in 1980-81. There were 25% districts of Punjab, 15% districts of Haryana and 25% districts of Rajasthan under high concentration category in 2010-11 whereas these percents were 25, 16.7 and 19.2 in 1980-81. Growing of Bajra is restricted to the drier part of the study region comprising the districts of Bhatinda, part of Firozpur, Faridkot and part of Sangrur (Punjab), Bhiwani, Mahendragarh, Rewari (Haryana) and Barmer, Jodhpur, Bikaner, Jalore, Churu, Nagaur, Jhunjhunu, Sikar (Rajasthan) districts have high concentration of Bajra.

Table 1: Rice Concentration

Category	Value	1980-81						2010-11					
		Punjab		Haryana		Rajasthan		Punjab		Haryana		Rajasthan	
		1	2	1	2	1	2	1	2	1	2		
Low	<0.58	1	8.3	7	58.3	15	57.7	1	5.0	8	40.0	24	75.0
Medium	0.58-1.16	6	50.0	2	16.7	5	19.2	7	35.0	4	20.0	4	12.5
High	>1.16	5	41.7	3	25.0	4	15.4	12	60.0	8	40.0	4	12.5
Total		12	100.0	12	100.0	26	100.0	20	100.0	20	100.0	32	100.0

Note:

1. Number of Districts
2. Percents to Total Districts

Source: Computed

Map 1: Spatial Districtwise Distribution of Index of Rice Concentration

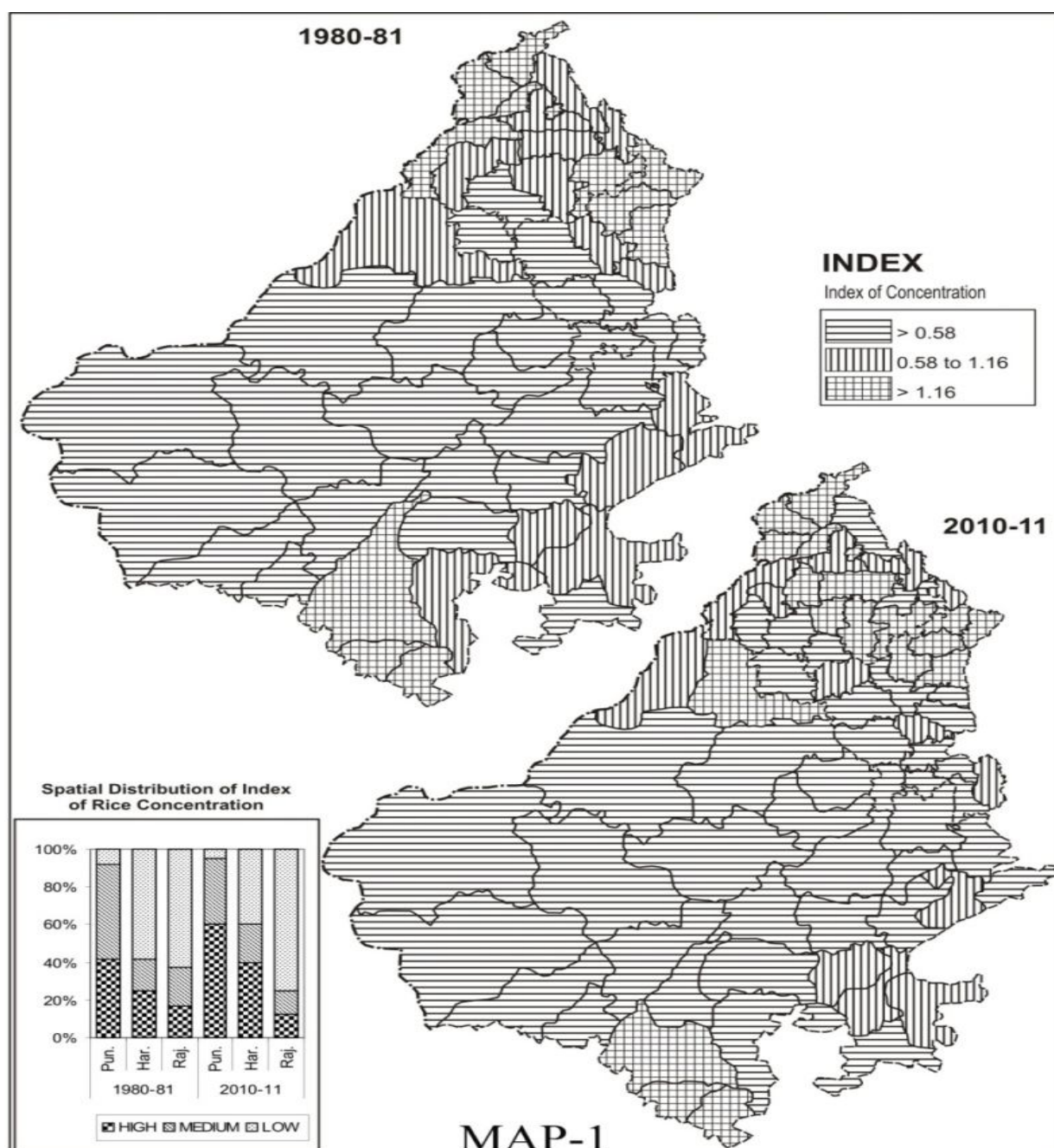


Table 2: Bajra Concentration

Category	Value	1980-81						2010-11					
		Punjab		Haryana		Rajasthan		Punjab		Haryana		Rajasthan	
		1	2	1	2	1	2	1	2	1	2	1	2
Low	<15%	5	41.67	9	75.00	25	96.15	0	0.00	10	50.00	31	96.88
Medium	15-30%	4	33.33	1	8.33	1	3.85	8	40.00	5	25.00	1	3.13
High	>30%	3	25.00	2	16.67	0	0.00	12	60.00	5	25.00	0	0.00
Total		12	100.0	12	100.0	26	100.0	20	100.0	20	100.0	32	100.0

Note:

1. Number of Districts
2. Percents to Total Districts

Source: Computed

Map 2: Spatial Districtwise Distribution of Index of Bajra Concentration

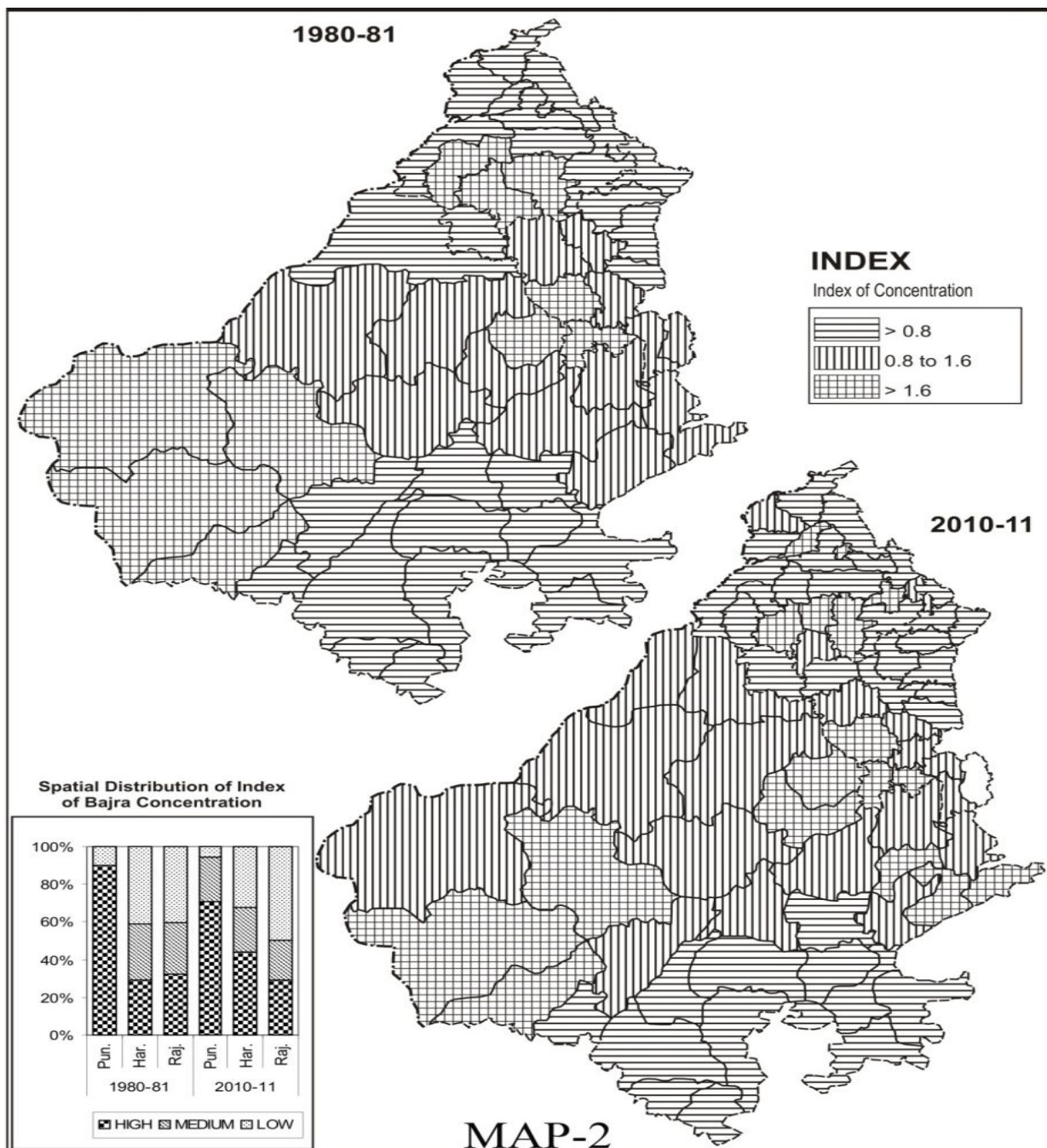


Table 3: Wheat Concentration

Category	Value	1980-81						2010-11					
		Punjab		Haryana		Rajasthan		Punjab		Haryana		Rajasthan	
		1	2	1	2	1	2	1	2	1	2	1	2
Low	<0.51	0	.0	1	8.3	7	26.9	0	.0	1	5.0	8	25.0
Medium	0.51-1.02	5	41.7	2	16.7	7	26.9	4	20.0	5	25.0	8	25.0
High	>1.02	7	58.3	9	75.0	12	46.2	16	80.0	14	70.0	16	50.0
Total		12	100.0	12	100.0	26	100.0	20	100.0	20	100.0	32	100.0

Note:

1. Number of Districts
2. Percents to Total Districts

Source: Computed

Map 3: Spatial Districtwise Distribution of Index of Wheat Concentration

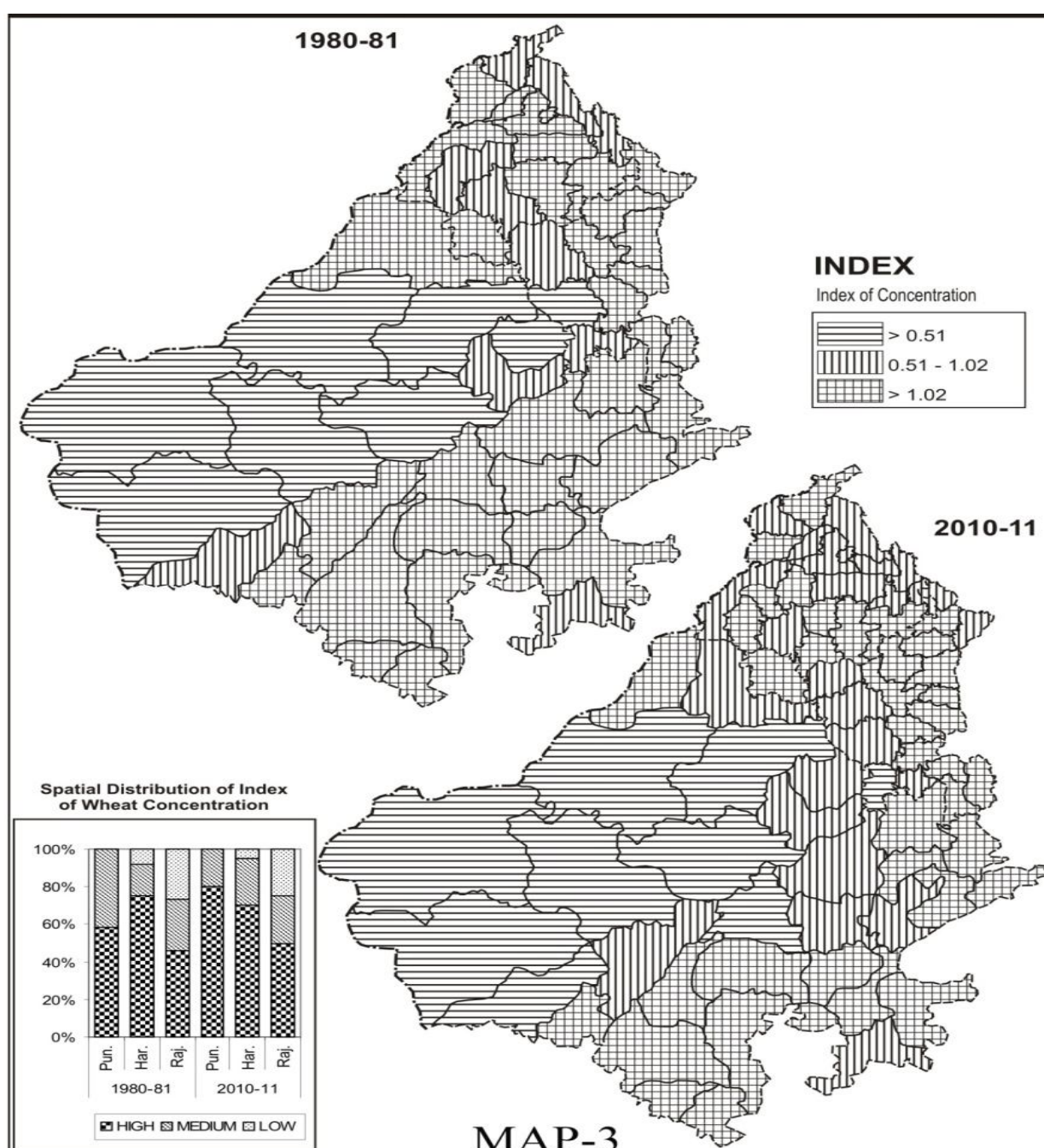


Table 4: Ranking of Crops in Punjab

Crops	First Ranking		Second Ranking		Third Ranking	
	1980-81	2010-11	1980-81	2010-11	1980-81	2010-11
Wheat	12	19	0	1	0	0
Rice	0	1	8	15	3	4
Maize	0	0	2	1	3	3
Cotton American	0	0	2	3	3	5
Sugarcane	0	0	0	0	1	3
Groundnut	0	0	0	0	1	0
Rape & Mustard	0	0	0	0	1	0
Potato	0	0	0	0	0	5

Source: Computed

Map 4: Spatial Districtwise Distribution of First Ranking Crops

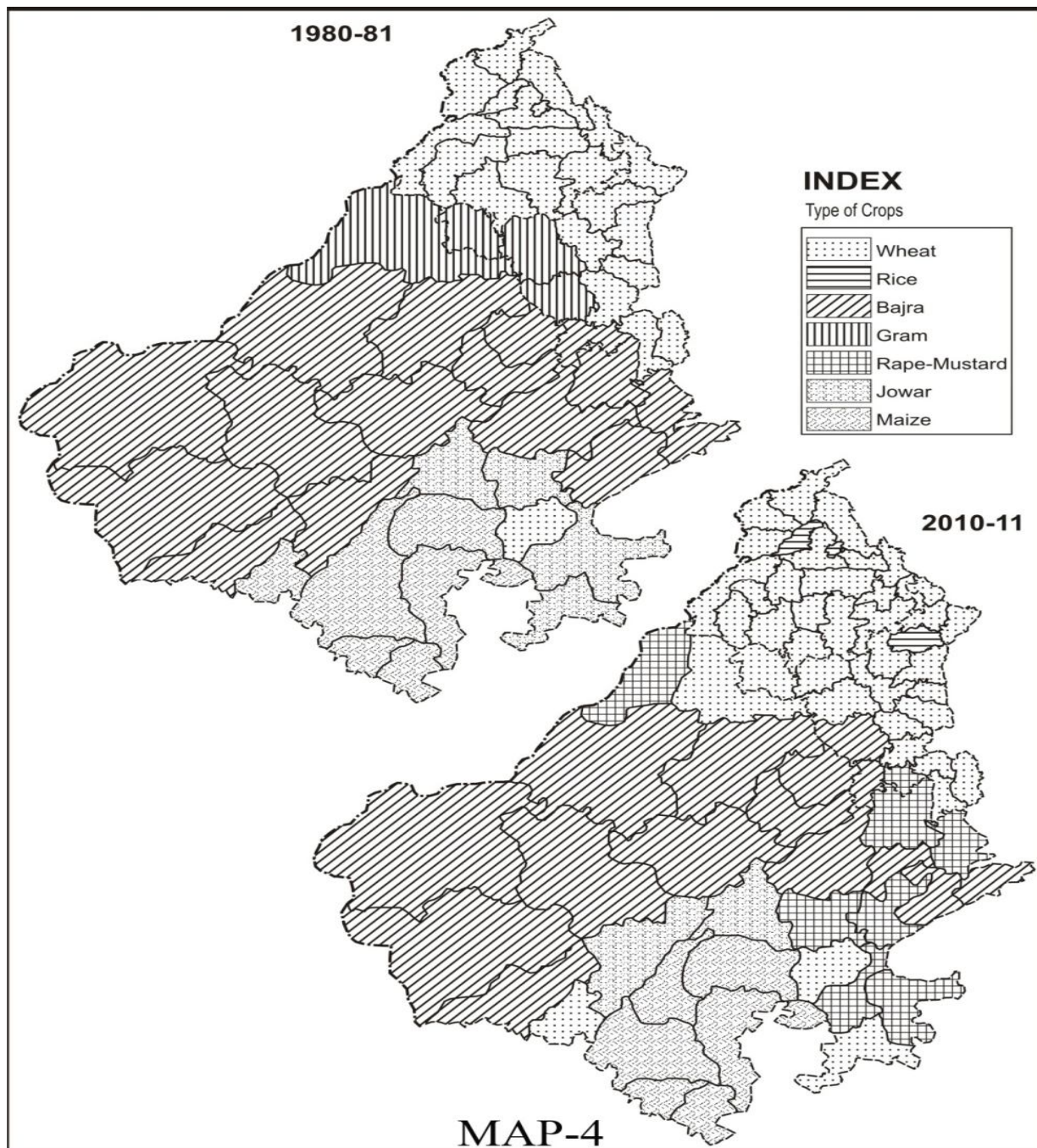


Table 5: Ranking of Crops in Haryana

Crops	First Ranking		Second Ranking		Third Ranking	
	1980-81	2010-11	1980-81	2010-11	1980-81	2010-11
Wheat	8	16	3	2	1	2
Gram	2	0	1	0	3	0
Bajra	2	2	5	2	0	6
Rice	0	1	3	9	0	3
Rape & Mustard	0	1	0	3	0	2
Cotton American	0	0	0	3	2	0
Maize	0	0	0	1	1	0
Barley	0	0	0	0	2	0
Sugarcane	0	0	0	0	2	5

Source: Computed

Map 5: Spatial Districtwise Distribution of Second Ranking Crops

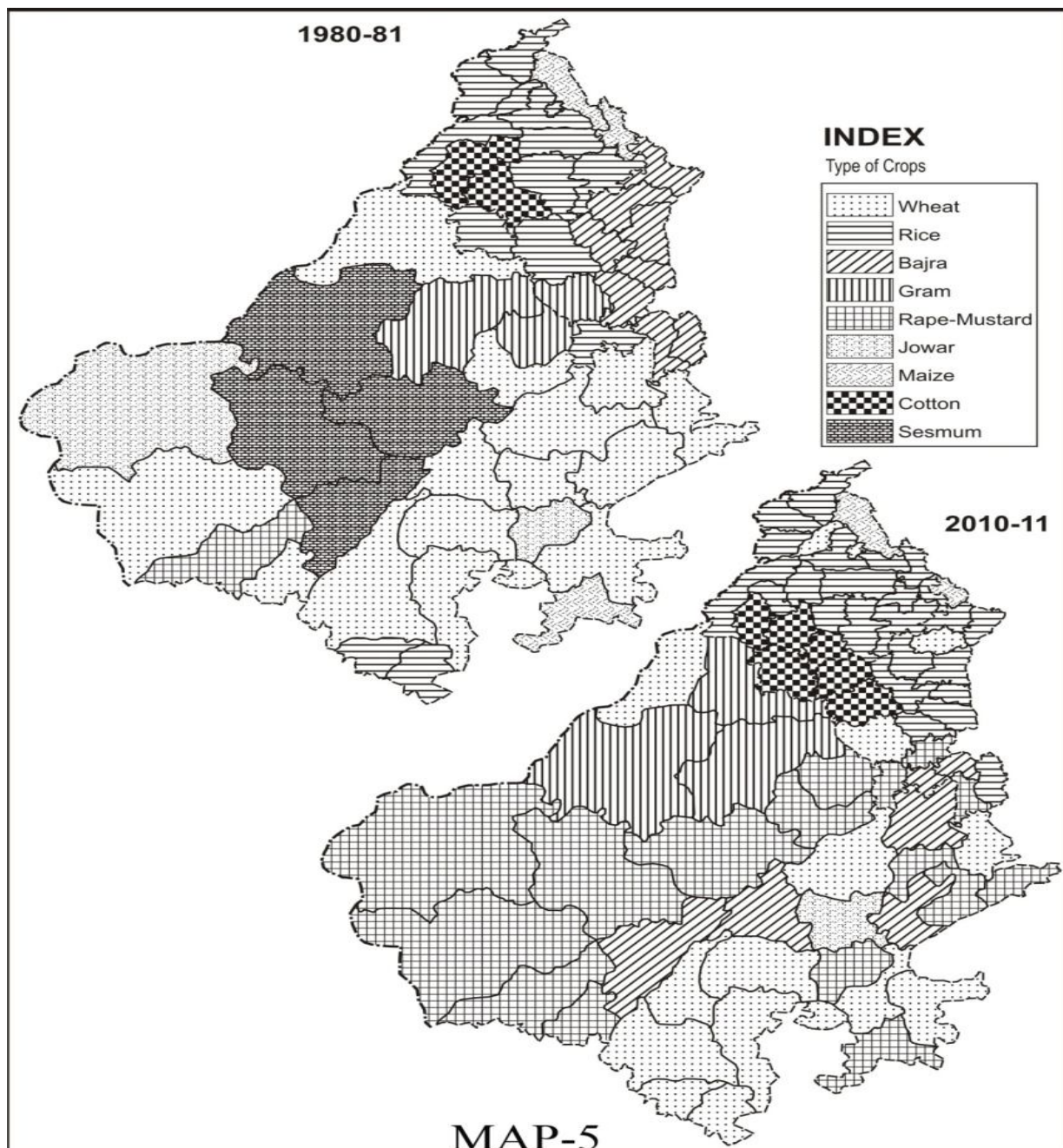
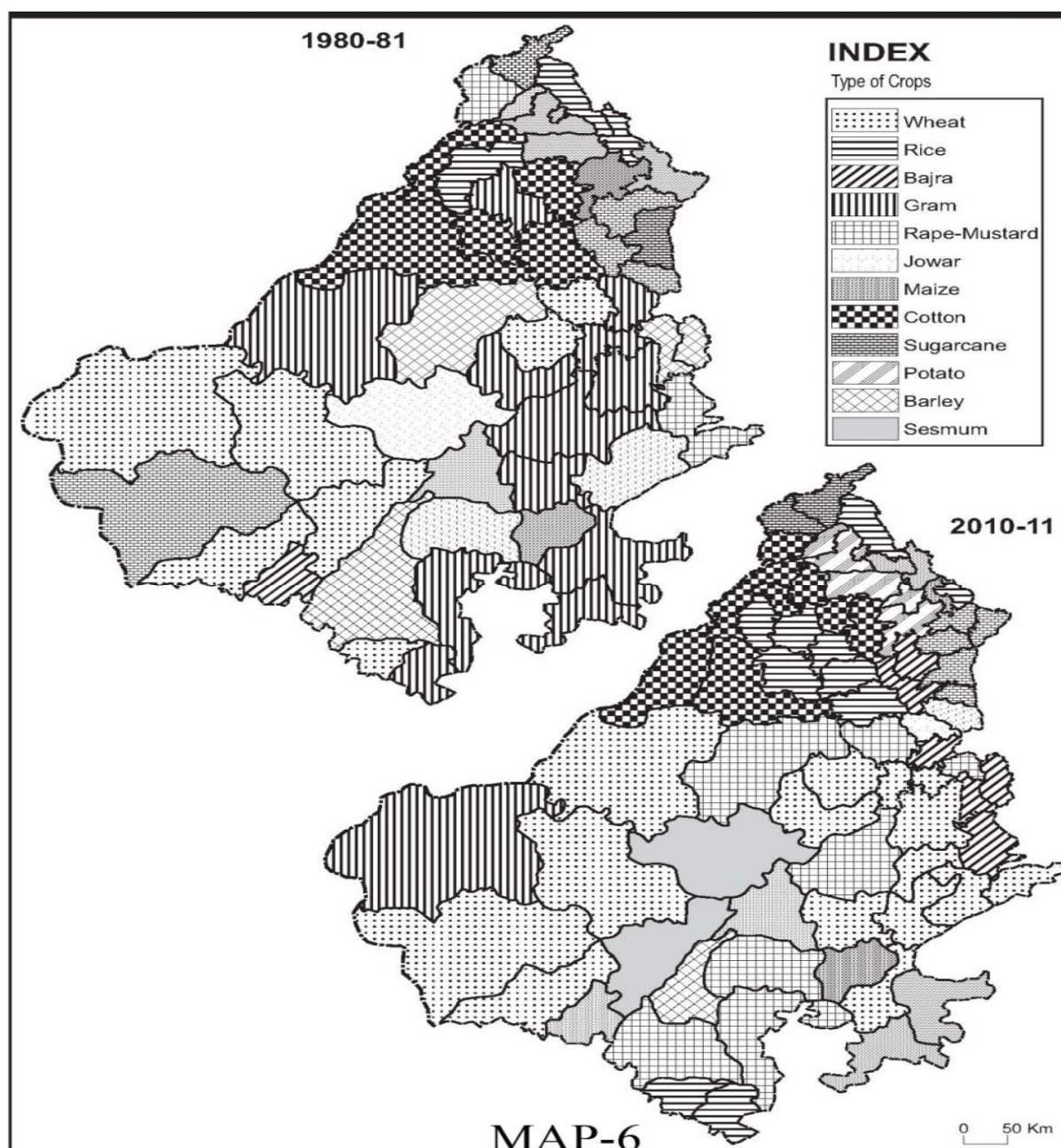


Table 6: Ranking of Crops in Rajasthan

Crops	First Ranking		Second Ranking		Third Ranking	
	1980-81	2010-11	1980-81	2010-11	1980-81	2010-11
Bajra	14	13	0	4	1	1
Jowar	4	2	2	1	3	1
Maize	6	6	1	0	2	6
Wheat	1	4	14	11	5	11
Gram	1	0	2	3	9	1
Rape & Mustard	0	7	1	13	2	5
Rice	0	0	2	0	0	2
Sesamum	0	0	4	0	0	2
Barley	0	0	0	0	3	1
Cotton	0	0	0	0	1	2

Source: Computed

Map 6: Spatial Districtwise Distribution of Third Ranking Crops



These districts had larger area under Bajra crop because of suitable climatic conditions for its cultivation. Here annual rainfall is less than 20 cm which is ideal for its cultivation. Arid type of climate is found in these districts which is best suited to Bajra cultivation. The high share of Bajra in these districts is because of sandy soils, irregular topography with structural hills of Aravallis. The physical environment of these districts is not suitable for other Kharif crops like rice, maize, etc. Due to all these factors, Bajra is dominant crop in these districts. While districts which have well developed irrigation facilities well developed agricultural infrastructure, fertile soils, etc. promote the cultivation of rice, oilseeds, pulses and cotton cultivation in Kharif season which minimize the concentration of Bajra.

WHEAT CONCENTRATION:

Wheat is the most important crop in Punjab & Haryana it is also an important crop of Rajasthan. In 2010-11, 5% and 25% districts of Haryana & Rajasthan respectively made low concentration category. 60% districts of Punjab, 25% districts of Haryana and 25% districts of Rajasthan were in moderate category while these percents were 40, 70 and 50 in high concentration category. In 1980-81, 8.3% district of Haryana and 26.9% districts of Rajasthan were under low concentration category. 58.3% districts of Punjab, 66.7% districts of Haryana and 61.5% districts of Rajasthan were under high concentration category according to table 3 and map 3.

Almost the entire state (except the arid part) of Punjab-Haryana; eastern and northern district of Rajasthan had high to moderate concentration of wheat and rice crops as these areas are having developed agricultural infrastructure, developed irrigational facilities, fertile soil, high yielding varieties of seeds and the adoption of the advance farm technology by farmers. While arid and hilly districts had low concentration of wheat cultivation due to rough topography, inadequate irrigational facilities, less developed agricultural infrastructure, popularity of oilseeds and pulses in such prevailing conditions etc. Topography of these areas is rugged and undulated which is not highly suitable for its cultivation. Moreover, these districts have sandy, loamy sand type of soils which is also major reason of low wheat and rice concentration in these areas. Due to all these factors farmers prefer to grow pulses, oil seeds, in place of wheat and rice.

RANKING OF CROPS

Table 4, 5, 6 and Map 4, 5, 6 are showing ranking of crops in Punjab, Haryana and Rajasthan respectively which were further described.

THE FIRST RANKING CROPS:

Punjab- The first ranking crop in the state was wheat in 1980-81 where as rice entered this rank in 2010-11. In 1980-81 all 12 districts of Punjab had wheat as first ranking crop. In 2010-11, 19 districts out of 20 districts had wheat as first ranking crop and only one district had Rice as first ranking crop. Wheat is enjoying first rank, which shows the suitable of physical and socio-economic conditions for its cultivation.

Haryana- Wheat was first ranking crop in 8 districts in 1980-81 and 16 districts in 2010-11. Gram and Bajra occupied first rank crop in 2-2 districts in 1980-81. Rice and Rape & Mustard also entered in this category and stood as first rank crop in one-one districts.

Rajasthan- The first ranking crops in the states included Bajra, Jowar, Maize, Wheat and Gram in 1980-81. Rape & Mustard also entered in this category in 2010-11. Among these crops, Bajra was most important crop. The next crop was Maize in 6-6 districts in both point of time. Rape & Mustard gain important place in 2010-11 where it had stood as first rank crop in 4 districts. The table 4 shows that wheat and Rape & Mustard crop had significant increment over the period of time.

THE SECOND RANKING CROPS:

Punjab- Wheat, Rice, Maize and cotton American crops stood as second rank crop during study period. Rice was dominant crop in both point of time and more than 65% districts had rice as second ranking crop. Other important crop was cotton American.

Haryana- Among the second ranking crops Bajra, Wheat, Rice and gram were important in 1980-81. Rape & Mustard, Cotton American and maize also entered in this category while gram excluded from this category. Bajra was the most important crop in 1980-81 followed by wheat and Rice. Gram was second ranked crop in only one district. In 2010-11, Rice gained the most important second ranked crop and extended to nine districts of the state. Area under Bajra cultivation decreased during the study period.

Rajasthan- Wheat, Sesamum, Jowar, Gram Rice, R & P and Maize were second ranked crop in 1980-81. Among these crops wheat was the most important crop and extends to about 50% districts of Rajasthan. Over the period of time Rape & Mustard gained important place and extended to 13 districts of Rajasthan. Wheat was another important crop after Rape & Mustard in 2010-11.

THE THIRD RANKING CROPS:

Punjab- Rice, maize, cotton American, Sugarcane, groundnut and Rape & Mustard were under third Ranking crops in 1980-81. Rape & Mustard and groundnut excluded and potato entered in this category in 2010-11. Cotton American and Potato were most important crops Maize and Sugarcane were important crop.

Haryana- Gram, Cotton American, barley, Sugarcane, Wheat, Maize and Jowar were third ranking Crops in 1980-81. Over the time period Bajra and Sugarcane became more important crop followed by Rice, Wheat, Rape & Mustard and Jowar.

Rajasthan- Gram (9 Districts) and wheat (5 districts) were the most important third ranking crop in 1980-81. Other third ranking crops were Jowar, Barley, Maize, R&P, Bajra and Cotton. In 2010-11, Wheat increased and extended to 11 districts of the state. Maize, Rape and Mustard were other important third ranked crops. Rice and Sesamum also entered in this category in 2010-11.

CONCLUSION

Crop concentration method shows that wheat and rice crops had high to moderate concentration in Punjab-Haryana; eastern and northern districts of Rajasthan as having developed agricultural infrastructure, developed irrigational facilities, fertile soil, high yielding varieties of seeds and the adoption of the advance farm technology by farmers; while arid and hilly districts of study area had high to moderate concentration of Bajra, pulses and oilseeds.

Ranking method reveals that wheat enjoyed first rank in Punjab and Haryana; whereas Bajra had first rank in Rajasthan during the study period. Rice occupied second rank in Punjab and Haryana while wheat occupied this rank in Rajasthan. Third rank crops were cotton, potato and sugarcane in Punjab; Bajra and sugarcane in Haryana; maize and rapeseed-mustard in Rajasthan.

Most of the district of Punjab and Haryana are having flat land; fertile soils, well developed agricultural infrastructure and developed irrigational facilities which are responsible factors for high proportion of wheat and rice crops. Western sandy part of Rajasthan enjoys Bajra as dominant crop due to favorable condition for Bajra cultivation. The changes in agriculture infrastructure, HYVs of seeds etc. have positive bearing on wheat and rice cultivation. The invasion of Rice in Maize dominant area, rice has captured average from maize cultivation because of the higher economic in case of farmer. As a result of increase in irrigational facilities, Bajra cultivation is losing area under its cultivation.

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