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Research Article

AN ANALYSIS OF CROPPING PATTERN IN NORTH-WESTERN INDIA

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ABSTRACT

Cropping pattern is the proportion of area under various crops at a point of time. The cropping pattern of any region is decided by and large, by a number of soils and climatic parameters as well as socio-economic factors that determine overall agro-ecological setting for cultivation of a crop or set of crops for cultivation. The evolving cropping pattern has been the net outcome of physio-cultural factors. The north western India has highly varied relief and climatic conditions which resulted in different cropping pattern. The present study has been undertaken in Punjab, Haryana and Rajasthan states of north-western India and the data have been collected at district level to analyze the cropping pattern. The research reveals that the food grain crops specially cereals were dominant crops in the study area. Wheat crop ranks first in overall cropping pattern in Punjab and Haryana; while Bajra ranks first in Rajasthan state. It is also observed that number of crops has been decreased during the study period which shows that agriculture is going to be more specialized from diversified.

INTRODUCTION

Cropping pattern refers to the proportionate area under different crops during an agricultural year. It means the series of crops at a point of time. Cropping pattern must ensure the greatest efficiency of man, fertilizers, irrigation and other inputs. It is dynamic concept as no cropping pattern can be suitable for all times to come. A successful cropping pattern implies the most efficient use of arable land, consequent upon application of water resources, bio-chemical inputs and the like. In addition, it must offer the cultivators the possibility to maximize agricultural productivity per unit area per unit of time. A cropping pattern is determined by the interaction of physical and socio-economic factors over a period of time. No cropping pattern can be good for all times to come. But there is often a tendency for the cropping pattern to stabilize over a period of time in different agro-climatically homogeneous farming area (Singh and Sharma, 1985).

STUDY AREA AND OBJECTIVE

This research work has been done on three states in north-western India. These states are Punjab, Haryana and Rajasthan. 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 with 436813 square kilometers area which accounts for 13.29 percents of the total geographical area of India. The study area is inhabited by 12,16,78,329 persons (2011) which accounts for 10.05 percents of India's population; out which 6,37,60,035 are males and 5,79,18,294 are females. Density of population is 279 persons per square kilometer. The main objectives of the present study are to analyze and present the cropping pattern in the north-western India for the years 1980-81 to 2010-11.

DATA SOURCE AND METHODOLOGY

The present research is based on secondary data collected from Directorate of Economics and Statistics of Punjab, Haryana and Rajasthan ranging between years 1980 to 2011 at district level as district was the study unit. The cropping pattern has been obtained by calculating the percents of each crop to total cropped area and arranged in low, medium and high categories. The detail analysis is as follow-

Kharif Crops

The Kharif season starts in June when the south-west monsoon starts. Seeds are sown in June and July and crops are harvested in September and October. Crops which require large quantities of water are cultivated during this season. The main kharif crops are Rice, Jowar, Bajra, Maize, Groundnut, Cotton, Sugarcane etc.

Rice

In Hindi it is called as 'Dhan' and 'Chawal', one of the three most important crops in the world, forms the staple diet of half the world's population. Map 1 shows spatial district wise distribution of rice in north-western India.

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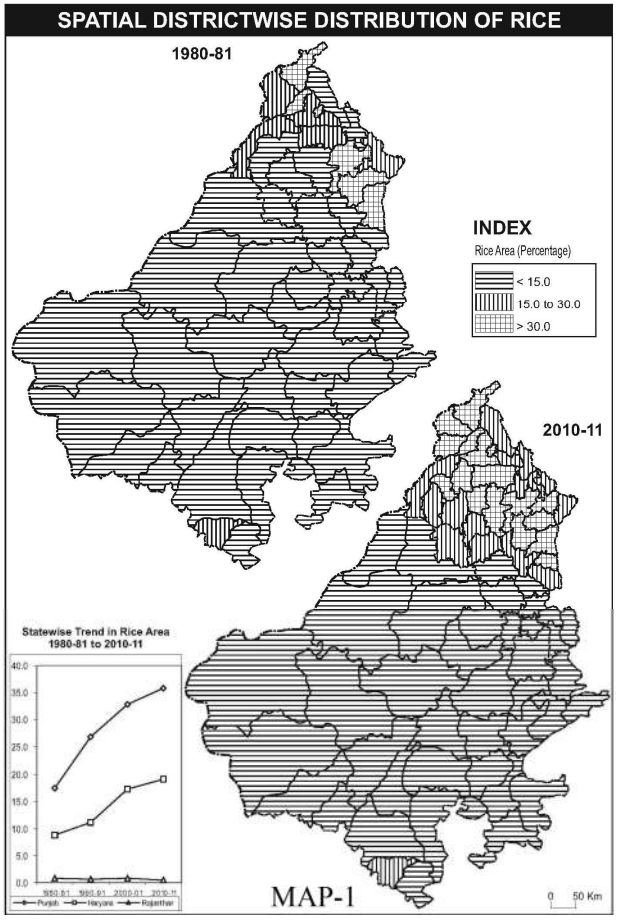


Punjab*:* Rice is the most important Kharif crop from area, yield and production point of view in the state. Rice is the second largest crop of Punjab. Rice occupied 17.48 percent of the total cropped area in 1980-81, increased to over 33.15 percent in 2007-08 and then rose further to around 35.88 percent in 2010-11. Rice has been obtained its area by shifting the area from maize, groundnut, millets and cotton. For the Punjab as a whole, the area under rice was 1182 thousand hectares in 1980-81 and it increased to 2826 thousand hectares in the year 2010-11. The highest percent area under rice was recorded in Kapurthala (31.79%) district in 1980-81, followed by Gurdaspur (31.55%) district. But in 2010-11, the highest percent area was recorded in Moga (44.75%) district followed by Patiala (44.15%) and Taran Taran (43.22%) districts. The lowest percent area was recorded in Bhatinda (1.34%) district in 1980-81. In 2010-11 lowest percent area was recorded in Bhatinda (16.21%) district. There were 25 percent districts under high category in 1980-81, which increased to 60 percent in 2010-11. There was no district under low category in 2010-11 which was 41.7 percent in 1980-81. Moga, Patiala, Fatehgarh Sahib, Taran Taran, Amritsar, Kapurthala, Patiala, Firozpur, Sangrur, Gurdaspur & Ludhiana districts are important in rice cultivation.

Haryana-Rice is the second largest crop of Haryana. It occupied 8.86 percent of total cropped area in 1980-81 which increased to 19.10 percent of total cropped area in 2010-11. The area under rice cultivation was 484 thousand hectares in 1980-81 which increased to 1243.3 thousand hectares in 2010-11. Largest percent area under rice was in Kurukshetra (32.73%) district followed by Karnal (30.50%) and Ambala (17.28%) in 1980-81. In 2010-11, Karnal (42.41%) occupied first position, second was Kurukshetra (41.97%) and Panipat (38.76%) occupied third position. Lowest percent area was registered in Mahendragarh followed by Rewari (0.61%) and Bhiwani (2.18%). There were 75 percents districts under low category in 1980-81 which decreased to 50 percent in 2010-11. Percents under high category increased from 16.7 to 25 during the study period. In Haryana major rice growing districts are Karnal, Kurukshetra, Panipat, Kaithal, Kapurthala and Sonipat. However its cultivation has been extended to Hisar, Jind, Sirsa, Fatehabad and Faridabad also.

Rajasthan-In Ganganagar and Hanumangarh Rice is 100 percent irrigated and in Banswara, Dungarpur and Udaipur, it is rain fed. Rice occupied only 0.81 percent of total cropped area in 1980-81 which decreased to 0.58 percent of total cropped area in 2010-11. In 1980-81, rice occupied 140 thousand hectares area of the state. In 2010-11, there was not much significant change in area under rice cultivation. It slightly increased and extended to 150.7 thousand hectares. The highest percent area was recorded in Dungarpur at the both point of time. The lowest percent area was recorded in western districts of Rajasthan. Banswara, Dungarpur and Udaipur districts had largest area under rice cultivation. Total Area, under this crop experienced many fluctuations over the period of time. Rajasthan has not show any considerable change. The category wise percents were almost same at both the study point.

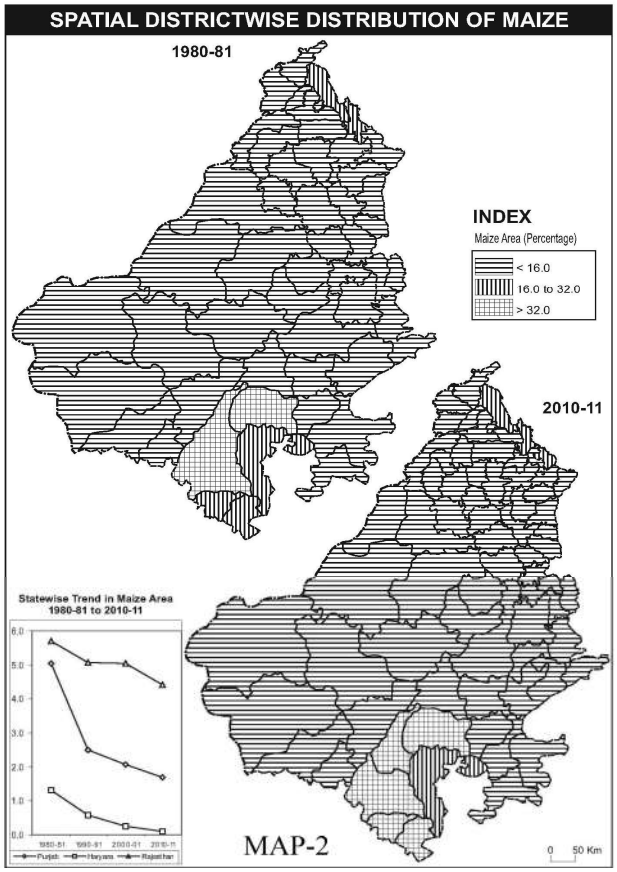
Districts are having flat land; fertile soils, well developed agricultural infrastructure and developed irrigational facilities which are responsible factors for high proportion of rice crop in these districts. Rugged topography, deep sub-soil water, poor irrigation facilities, presence of sandy soil, 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 proportion of rice cultivation.

Maize

In hindi, it is called as 'Makki'. Maize or corn in one of the most important cereal crops in the world agricultural economy both as food for man and feed for animals including poultry. Map 2 shows the spatial district wise distribution of Maize in north-western India.

Punjab- Maize is an important kharif crop of the state. The area under maize in the state was continuously declining over the time period. Maize is an important Kharif crop the state. The area under maize in the state was continuously declining during the study period. Maize occupied 5.03 percent of total cropped area in 1980-81 which decreased to 1.69 percent of total cropped area in 2010-11. In the year 1980-81, area under maize was 340 thousand hectares which reduced to 133 thousand hectares in 2010-11. In the year 1980-81, the percent area of maize was highest in Hoshiarpur (19.24%) followed by Rupnagar district (18.23%) and was lowest in Firozpur (0.63%) district. Same position was occurred in 2010-11. As the area under this crop had decreased over the time, the category wise percents were almost same and there was no district under high category during the study period. The crop has suffered setback during recent past due to its low yields as a result of the attack

of maize borer. Quite a sizeable area under maize has been replaced by rice. Hoshiarpur, Rupnagar, Gurdaspur, Jalandhar, Ludhiana, Patiala, Amritsar are main districts in maize cultivation.



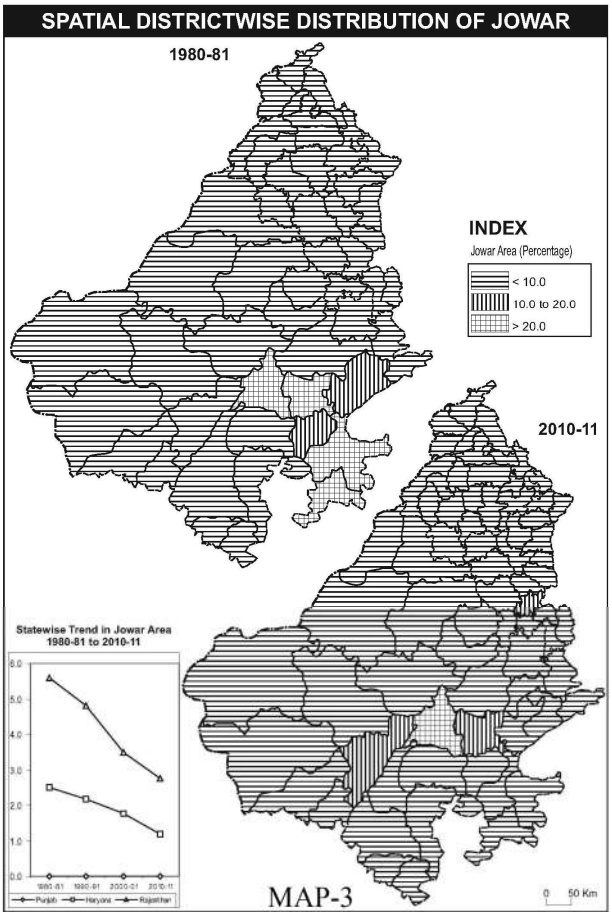
Haryana- Maize is not much important crop in Haryana. The area under maize in Haryana was continuously declining from 1980-81 to 2010-11. Maize occupied 1.31 percent of total cropped area in 1980-81 which decreased to 0.1 percent of total cropped area in 2010-11. The area under maize cultivation was 71.3 thousand hectares in 1980-81. Over the time period it reduced to 9.6 thousand hectares in 2010-11. In 1980-81, the highest percent area was recorded in Ambala (9.51%), and lowest in Bhiwani (0.03%). In 2010-11, the highest percent area was recorded in Panchkula (16.60%) and lowest in Kaithal (0.02%). The condition of the state was almost same to Punjab and there was not much change in the percents of category during the study period. There was no district under high category during the study period. Maize is grown mainly in Panchkula, Ambala, Yamunanagar, Kapurthala and Karnal districts.

Rajasthan- Rajasthan has the largest area of maize in India i.e. 1 million hectares with production of 1.1 million tones and productivity of 1,100 kg/ha. The crop is predominantly cultivated under rain fed conditions in Kharif season. In winter, cultivation is done in assured irrigated conditions. Maize is mainly used as a food crop in the state. Area under this crop suffered from many ups and downs but it was almost constant. It occupied 5.71 percent of total cropped area in 1980-81 which decreased to 4.40 percent of total cropped area in 2010-11. Area was increased from 990 thousand hectares in 1980-81 to 1143.1 thousand hectares in 2010-11. Jaisalmer and Churu did not have area under this crop. The percent under the low category was about 80 at the both point of study time. There were 15.6 percent districts under high category in 2010-11 which were 7.7 percent in 1980-81. The maximum proportion of maize was registered in Udaipur at the both point of time. The minimum proportion of maize was registered in western districts of Rajasthan. Major area under rice cultivation is in Aravalli Region and Banas Basin, where it is about 92% of the state's maize area. Major districts are Udaipur, Rajasthan, Chittorgarh, Bhilwara, Banswara and Dungarpur.

The districts had higher proportion of maize are having hills, piedmont plain, relatively high rainfall, well drained loamy and loamy sand soil, steep gradient, and dissected topography which do not allow the water to stand in the field which is the prerequisite conditions for maize cultivation. In such conditions rice cannot be cultivated successfully. Thus in such suitable physical environment, farmers give more preference to maize cultivation then rice or bajra.

Jowar

It ranks third in the major food grain crops in India, whereas it is the fourth food grains of the world. Millions of people in Africa & Asia depend on Jowar as the staple food. Map 3 shows the spatial district wise distribution of Jowar in study area.



Punjab- Punjab state occupied negligible area under Jowar. It was 1.1 thousand hectares in 1980-81 and less than 0.1 thousand hectares in 2010-11 S.A.S. Nagar district is the main producer and other one is Mansa district. There was no district under medium and high category during the study period.

Haryana- It is an important crop in the Haryana state. The area under this crop is continuously decline over the time period. Jowar occupied 2.51 percent of total cropped area in 1980-81 which decreased to 1.2 percent of total cropped area in 2010-11. In the year 1980-81, area under Jowar in Haryana was 136.9 Thousand hectares and 78.7 thousand hectares in 2010-11. The highest percent area was recorded in Rohtak (9.87%) followed by Sonipat (7.71%) and lowest in Ambala and Sirsa (0.04%) in 1980-81. In 2010-11, highest percent area was in Jhajjar (10.21%). Major area under this crop is in Jhajjar, Rohtak, Sonipat and Mewat Districts. Almost the entire state was under low category during the study period.

Rajasthan- Jowar occupied 5.59 percent of total cropped area in 1980-81 which decreased to 2.77 percent of total cropped area in 2010-11. Area under this crop was 969 thousand hectares in 1980-81; after many ups and downs it was reached to 718.57 thousand hectares 2010-11. The highest percent area was recorded in Jhalawar (33.18%) and lowest in Churu (0.01%) in 1980-81. In 2010-11, highest percent area was in Ajmer (30.10%). The percent under high category was reduced to 3.1 from 15.4 over the study period. There were 90.6 percent districts under low category in 2010-11, which were 76.9 in 1980-81. Jowar cultivation is mainly concentrated in central part of Rajasthan, where Ajmer, Pali, Bhilwara and Rajsamand are major districts.

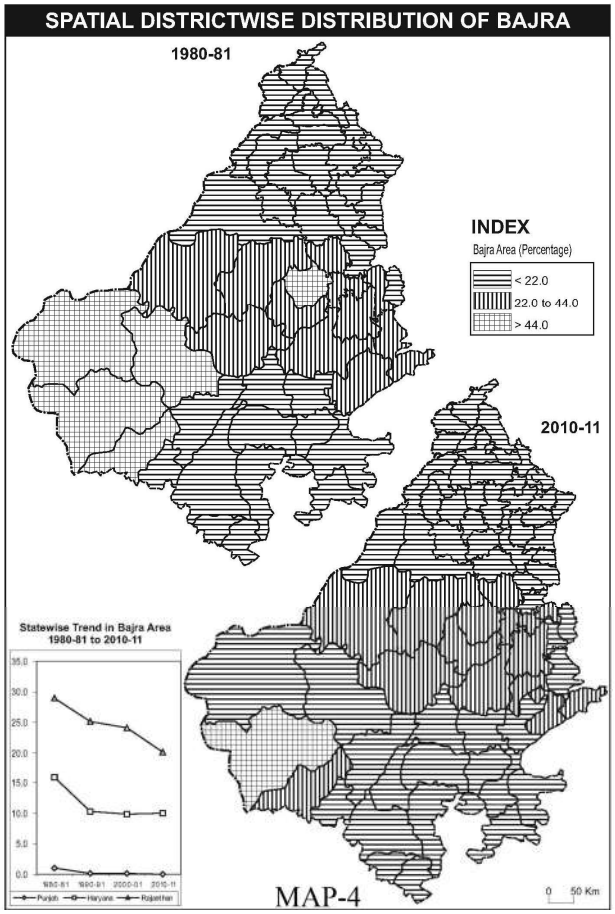
The districts had higher percent area are in dry region with low rainfall and rugged topography with lack of developed irrigation and consequently are not highly suitable for cereal crops like wheat, rice, sugarcane, maize, etc. which require frequent watering. Due to this reason, farmers prefer to grow Jowar for their domestic as well as commercial purpose which has resulted into high share of this crop to the total cropped area.

Districts having low share of Jowar are having favorable topography, well developed agricultural infrastructure, fertile soils, developed irrigation facilities etc. In these areas farmers prefer to grow wheat, rice, cotton and sugarcane crops because of their higher economic returns from these crops. Owing to these reasons, these districts are having low proportion of Jowar cultivation.

Bajra

Its other common names are Pearl millet, Indian millet, Bulrush millet, Cattail millet and pencillaria. It is the major cash grain crop of world. Map 4 shows the spatial district wise distribution of Bajra in north-western India.

Punjab- The area under Bajra in Punjab was continuously declining over the time period. Bajra occupied 1.02 percent of total cropped area in 1980-81 which decreased to 0.04 percent of total cropped area in 2010-11. The area under Bajra cultivation was 69 thousand hectares in 1980-81, which decreased to 3 thousand hectares in 2010-11. The entire state was under low category during the study period. The largest percent area was in Sangrur (2.35%) and lowest Jalandhar (0.02%) in 1980-81. There was negligible area in 2010-11. Growing of Bajra is restricted to the drier part of the state comprising the districts of Bhatinda, part of Firozpur, Faridkot and part of Sangrur.



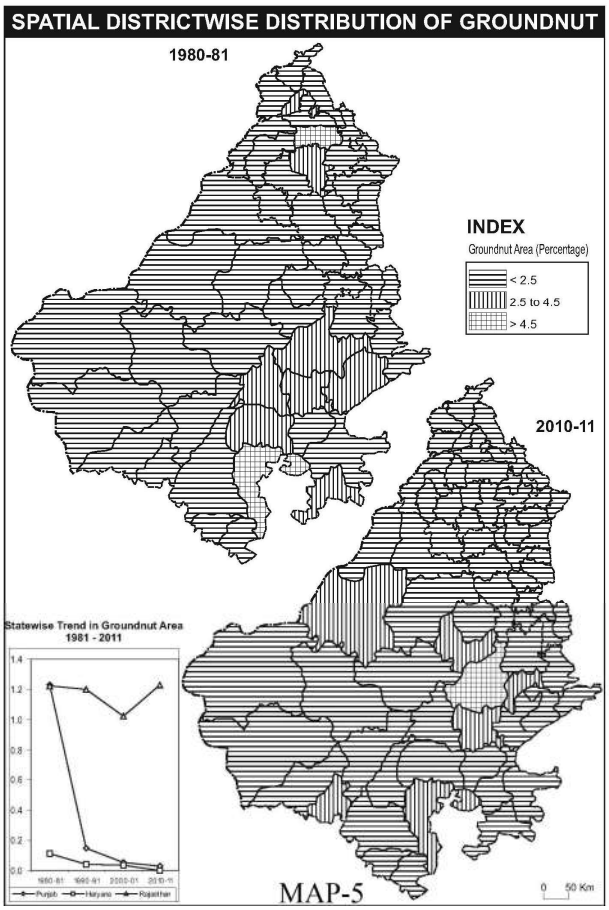
Haryana- Although the area under Bajra is continuously declining but still, it is an important crop in the state. Bajra occupied 15.93 percent of total cropped area in 1980-81 which decreased to 10.1 percent of total cropped area in 2010-11. The area under t is crop was 870.3 thousand hectares in 1980-81, which reduced to 659.6 thousand hectares in 2010-11. The maximum area concentration of Bajra cultivation was observed in Bhiwani district followed by Mahendragarh, Hisar, Gurgaon and Rewari districts. The districts under low and medium category were almost same at both point of time and there was no district under high category during the study period.

Rajasthan- Rajasthan has the highest area under Bajra with the highest production in the country. The crop is grown as a sole crop as well as mixed crop or inter cropped with legumes or sesamum in the state. It is also grown as irrigated fodder in summer. Barmer, Jodhpur, Bikaner, Jalore, Churu and Nagaur districts have more than 60% area of the state under Bajra cultivation. Area under this crop is mainly concentrated in western sandy plain of the state. Barmer district had the highest percent area under this crop during the study period. Bajra occupied 29 percent of total cropped area in 1980-81 which decreased to 20.09 percent of total cropped area in 2010-11. Total area under this crop was 5031.7 thousand hectares in 1980-81 which experienced many fluctuations and came to 5223.6 thousand hectares in 2010-11. There was only one district (Barmer) under high category in 2010-11 while in 1980-81, there were five districts under this category. Percents under low category were increased to 62.5 from 50 during the study period.

The 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 agriculture infrastructure, fertile soils, etc. promote the cultivation of rice, oilseeds, pulses and cotton cultivation in Kharif season which minimize the share of Bajra.

Groundnut

It is also called peanut or 'Mungfali'. It is a soil erosion resistant crop and being a legume crop, it can fix the atmospheric nitrogen and is useful as a rotational crop. India occupies the first place in regard to acreage and second in production. Map 5 depicts the spatial district wise distribution of Groundnut in north-western India.



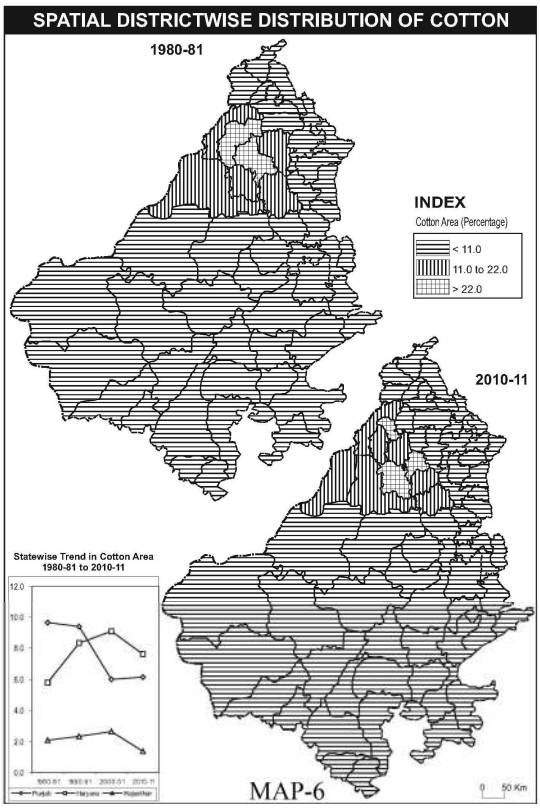
MAP-5

Punjab-It is not an important crop of the state. It is, however, sown in some areas of Sangrur, Hoshiarpur, Gurdaspur, Amritsar, Patiala and Ludhiana districts. The area under groundnut sharply came down from 83 thousand hectares in 1980-81 to 2 thousand hectares in 2010-11. Groundnut occupied 1.23 percent of total cropped area in 1980-81 which decreased to 0.03 percent of total cropped area in 2010-11. The largest percent area was recorded in Ludhiana (4.61%) in 1980-81. There were 16.7 percent and 8.3 percents districts were under medium and high category respectively in 1980-81, but in 2010-11 there was no district under these categories. The consistent declines in the area under groundnut in the state as the farmers have been diverting their area from this crop to other remunerative crop such as paddy and cotton.

Haryana- Area under groundnut cultivation in 1980-81 was 6.2 thousand hectares this was increased to 10.4 thousand hectares in 1985-86. After this the area was declined over the time period to 2.3 thousand hectares. It is sown in Hisar, Fatehabad, Sirsa, Rewari and Jhajjar districts. The entire state was under low category during the study period.

Rajasthan- It is grown in a large number of districts covering an area of 3 lakh hectares. The largest percent area was recorded in Chittorgarh (6.65%) in 1980-81 and Jaipur (5.01%) in 2010-11. In 1980-81, this crop has 212 thousand hectares area which increased to 319.04 thousand hectares in 2010-11. Groundnut occupied 1.22 percent of total cropped area in 1980-81 which slightly increased to 1.23 percent of total cropped area in 2010-11. There were 73.1 percent districts under low category in 1980-81, which increased to 78.1 percent in 2010-11. The medium category percents decreased to 18.8 from 23.1 during the study period. Major districts were Jaipur, Dausa, Chittorgarh, Sawai Madhopur and Bikaner.

The districts had higher share of groundnut cultivation are having loamy sand soil, occurrence of sand dunes, less developed agricultural infrastructure, etc. Here the climatic conditions which are hot and dry also favorable. Topographically, these areas are not homogenous but marked with rocky surface. In this type of topography rice, wheat, sugarcane, etc. crop cannot be grown successfully, but groundnut responds well.



MAP-6

Cotton

In Hindi, it is also known as 'Kapas'. It is one of the most important commercial crops. It is grown for fiber world over. Map 6 shows the spatial district wise distribution of cotton in study area.

Punjab - Cotton is the most important cash crop in the state. The share of cotton American was higher than the cotton desi. The total area under cotton American was 501.5 thousand hectares and cotton desi was 147 thousand hectares in 1980-81. Cotton occupied 9.60 percent of total cropped area in 1980-81 which decreased to 6.13 percent of total cropped area in 2010-11. The area under cotton American and cotton desi declined over the study period. The total area and production of had decreased continuously from year to years. The reason may be that due to severe attack of insect pests and variation in prices, the area and productivity of this crop has very wide fluctuations. Area of cotton American and desi moved down to 470 thousand hectares and 13 thousand hectares respectively in 2010-11. The largest percent area was recorded in Bhatinda (28.95%) in 1980-81 and Mansa (31.52%) in 2010-11. There were 66.7 percent districts under low category in 1980-81 which increased to 75 percent in 2010-11. There were two-two districts under the high category at both the point of time.

In the districts Gurdaspur, Amritsar, Nawan Shehar, Hoshiarpur, Rupnagar and Fatehgarh Sahib the area and production has declined and reached to nil level. Mansa, Bhatinda, Faridkot, Jalandhar, Firozpur and Kapurthala districts had higher proportion of area under cotton cultivation.

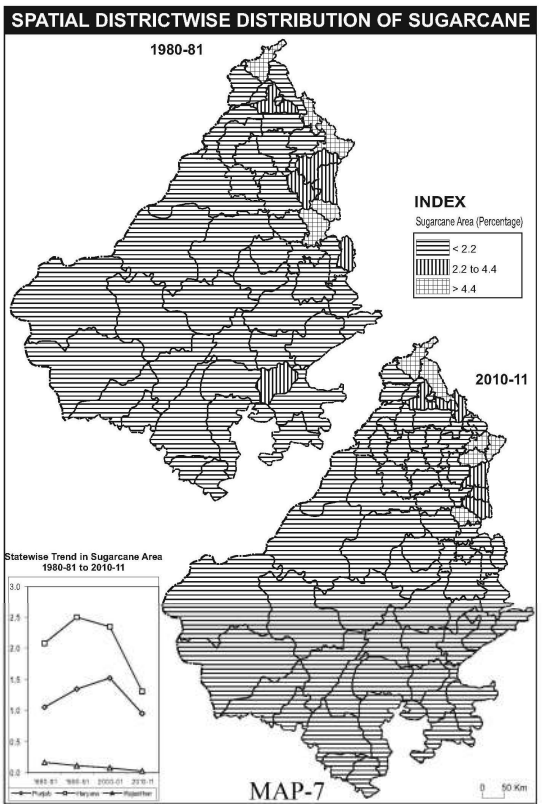
Haryana - It is very important crop in Haryana. Similar to Punjab, the share of cotton American was higher than the cotton Desi. Cotton occupied 5.79 percent of total cropped area in 1980-81 which increased to 7.6 percent of total cropped area in 2010-11. The total area of cotton American was 211.6 thousand hectares and under cotton Desi was 104.6 thousand hectares. The area under cotton American increased, whereas area under cotton Desi declined. In 2010-11 area under cotton American was 470.1 thousand hectares and cotton Desi was 23.2 thousand hectares. The highest percent area was recorded in Sirsa district during the study period. Main districts are Sirsa, Hisar, Fatehabad, Jind and Bhiwani. There was only one district (Sirsa) under high category in 2010-11.

Rajasthan - It is also called "Baniya" in rural area in Rajasthan. Cotton Desi is sown in Rajsamand, Udaipur, Chittorgarh and Jhalawar. Cotton American is sown in Ganganagar and Banswara. Cotton Malwi is sown in Baran, Kota, Bundi, Jhalawar, Banswara and Tank. More than 75% cotton area of the state is in Ganganagar and Hanumangarh. Remaining 25% cotton area is in Rajsamand, Udaipur, Sirohi, Bhilwara, Chittorgarh, Ajmer, Jhalawar and Banswara districts. Cotton occupied 2.06 percent of total cropped area in 1980-81 which decreased to 1.38 percent of total cropped area in 2010-11. In 1980-81, total area under this crop was 357 thousand hectares and 360.37 thousand hectares in 2010-11. The area under this crop was not constant during study period. The highest percent area was registered in Ganganagar at the both point of time. There was no district under high category at the both point of time.

The districts which had higher area under cotton crop have many favorable factors. The vital and determining factor in cotton cultivation in these districts is climate. Here the rainfall is low and temperature is high during its growing period and warm dry weather at the time of picking which are the favorable factors for its cultivation. Thus physical and non-physical factors are not highly suitable for other Kharif cereal crop such as rice, maize etc. Owing to these reasons, these districts are having high proportion of cotton cultivation.

Sugarcane

It is known as 'Ganna' in hindi. It is one of the most efficient photo synthesizers in the plant kingdom. Map 7 shows the spatial district wise distribution of sugarcane in north-western India.



Punjab- Among the cash crops, sugarcane was the most important cash crop cultivated in the state. The area under sugarcane cultivation in Punjab showed many ups and downs. Sugarcane occupied 1.05 percent of total cropped area in 1980-81 which decreased to 0.95 percent of total cropped area in 2010-11. As in year 1980-81, area under sugarcane was 71 thousand hectare. Gradually it increased and reached to 154 thousand hectares in 2002-03. After this there was a sharp decrease to 75 thousand hectares 2010-11. The sharp decline in the area under sugarcane crop was due to the marketing problem faced by the farmers and change in the dietary habits of people of the state. Almost the entire state was under low category at the both point of time. In 1980-81, the highest percent area was recorded in Rupnagar (5.21%). Hoshiarpur (6.60%) had the largest percent area in 2010-11. Hoshiarpur, Jalandhar, Gurdaspur, Nawan Shehar and Amritsar districts have considerable area under sugarcane cultivation.

Haryana- It is an important cash crop in the state. Area of sugarcane cultivation in Haryana showed many ups and downs.

As in the year 1980-81 area under this crop was 113.1 thousand hectares. Gradually it increased and reached to 143.0 thousand hectares in 2000-01. After this there was a sharp decrease to 84.5 thousand hectares. Sugarcane occupied 2.07 percent of total cropped area in 1980-81 which decreased to 1.3 percent of total cropped area in 2010-11. The largest percent area was recorded in Ambala (8.71%) in 1980-81 and Yamunanagar (17.59%) in 2010-11. There were 20 percent districts under high category in 2010-11. Major districts are Yamunanagar, Kurukshetra, Ambala and Karnal.

Rajasthan- It is not a much important crop in Rajasthan. During the study period area under this crop was continuously declining. In 1980-81 it was 29.46 thousand hectares which reduced to 5.5 thousand hectares in 2010-11. The highest area was registered in Bundi during the study period. There was no district under high category during the study time. Major districts are Bundi, Rajsamand, Udaipur, Ganganagar, Hanumangarh and Chittorgarh which have three fourth share of the state's sugarcane area.

Flat topography, well developed agricultural infrastructure, adequate irrigation facilities, sugar mills etc are the main factors responsible for high proportion of sugarcane cultivation. Districts are having sandy soil, structural hills of Aravallis, undeveloped irrigational facilities and irregular topography etc. lead to low share of sugarcane.

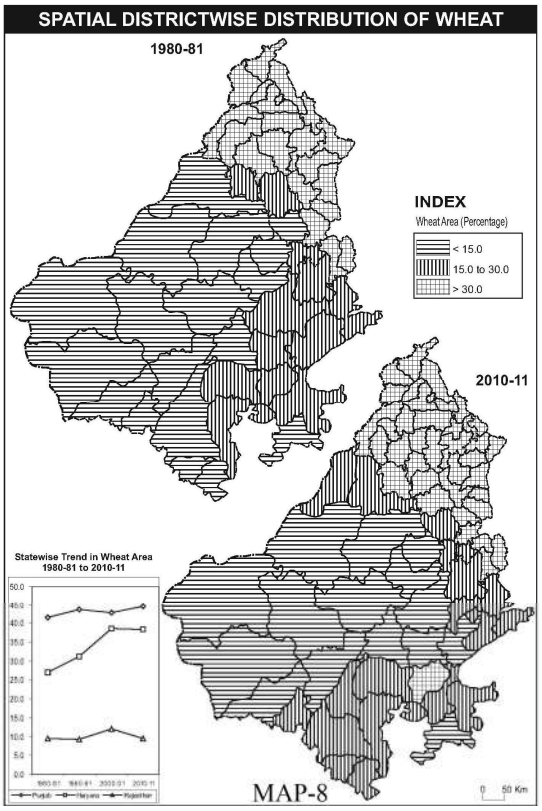
Rabi Crops

The Rabi season starts in the middle of October when the south-west monsoon retreats and the north-east monsoon begins. Seeds are sown in October and crops are harvested in March and April. Generally, Crops which require less water are grown during this season. The main Rabi crops are Wheat, Barley, Gram, Rape & Mustard, etc. These crops require cooler conditions and less moisture.

Wheat

Wheat is locally known as 'Gehun'/ 'Kanak'. It is the world's number one cereal crop with an area of about 214 million hectare, which is about 14% of the global arable land area. Wheat is the second most important food crop of the country, which contributes nearly one-third of the total food grains production. Map 8 shows the spatial district wise distribution of wheat in north-western India.

Punjab - Wheat is the most important Rabi crop in the state which occupies 85 percent of the area during Rabi season. Main success of this crop lays in its wide adaptability, disease resistant varieties and good support price. Most of this crop is grown under irrigated conditions, but in sub-mountain districts of Hoshiarpur, Gurdaspur and Rupnagar, some area is sown as rain fed. Wheat occupied 41.58 percent of total cropped area in 1980-81 which increased to 44.57 percent of total cropped area in 2010-11. The total area under wheat in Punjab was 2811 thousand hectares in 1980-81. The largest percent area was recorded in Kapurthala (46.14%) in 1980-81 and Taran Taran (46.67%) in 2010-11. Higher area under wheat crop was in Taran Taran, Faridkot, Barnala, Sangrur, Firozpur, Ludhiana and Bhatinda districts. The area under wheat increased with the passage of time in all the districts of Punjab and reached to 3510 thousand hectares in 2010-11. The entire state was under high category during the study period.



Haryana - Wheat is the most important Rabi crop in Haryana. Area under wheat cultivation was 1479 thousand hectares in 1980-81. It occupied 27.08 percent of total cropped area in 1980-81 which increased to 38.5 percent of total cropped area in 2010-11. The area is significantly increased over the time period and reached to 2504 thousand hectares in 2010-11. The largest percent area was recorded in Sonipat (48.68%) in 1980-81 and again Sonipat (47.11%) in 2010-11. Sonipat, Jind, Hisar, Fatehabad, Kaithal, Karnal districts have significant under wheat cultivation. There were 85 percent and 15 percent districts under high and medium category respectively in 2010-11, while this percents were 66.7 and 25 in 1980-81.

Rajasthan - Wheat is mainly sown in Eastern and South-Eastern part of Rajasthan, where it accounts for about 70% share of state's area under wheat cultivation. Area under this crop is gradually increases over the passage of time. Wheat occupied 9.42 percent of total cropped area in 1980-81 which slightly increased to 9.53 percent of total cropped area in 2010-11. It was 1635 thousand hectares in 1980-81 and increased to 2479.2 thousand hectares in 2010-11. In 1950-51 it was only 524 thousand hectares. The largest percent area was recorded in Bundi (27.11%) in 1980-81 and again Bundi (30.49%) in 2010-11. There was only one district (Bundi) under the high category in 2010-11. There were 65.4 percent districts under low category in 1980-81 which reduced to 46.9 percent in 2010-11. Now it is almost five times more than 1950-51. Major districts are Bundi, Bharatpur, Dausa, Alwar, Bharatpur, Dholpur, Ganganagar and Hanumangarh.

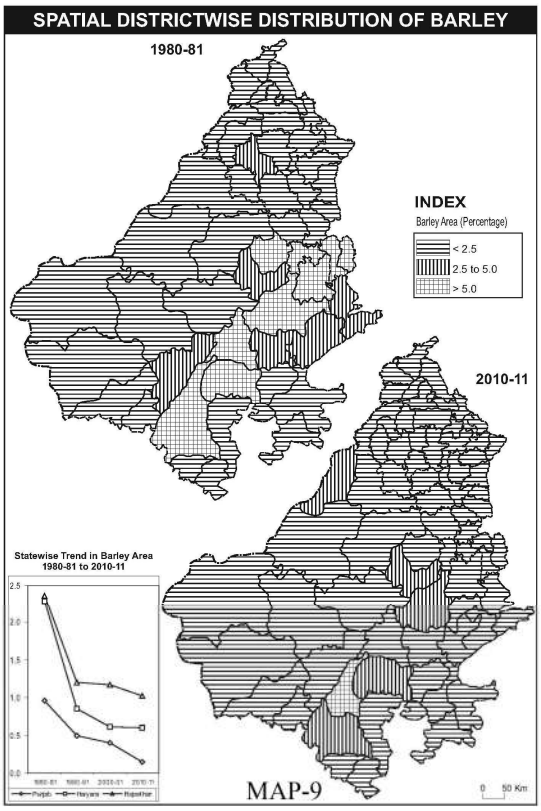
The high share of wheat cultivation was due to some reasons. The main reasons for high share in these districts of the study area are developed agricultural infrastructure, well developed irrigational facilities, fertile soil, high yielding varieties of seeds and the adoption of the advance farm technology by

farmers all these factors have contributed for high wheat cultivation. Wheat is facing less competition from other Rabi crops like barley, grams, oilseeds pulses etc. is another major factor for high share of wheat cultivation because wheat is more economical and assured crop than others.

While many districts had low share 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. Due to this type of topography, the irrigation facilities are also lacking behind in these areas. Moreover, these districts have sandy, loamy sand type of soils which is also major reason of low wheat share in these areas. Due to all these factors farmers prefer to grow pulses, oil seeds, in place of wheat.

Barley

It is commonly known as 'Jau'. It is very hardly crop and can be cultivated in adverse agro-environment like drought, salinity, alkalinity etc. in plains and hilly areas under rain fed and irrigated conditions. The spatial district wise distribution of barley in the study area has been shown in Map 9.

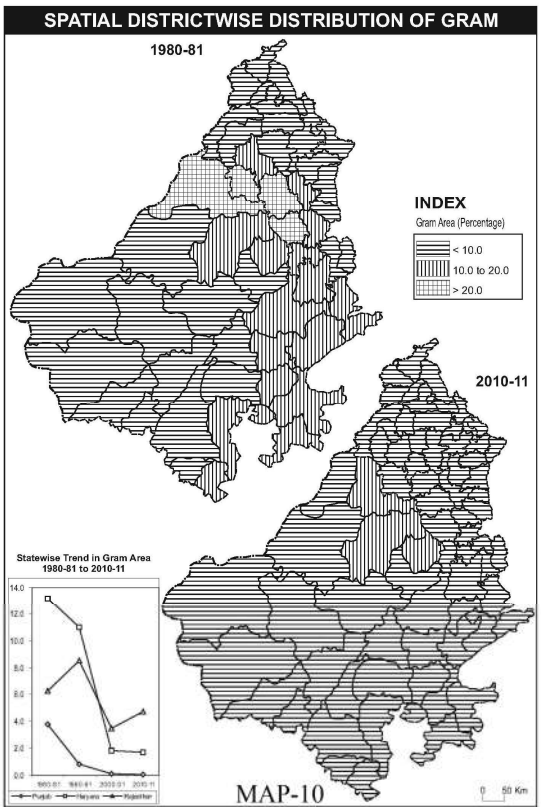


Punjab - It is a minor crop grown in the state during Rabi. Barley is generally grown under situation where it is not possible to have wheat crop. The area under this crop is gradually decreasing. The main reason for its low popularity is lack of remunerative market price. The area under barley decreased in Punjab from 65.3 thousand hectares in 1980-81 to 12 thousand hectares in 2010-11. Sangrur, Firozpur are main districts in Barley cultivation. Almost the entire state was under low category during the study period.

Haryana - It is not a significant crop in the state. The total area under Barley cultivation is continuously decreasing over the passage of time. In 1980-81, the area under this crop was 124.5 thousand hectares, which shrank to 37.3 thousand hectares in 2010-11. Barley occupied 2.29 percent of total cropped area in 1980-81 which decreased to 0.6 percent of total cropped area in 2010-11. The largest percent area was recorded in Gurgaon. There were 25 percent districts under high category in 1980-81, while in 2010-11, the entire state was under low category. The major barley growing districts are Gurgaon, Hisar, Sirsa, Bhiwani, Mahendragarh, Rewari and western part of Jind and Rohtak.

Rajasthan - Barley is an important Rabi cereal in Rajasthan. It occupied 2.36 percent of total cropped area in 1980-81 which decreased to 1.02 percent of total cropped area in 2010-11. In 1980-81, area under this crop was 410.12 thousand hectares and reduced to 263.96 thousand hectares in 2010-11. The largest percent area was recorded in Jaipur (7.44%) in 1980-81 and Rajsamand (5.47%) in 2010-11. The percents under low, medium and high category were 57.7, 19.2 and 23.1 respectively in 1980-81, while in 2010-11, these were 81.3, 15.6 and 3.1. Major districts are Rajsamand, Jaipur, Bhilwara, Sikar and Udaipur.

In these districts barley is dominant because of suitable climatic conditions for its cultivation. Arid type of climate is found in these districts which is suited to barley cultivation. The high share of barley in these districts is because of sandy soils, irregular topography with structural hills of Aravallis.



Gram

It is an important cool season food legume. Globally it is the third most important pulse crop after dry beans (*Phaseolus vulgais*) and dry peas (*Pisum sativum*). India ranks first in area

and production of gram at world level. The spatial district wise distribution of gram in north-western India has been shown in map 10.

Punjab- Gram is an important Rabi pulse of the state. It is mostly grown rain fed in the districts of Bhatinda, Faridkot, Firozpur, Sangrur, Rupnagar and Hoshiarpur. The position regarding gram in study period was very dismal in all the districts. Gram occupied 3.81 percent of total cropped area in 1980-81 which decreased to 0.04 percent of total cropped area in 2010-11. The areas under this crop have experienced a declining trend. The total area under gram in Punjab was 258 thousand hectares in the year 1980-81. In 2010-11, the area declined to 03 thousand hectares. This steps fall in the area under this crop was due to its low yield, susceptibility to wilt and blight diseases and partly due to popularity to wheat. The largest percent area was recorded in Bhatinda (12.44%) in 1980-81. Almost the entire state was under low category during the study period.

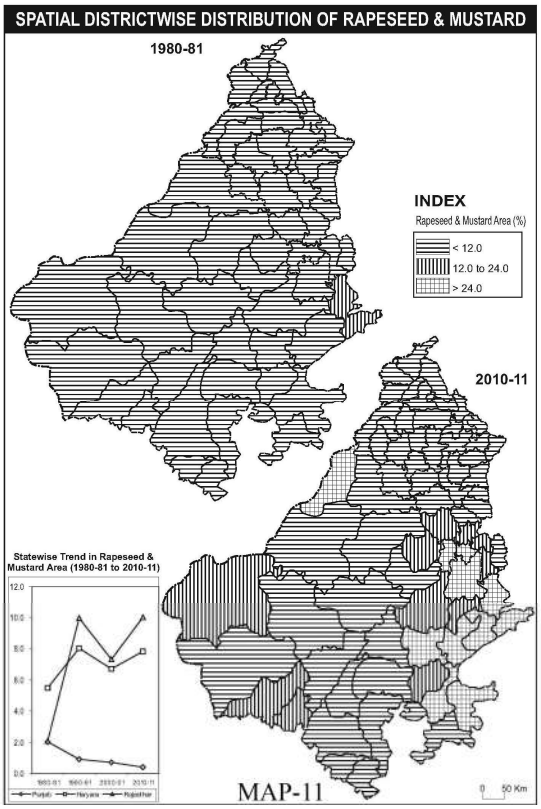
Haryana- The area under this crop in Haryana has declined alarmingly from 721.9 thousand hectares in 1980-81 to 111.5 thousand hectares in 2010-11. Gram occupied 13.20 percent of total cropped area in 1980-81 which decreased to 1.7 percent of total cropped area in 2010-11. The largest percent area was recorded in Sirsa (30.06%) in 1980-81 and Bhiwani (9.59%) in 2010-11. There was no district under medium and high category in 2010-11, while in 1980-81, there were 25 percent districts under the both categories. In Haryana this crop is generally grown in south western districts. Bhiwani, Hisar, Sirsa and Mahendragarh districts have some area under this crop.

Rajasthan - Gram stands second in Rabi food grains in Rajasthan. It occupied 6.24 percent of total cropped area in 1980-81 which decreased to 4.75 percent of total cropped area in 2010-11. It is mainly sown in Ganganagar, Hanumangarh, Churu and Bikaner districts have irrigational facility of Indira Gandhi Canal. The area under this crop experienced many fluctuations over the period of time but overall area has increased. The largest percent area was recorded in Ganganagar (30.85%) in 1980-81 and Churu (19.29%) in 2010-11. In 1980-81, the area was 1081.93 thousand hectares, which increased to 1233.89 thousand hectares in 2010-11. The percents under low, medium and high category were 50, 46.2 and 3.8 respectively in 1980-81, while in 2010-11, these were 90.6, 9.4 and zero.

The major factors responsible for high share of gram cultivation are sufficient fertility of sandy soils, low moisture content, adequate extent of irrigation, high temperature. In such conditions are highly ideal for gram cultivation.

Rapeseed and Mustard

Rapeseed mustard comprising eight different species under brassicaceae family viz. Indian mustard, Indian rape, turnip rape, canola, Ethiopian mustard and rocket plant are being cultivated in 53 countries spreading all over the globe. Map 11 shows the spatial district wise distribution of rapeseed and mustard in the study area.



Punjab - This includes different crops namely Sarson, Toriya, raya and taramira. Toriya is confined mainly to Amritsar and Gurdaspur districts. Raya and Sarson are mainly grown in South- western districts of Bhatinda, Faridkot, Firozpur, Sangrur and part of Ludiana. Taramira is generally grown in a limited area under rain fed conditions. These crops have not been able to occupy much of the area in the state because of their low yield susceptibility frost and attack of mustard aphid. The area under this crop in 1980-81 was 136 thousand hectares. However, the area under this crop decreased to 29 thousand hectares in 2010-11 after touching the highest of 158 thousand hectares during 1987-88. This crop occupied 2.01 percent of total cropped area in 1980-81 which decreased to 0.41 percent of total cropped area in 2010-11. The largest percent area was recorded in Amritsar (3.53%) in 1980-81 and Rupnagar (1.18%) in 2010-11. There was no district under high category during the study period.

Haryana-This is an important oilseed crop in the state. It occupied 5.49 percent of total cropped area in 1980-81 which increased to 7.8 percent of total cropped area in 2010-11. The total area under this crop is rapidly increasing from 299.6 thousand hectares to 509.7 thousand hectares in 2010-11. Bhiwani district has the highest area in Haryana. Mahendragarh, Rewari, Hisar, Sirsa, Jhajjar and Mewat districts have significant area under this crop. The largest percent area was recorded in Gurgaon (7.24%) in 1980-81 and Mahendragarh (36.40%) in 2010-11. The entire state was under low category in 1980-81. In 2010-11, districts under low, medium and high category were 70 percent, 20 percent and 10 percent.

Rajasthan - It is a major crop of Rajasthan occupying more than 20 Lakh hectares and is the largest area coverage in the

country. It is irrigated to the extent of 80 percent. Major districts are Ganganagar, Hanumangarh, Bharatpur, Dholpur, Alwar, Dausa, Jaipur, Karuali, Sawai Madhopur, Baran, Kota and Jalore. Total area under this crop was gradually increasing over the passage of times. It occupied 2.09 percent of total cropped area in 1980-81 which increased significantly to 10 percent of total cropped area in 2010-11. It was 362.5 thousand hectares in 1980-81 and increased to 2599.60 thousand hectares in 2010-11. The largest percent area was recorded in Bharatpur (15.41%) in 1980-81 and Sawai Madhopur (46.65%) in 2010-11. There was no district under high category in 1980-81. The percents under low, medium and high category were 50, 21.9 and 28.1 respectively in 2010-11.

This crop demands favorable conditions same as wheat, so the districts are having fertile soil, adequate irrigational facilities, flat topography etc. had higher share of rapeseed and mustard.

CONCLUSION

Analysis of cropping pattern reveals that the food grain crops specially cereals were dominant crops in the study area. As the cultivation of any crop in a region is mainly the outcome of various physical and socio-economic factors that reflects in the cropping pattern of that region. Different crops are grown in the study region, among all the crops, wheat, rice and Bajra were most important from areal point of view. Wheat crop ranks first in overall cropping pattern in Punjab and Haryana; while Bajra ranks first in Rajasthan state. In 1980-81, wheat occupied 41.58 percent and 27.08 percent area in Punjab and Haryana respectively while these percents were 44.57 and 38.5 in 2010-11. In case of Rajasthan percents of Bajra were 29 and 20.9 in 1980-81 and 2010-11 respectively. Rice had second rank in Punjab and Haryana. In 1980-81, rice occupied 17.48 percent area which increased to 35.88 percent in 2010-11 in Punjab while these percents were 8.86 and 19.1 in Haryana. In case of Rajasthan wheat (9.42%) had second rank in 1980-81 whereas rapeseed-mustard (10%) had second rank in 2010-11. Other important crops were cotton (6.13%) in Punjab; rapeseed-mustard (7.8%) and cotton (7.6%) in Haryana; wheat (9.53%), gram (4.75%) and maize (4.40%) in Rajasthan.

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