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Dynamics of Cropping Pattern in Northwestern Haryana A Spatio- Temporal Study

Satpal Kumar

Assistant Professor, Jaharveer Goga Ji Kanya Mahavidyalaya, Chhani Bari, Hanumangarh (Rajasthan) (India)

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ABSTRACT

The present paper is an attempt to find out the spatial and temporal variation and dynamics of cropping pattern during 1998-99 to 2015-16 in Northwestern Haryana. The district wise time series data has been obtained from secondary sources. Harfindal and Simpson index have been used to find out the crop diversification and Doi's method to compute the crop combinations in the region. The results show that cropping pattern in Northwestern Haryana has been quite different from rest of the state. In 1998-01 the dominant crops in Northwestern Haryana were wheat and cotton and these two crops covered about 65 percent area to total cropped area. Rice, mustard and bajra were other important crops grown in the region. But in rest of Haryana the dominant crops were wheat and rice followed by bajra. In 2013-16 the cropping pattern changed as area under cotton has shrunk whereas acreage of rice has increased in the region. Rice is gaining at the cost of cotton acreage in Northwestern region. But there is not much change in the crop combination pattern in the region during the study period. Northwestern part of state has had highly diversified cropping pattern and there was not much change during study period. Simpson index shows that in Northwestern Haryana cropping pattern is almost same during the study period with just a slight tilt towards foodgrains.

1. Introduction

Cropping pattern means the proportion of area under various crops at a point of time (Husain 2010).Concept of crop diversification means competition among various grown crops for space in a given region. It also means raising a variety of crops involving intensity of competition amongst field crops for arable land: the keener the competition, the higher the magnitude of crop diversification (Singh J, 1976). Cropping pattern is influenced by physical and socio economic factors. Physical environment play a vital role in the growth of plant and set limitation on the selection of crops. Socio- economic factors are also important and farmer grows the crops with their choices and habits. Modern technology has opened the scope of various crops in the region where climate do not suits them. Irrigation facilities, farm mechanism, use of fertilisers are the modern inputs which make the selection of particular crop easy. North western Haryana is a semiarid region and here the selection of crops is dependent on soil characteristics and rainfall. But enhancement of modern technologies and irrigation facilities open the scope for cash crops like Wheat, Rice and Sugarcane. So the cropping pattern in this region has been changed during study period.

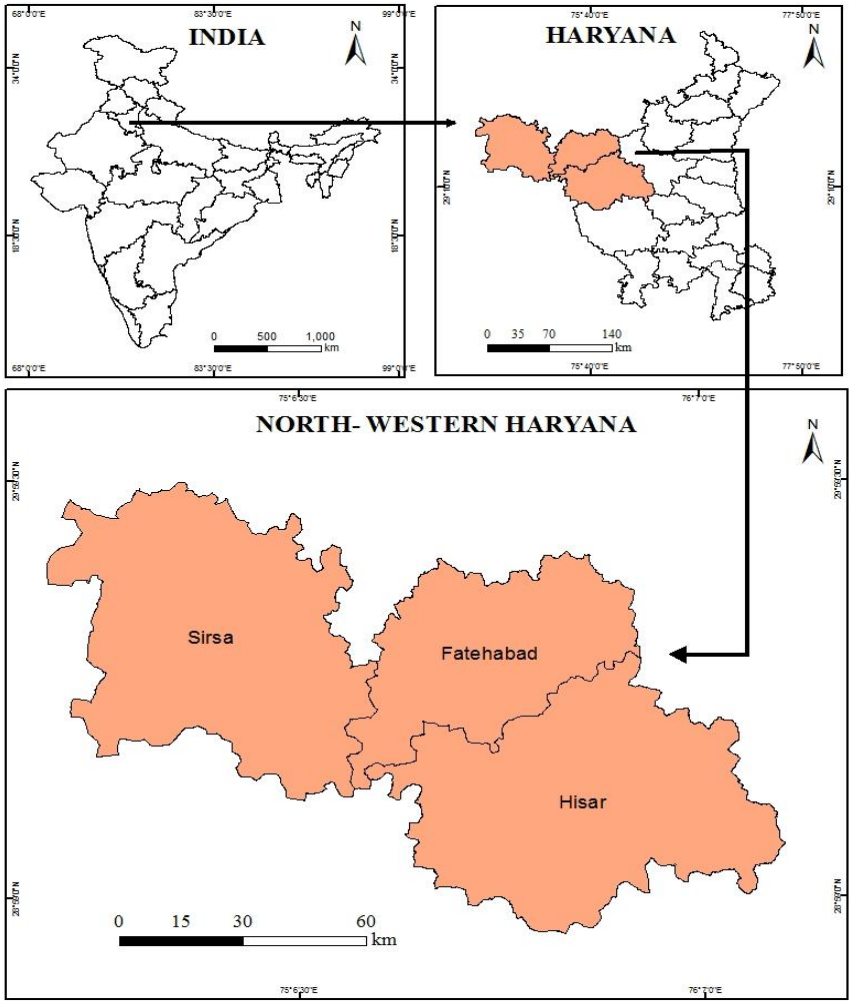
In India, agriculture is a tradition that has shaped the thoughts, the outlook, the culture, and the economic life of the people for centuries. Agriculture is and will continue to be central to all strategies for planning socio-economic development of the country (Dhandapani & Rath, 2004). Since 1990s Indian agriculture experiences a significant change in cropping pattern and it has been moving from traditional food crops to the commercial crops (Nadkarni, 1996, Joshi et. al., 2004, Kumar and Gupta, 2015).Several researchers have argued that agricultural diversification can be used as an instrument to raise farm income, generate employment opportunities, alleviate poverty and for conservation of natural resources (Von Braun, 1995; Pingali and Rosegrant, 1995; Ryan and Spencer, 2001; Birthal et al., 2005).

2. Study Area

Haryana carved out of the former state of Punjab on 1 November 1966, is one of the 29 states in India, Situated in Northwestern part of India with less than 1.4% (44,212 km^2) of India's land area. Geographic location of Haryana is $27^0 39'$ N to $30^0 55'$ N latitude and $74^0 27' 8''$ E to $77^0 36' 5'$ E longitudes. It is surrounded by Himachal Pradesh and Punjab in North and North- west, Utter Pradesh and Delhi in East and Rajasthan in South and South- west. Shivalik hills and Aravali range surround the state from North and South respectively.

Present study covers the Northwestern part of state including three districts named Hisar, Fatehabad and Sirsa. This part covers the area of 10798 km^2 which is 24.42 percent of the total area of Haryana. Study area is located between 28°54'N to 29°59'N latitude and 74°28'E to 76°19'E longitude.

Figure 1
Study Area



3. Objective

To evaluate the change in cropping pattern and diversification in Northwestern Haryana during study period.

4. Data and Methodology

District wise data pertaining toNet Sown Area and gross cropped area have been collected for the period of 1998-99 to 2015-16 from Statistical abstract of Haryana, Economic and statistical organization Chandigarh (various issues). Eight major crops which cover a significant area in gross cropped area have been selected for calculating the cropping pattern and shown with the help of tables,pie and bar diagram. Temporal and spatial variation in proportion of different crops to total cropped area has been calculated on the basis of triennium average of 1998-01 and 2013-16. Crop diversification has been calculated with the help of Harfindal and Simpson index method with the following formula:

Herfindel Index of crop diversification= $\sum_{i=1}^{n} Pi^2$

Pi = Ai/$\sum Ai$

where, Pi = Proportion of Area under i th Crop Ai = Actual Area under i th Crop, ∑Ai = Total Cropped Area. The index value worked out by this formula varies from 0 to 1. It is 0 in case of perfect crop diversification whereas 1 represents the perfect crop specialization.

After calculation of Harfindal index the Simpson index of crop diversification has been used for the evaluation of the diversification among the foodgrains. Following formula has been used for the calculation of Simpson index of diversity (SID):

$\text{SID} = 1 - \sum Pi2$

here i = 1, 2…..n. and Pi is the proportional value (or area) of the ith crop in the total value (area) of output. When The Simpson index of diversification (SID) is close to one it implies that the diversification increases and when SID is close to zero, there is no diversification.Crop combination has been calculated at district level by the method of Doi (1957).

5. Result and Discussion

Table 1, 2 and figures 2 show the percent share of main crops in total cropped area in different regions of Haryana and Northwestern districts. Tables reveals that wheat is the dominant crops in all parts of Haryana and it covers almost 40 percent area to total cropped area. In Northwestern Haryana the area under wheat is 39.17 percent which is approximately similar to Haryana and rest of Haryana. In 1998-01 the area under wheat was 36.78 percent in Northwestern Haryana and it has increased to 39.17 percent in 2013-16. Area under wheat

has been increased in all over Haryana during the study period. Second largest crop in Northwestern Haryana is cotton which account for 21.97 percent to total cropped area while in Haryana and rest of Haryana the second largest crop is rice. Area under cotton is shrinking in northwestern Haryana during last two decades and there is an increase in the acreage of rice. In 1998-99 the share of cotton was 27.58 percent in Northwestern Haryana but in 2013-16 this declined to 21.97 percent to total cropped area. On the other hand there is approximately three percent point increase in the share of rice in Northwestern Haryana during this period. Therefore, it can be said that there is shift from the cotton to rice in Northwestern region of Haryana. In Haryana the share of both cotton and rice has increased. In 1998-01 the percent share of bajra was 4.71 percent in Northwestern Haryana, 11.61 percent in rest of Haryana and 9.79 percent in Haryana but in 2013-16 this has decreased to 1.40 percent in Northwestern Haryana, 7.72 percent in rest of Haryana and 5.96 percent in Haryana. It shows that bajra cultivation has been wiped out in Northwestern part. Gram cultivation also meets the same fate and its share is negligible in all regions of state. Rapeseed & mustard shows a marginal increase in its share to total cropped area while sugarcane shows a decline in all regions of study area study during study period. In Northwestern Haryana the highest share (44.13percent) under wheat is in Fatehabad district and it shows a three percent point increase in area under wheat during study period. There is tremendous increase in the share of area under rice and it increased from 16.30 percent in 1998-01 to 23.45 percent in 2013-16. In 1998-99 the share of cotton crop was 24.81 percent and it has declined to 17.85 percent in 2013-16 in district Fatehabad. In Sirsa there is 5 percent increase in share of rice and 6 percent decrease in share of cotton during study period. In District Hisar the share of rice and cotton show a decreasing trend but there is increase in the share of rapeseed &mustard and other crops during study period. Bajra crop show approximately 7 percent decrease in the share to total cropped area in Hisar during study period.

Table 1 Percent Share of Different Crops in Total Cropped Area (1998-01)

District/Region	Rice	Bajra	Wheat	Barley	Gram	Rapeseed &Mustard	Cotton	Sugarcane	Others
Hisar	6.93	10.47	32.65	0.88	4.38	7.83	23.93	0.77	12.14
Fatehabad	16.30	2.85	41.07	1.06	1.58	4.37	24.81	0.39	7.57
Sirsa	6.58	0.57	37.29	1.24	3.52	6.91	32.32	0.06	11.51
N.W. Haryana	9.21	4.71	36.78	1.07	3.36	6.63	27.58	0.40	10.27
Rest of Haryana	20.40	11.61	37.28	0.46	3.08	7.60	2.52	2.85	14.20
Haryana	17.46	9.79	37.15	0.62	3.15	7.35	9.11	2.21	13.16

Source: director of Land Record Haryana

Table 2
Percent Share of Different Crops in Total Cropped Area (2013-16)

District/Region	Rice	Bajra	Wheat	Barley	Gram	Rapeseed &Mustard	Cotton	Sugarcane	Others
Hisar	7.82	3.38	34.45	0.69	2.13	10.27	21.64	0.18	19.44
Fatehabad	23.45	0.47	44.13	0.46	0.09	2.92	17.85	0.05	10.59
Sirsa	11.01	0.17	40.52	0.80	0.70	5.88	24.68	0.01	16.23
N.W. Haryana	12.79	1.40	39.17	0.68	1.07	6.77	21.97	0.08	16.06
Rest of Haryana	22.50	7.72	39.39	0.47	0.93	8.21	4.46	2.03	14.29
Haryana	19.79	5.96	39.33	0.52	0.97	7.81	9.34	1.48	14.79

Source: director of Land Record Haryana

Crop Combination

Crop combination refers to the cultivation of crops in association. It is rarely found that a single crop is grown in the field. Crops are generally grown in combination as two crop combinations or three crop combinations etc. There are several method applied in the delineation of crop combination region. One method is arbitrary method which arbitrarily selects the major crops on the basis of observations and delineates the crop combination region. Weaver (1954) was the first to use statistical technique in the field of delineating crop combination region. After that some other geographers modified Weaver's method and delineate the crop combination regions. Doi's method has been used in present study for making an analysis of crop combination in the study area. In this method percent share of crops to total cropped area has been calculated. After getting percentage share the cumulative percentage has been calculated. According to Doi technique all those crops are included in the combination whose cumulative percentage is less than 50. Crop combination applied on the cumulative percentage of 50 and above.

Table 3
Crop Combination

1998-01			2013-16	
District/Region	combination	Crops	combination	Crops

Hisar	3	Wheat, Cotton , Bajra	4	Wheat, Cotton , Mustard, Rice
Fatehabad	3	Wheat, Cotton , Rice	3	Wheat, Rice, Cotton
Sirsa	2	Wheat, Cotton	3	Wheat, Cotton , Rice
NW Haryana	3	Wheat, Cotton , Rice	3	Wheat, Cotton , Rice
Rest of Haryana	3	Wheat, Rice, Bajra	3	Wheat, Rice, Mustard
Haryana	4	Wheat, Rice, Bajra, Cotton	3	Wheat, Rice, Cotton

Source: Calculated by researcher on the basis of statistical abstract of Haryana

Figure 2

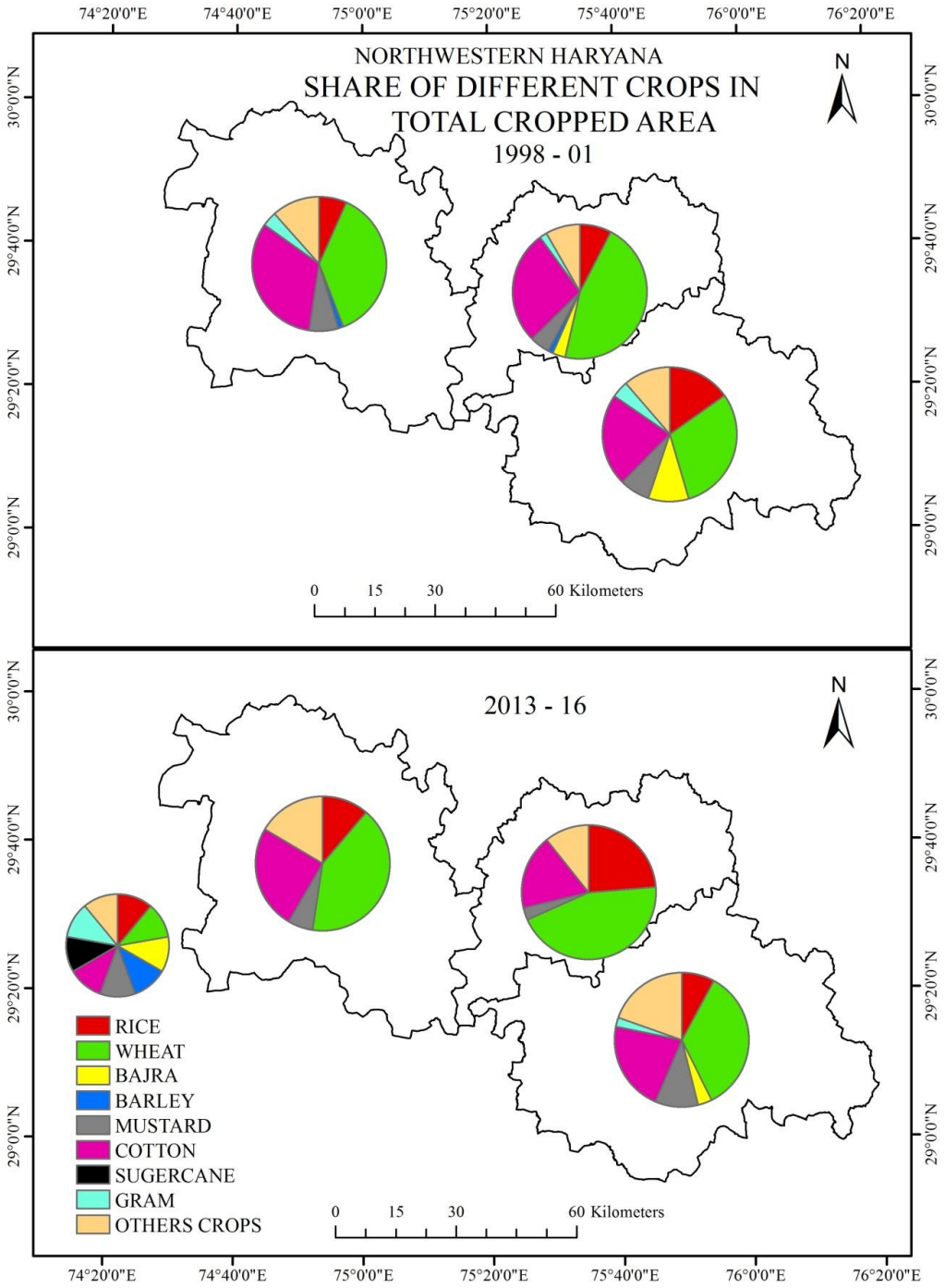


Table 3 shows the crop combination in study area during two different time periods. It reveals that in Haryana there were four crop combinations of Wheat, Rice, Bajra and Cotton in 1998-01. But with the time this combination has been changed and in 2013-16 Bajra has lost its area and not included in crop combination. So Bajra has been replaced by other crops and the dominant crop of Haryana is Wheat, Rice and cotton. In rest of Haryana also the Bajra has been replaced by Mustard

and there are three crop combinations in the rest of Haryana. Northwestern Haryana has not experienced change in crop combination in study period and it retained its three crop combination in study period. Sirsa had two crop combinations in 1998-99 but by the time Rice cultivation is increased and in 2013-16 the combination is shifted to three crops. In 1998-99 the Cotton was the second largest crop in Fatehabad but in 2013-16 it has been replaced by Rice. In 1998-99 there were three crop combinations in Hisar but in 2013-16 it gained four crop combinations. The main thing which should be taken in to consideration that Bajra is being eliminated from the crop combination in all over Haryana and the cultivation of Rice is increasing.

Crop Diversification

Crop diversification refers to cultivation of various crops in an agricultural year. Diversification is opposite to crop concentration and diversification increase with the increase in number of crops. Diversification is used for soil health and getting employment from agriculture throughout year. High crop diversification is mainly found in subsistence agriculture and people grow more crops in an agricultural year to meet their various requirements. Small land holding size is also a factor responsible for diversification of crops. Northwestern Haryana where average rainfall is low and as a result there is high diversification in cropping pattern is found. Harfindal and Simpson index has been used for calculating diversification in study region. Zero value of Harfindal index represents perfect diversification and value 1 implies the perfect concentration of crops. On the other hand Simpson index has been used for calculating diversification in foodgrains and index value of 0 represent perfect concentration of crops whereas 1 implies perfect diversification.

Table 4
Harfindal Index values of Crop Diversification

Harfindal Index Value		
District/ Region	1998-01	2013-16
Hisar	0.19	0.18
Fatehabad	0.26	0.28
Sirsa	0.25	0.24
N.W. Region	0.23	0.22
Rest of Haryana	0.20	0.22
Haryana	0.19	0.21

Source: Calculated by researcher on the basis of statistical abstract of Haryana

In the table (4) the values of Harfindal index has been calculated from triennium average of 1998-01 and 2013-16. It is clearly seen that there is not much change in the index values in study period. In Hisar the diversification is high with the value of 0.19 during the period of 1998-01 and the almost same value occurred in 2013-16. Therefore it can be said that Hisar district consistently lies in the category of comparatively more diversified than other districts of region. On the other hand Fatehabad district had comparatively low diversified cropping pattern and it is moving towards the concentration of crops. Sirsa district also exhibits same pattern of the diversification in crops in study period. Rest of Haryana and Haryana as a whole are also depicting the high diversification and with the change in time these are moving toward the concentration of crops.

Table 5 shows the diversification in foodgrains in Haryana during given time period. It is seen in table that Haryana there is not much diversification in foodgrains. It attained the value of 0.33 in 1998-01 and again in 2013-16 it attained the same value. It shows there is not much diversification away from foodgrains. Rest of Haryana also depicts the same picture and it is moving towards the diversification of foodgrains. But Northwestern region of the state has a cropping pattern diversified away from the foodgrains (0.48) in 1998-01. In this region also diversification is less in Fatehabad district. But in Hisar district diversification away from foodgrains has increased. In 2013-16 index value of Hisar was 0.54. On the other hand Fatehabad and Sirsa loses their index value and it means both of these districts are moving towards the concentration of foodgrains because there is increase in acreage of wheat and rice.

Table 5
Simpson Index Values of Crop diversification

Simpson Index Value		
District/ Region	1998-01	2013-16
Hisar	0.49	0.54
Fatehabad	0.39	0.31
Sirsa	0.54	0.48
North Western Region	0.48	0.46

Rest of Haryana	0.26	0.29
Haryana	0.33	0.33

Source: Calculated by researcher on the basis of statistical abstract of Haryana

6. Sum Up

Eight major crops which occupy more than one percent area have been selected for getting an idea of temporal trend during study period. Cropping pattern in Northwestern Haryana has been quite different from rest of the state. In 1998-01 the dominant crops in Northwestern Haryana were wheat and cotton and these two crops covered about 65 percent area to total cropped area. Rice, mustard and bajra were other important crops grown in the region. But in rest of Haryana the dominant crops were wheat and rice followed by bajra. In 2013-16 the cropping pattern changed as area under cotton has shrunk whereas acreage of rice has increased in the region. Rice is gaining at the cost of cotton acreage in Northwestern region. But there is not much change in the crop combination pattern in the region.

In 1998-01 the crop combination for Northwestern Haryana was wheat, cotton and rice and it remained same in 2013-16 as well. Northwestern part of state has had highly diversified cropping pattern and there was not much change during study period. Simpson index shows that in Northwestern Haryana cropping pattern is almost same during the study period with just a slight tilt towards foodgrains.

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