

Diversification and Specialisation of Punjab in Growing Various Crops: A District Level Approach

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ABSTRACT

The paper examines the nature and extent of crop diversification, crop specialization and inter-district diversity in cropping pattern in the most advanced agricultural state Punjab during the period of 2000-01 to 2014-15. The study has used the index of crop diversification, location quotient, crop versatility and district versatility index for analysis. The study has revealed that both wheat and rice crop is grown by all the districts, so none of the district was found to be very highly specialised or very less specialised than state. However, for cotton and maize, four districts acquired specialization. The district versatility results shows that Hoshiarpur is the more versatile district and Patiala is less versatile district in 2014-15. The insights from the paper suggests that the government should enhance region-specific diversification on the basis of district specialization along with infrastructure and assured marketing of new crops through contract farming and supermarkets procurement.

Keywords: Cropping pattern, crop diversification, crop specialisation, crop versatility index, district versatility index

In Punjab, although the share of agricultural and allied sector is declining in Gross State Domestic Product (GSDP) but still this sector absorbs a significant share of employment. Punjab, *the grain bowl of India*, has always remained ahead in achieving the target of food security since the advent of green revolution as despite having only 1.5 per cent of the geographical area; as it contributes around 42 per cent of wheat and 24 per cent of rice to the central pool (GoP, 2015). Consequently, area under wheat and rice has increased significantly. Above 80 per cent of the Gross Cropped Area (GCA) was under wheat and rice during 2014-15 (GoP, 2015). As a result, this has created the severe unbalanced situation for the cropping pattern of Punjab. The monoculture of wheat-rice crop rotation has originated some serious ecological as well as economic problems such as ground water depletion, decline in soil fertility, rise in water pollution due to over usage of chemicals, soil erosion, rising burden on state exchequer to provide free power supply

to farm sector etc. Therefore, producing these traditional cereals is no longer viable for Punjab particularly, for combating these environmental and financial issues. As a result, there is dare need to focus on the cropping pattern of Punjab. The present cropping pattern of Punjab needs to be shifted from traditional food-grains towards high value crops to minimize the adverse effects of the current system of crop specialization and monoculture for better resource use, reduction of risks and uncertainty and better soil conditions (Shergill, 2005; Acharya *et al.* 2011). Also, the demand for high value commodities such as fruits and vegetables is rising at a rapid rate and that of traditional food-grains such as rice, wheat etc. has declined considerably whereas in Punjab, the area under these crops is rising by every year and that of high value crops is very less. Hence, reshaping the cropping pattern of Punjab may solve the agrarian crisis of Punjab as the cropping pattern of any region or state plays a major role in determining the situation of

agricultural sector of any state or region in terms of realizing higher output growth, higher farm income, employment generation, sustainability of natural resources and poverty alleviation (Kumar and Gupta, 2015). Besides, nature has also gifted Punjab with suitable agro-climatic conditions to grow various food as well as non-food crops. It is therefore, the present study based on district level analysis will be beneficial for policy makers to formulate specific policies by understanding cropping pattern for the coming years. The specific objectives of the study are (1) to study the changes in percentage share of area under different crops over a period of time; (2) to analyse the district-wise extent of crop diversification in Punjab; (3) to study the specialisation of various crops in various districts in Punjab; and (4) to examine the suitability of the different districts in various crops.

Database and Methodology

The present study is based on secondary data sources. District-wise data on area under different crops was compiled from various issues of Statistical Abstract of Punjab, Punjab at a Glance, Directorate of Horticulture, Punjab and indiastat.com etc. Mainly, 11 crops have been analysed in the present study, i.e. 3 rabi crops, namely, wheat, barley and total pulses (*moong, masur and arhar*), 5 kharif crops, namely, rice, cotton, maize, bajra and sugarcane and 3 others that includes fruits, vegetables and total oilseeds. The study covered the period from 2000-01 to 2014-15. At present, Punjab state has 22 districts, but due to non-availability of data for newly carved districts, the present study has combined these into 17 districts. Also, during 2000-01, there were 17 districts in Punjab. The data has been analysed for four different periods viz. 2000-01, 2005-06, 2010-11 and 2014-15. The study has examined the district-wise cropping pattern and specialisation/concentration in growing various crops, by applying (a) Index of Crop Diversification (ICD) by Bhatia's method (b) Location Quotient (LQ) (c) Crop Versatility Index, and (d) District Versatility Index. Bhatia's method for measuring crop diversification was used with the following method:

Index of Crop diversification =

$$\frac{\text{Sum per cent of cropped area under X crops}}{\text{Number of X crops}}$$

Where, X crops are those crops which individually cover 10 per cent or more than 10 per cent of the cropped area or gross cropped area in each district. The index value calculated by this formula is inversely related to magnitude of crop diversification. It indicates that lower the index value higher is the magnitude of crop diversification and vice versa. If the index value is less than 20, it shows very high diversification, 20.1 to 25.4 shows high diversification, 25.5 to 40.5 shows little diversification and greater than 40 indicates very little diversification (Bhatia, 1965).

It is widely accepted method to find the region-wise (district-wise in the present study) importance in various crops (Bhatia, 1965; Ardeshta and Shiyani, 2011; Ghosh, 2011; Ramphul, 2012; De and Bodosa, 2014). Hence, it is used for calculating the regional crop concentration.

$$LQ_{ij} = \frac{A_{ij}/A_j}{A_i/A}$$

Where; A_{ij} = Area under crop 'a' in j^{th} district

A_j = Gross Cropped Area (GCA) in j^{th} district

A_i = Area under crop 'a' in the state

A = GCA of the state

Hence, it is the index for measuring the magnitude of the specialisation of a particular crop in a particular region. The value of LQ may equal to one, more than one or less than one. The value of LQ equal to unity shows the equal specialisation of a region/district vis-a-vis state in a particular crop. The value more than unity shows the more specialisation of a region in growing crop than state means the proportionate area under a specific crop in a particular district is more than the proportionate area under same crop in the state. However, the value less than one indicate the lesser specialisation of a region than state in a particular crop i.e. the proportion of a crop in a district to the GCA of a district is less than the proportion of the same crop to GCA in a state. Therefore, larger the value of LQ, higher will be the concentration of crop in a region and vice versa. Hence, it compares the relative situation of a crop in a region with that of the state level.

Crop Versatility Index is used to find out the coverage of a various crops in various regions or

districts. A crop is said to be more versatile if it is grown in more number of regions. The versatility of crop is inversely related to the value of coefficient of variation (CV) of a specific among various districts (Ramphul, 2012). The more the versatility of crop, lesser will be value of coefficient of variation and vice versa. The value of coefficient of variation (CV) is calculated as follows;

$$CV_i = \frac{\sigma A_i}{M_i} * 100$$

Where, CV_i = Coefficient of variation of share of area of i^{th} crop

σA_i = Standard Deviation of the district-wise percentage share of area under crop 'i'

M_i = Average of district-wise percentage share of area under crop 'i' to GCA

Hence, higher value of CV will indicate the more region specific crop and lesser value will show more versatile crop.

As the crop versatility index indicates the performance of crops in the ability to grow more number of districts, similarly, the district versatility index reflects the suitability of various districts in growing more number of crops. A district is said to be more versatile if it is growing more number of crops with same percentage distribution of acreage of gross cropped area (Ramphul, 2012).

$$CV_j = \frac{\sigma A_j}{M_j} * 100$$

Where, CV_j = CV of the percentage share of area under crops in district 'j'

σA_j = Standard deviation of crop-wise percentage of area to total cropped area of j^{th} district

M_j = Mean of the crop-wise percentage of area to total cropped area of j^{th} district

The more the versatility of district, lesser will be value of coefficient of variation and *vice versa*.

RESULTS AND DISCUSSION

Punjab state has experienced the major changes in its cropping pattern since 1950-51 as examined in Table 1. It is clear that proportionate area under rice experienced the surprising growth followed by wheat. This remarkable growth was principally due

to the origin of Green Revolution occurred in late 60s'. Hence, during this period, the area under wheat and rice rose from around 30 per cent and 5 per cent of GCA to 44 per cent and 37 per cent respectively during 2014-15. On the other hand, area under all other crops declined significantly except the marginal growth of area under fruits and vegetables. The proportionate area under total pulses declined from around 24 per cent during 1950-51 to just 0.1 per cent during 2014-15. Although, the growth of the area under fine cereals (wheat and rice) has fulfilled the target of food security of the nation as well as provided the remunerative returns to farmers, but at the same time, Punjab has caught into the net of many ecological problems and at present, is in serious agrarian crisis.

Table 2 shows the variations in the degree of crop diversification in Punjab amongst various districts. During 2000-01, only Hoshiarpur district showed the diversification with ICD value 24.68. However, the value of ICD for Ropar, Ferozpur, Bathinda, Mansa, S.B.S. Nagar and Jalandhar district lies between 25.5 to 40.5 and remaining districts have higher value than 40. Patiala and Fatehgarh Sahib has the least diversification with 43.39 and 43.82 ICD values, respectively. Punjab state with 37.94 ICD value lies in the low diversification category. In the fourth period (2014-15), in all the districts except Ropar the ICD value was recorded to increase. The value of ICD for Punjab increased to 40.5 in 2014-15. So, majority of the districts have experienced specialisation instead of diversification.

The perusal of Table 3 explains the extent of diversification in different districts of the state. During 2000-01 and 2014-15 time period, Faridkot, Kapurthala, Ludhiana, Gurdaspur, Amritsar, Sangrur, Moga, Patiala and Fatehgarh Sahib district did not experience the significant level of crop diversification and hence recorded a higher ICD values. Hoshiarpur and Ropar were only two districts that recorded a higher index of crop diversification during 2005-06. Even during this time period, two districts i.e. Kapurthala and Faridkot registered a little crop diversification as compared to very little crop diversification during other time periods. The reason behind it may be that during 2002, the government of Punjab introduced contract farming for hyola, maize, sunflower, barley and malting with the support of Punjab Agro Food-

Table 1: Percentage share of area under various crops to Gross Cropped Area (GCA)

Crop	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2005-06	2010-11	2014-15
Fruits	0.8	0.6	0.6	0.4	0.9	0.4	0.6	0.9	1.0
Vegetables	1.2	1.2	0.9	1.1	0.7	1.4	1.3	1.3	1.6
Rice	2.9	4.8	6.9	17.5	26.8	33.0	33.7	35.9	36.6
Bajra	5.2	2.6	3.7	1	0.2	0.1	0.1	0.0	0.0
Maize	6.3	6.9	9.8	5.6	2.5	2.1	1.9	1.6	1.6
Wheat	27.3	29.6	40.5	41.6	43.6	42.9	44.1	44.5	44.4
Barley	2.4	1.4	1	0.9	0.5	0.4	0.2	0.2	0.1
Total pulses	23.8	19.1	7.3	5	1.9	0.7	0.4	0.3	0.1
Total oilseeds	3.3	3.9	5.2	3.7	1.4	1.1	1.0	0.7	0.6
Sugarcane	2.2	2.8	2.3	1	1.3	1.5	1.1	0.9	1.2
Cotton	5.4	9.4	7	9.6	9.3	5.9	7.1	6.1	5.3
Others	19.2	17.7	14.8	17.6	10.7	10.5	8.5	7.6	7.5

Table 2: District-wise Index of Crop Diversification in Punjab by Bhatia’s method

Districts	2000-01		2005-06		2010-11		2014-15		Name of the crops
	No. of crops	ICD	No. of crops	ICD	No. of crops	ICD	No. of crops	ICD	
Ferozpur	3	27.33	3	29.61	3	28.94	3	29.05	Wheat, Rice and Cotton
Hoshiarpur	3	24.68	3	25.4	3	26.8	3	26.15	Wheat, Rice and Maize
Sri Muktsar Sahib	3	28.23	3	29.51	3	30.05	3	30.57	Wheat, Rice and Cotton
Bathinda	3	29.00	3	29.34	3	30.4	3	30.64	Wheat, Rice and Cotton
Ropar	3	25.87	3	22.81	3	27.14	3	25.77	Wheat, Rice and Maize
Mansa	3	29.61	3	29.84	3	30.06	3	30.08	Wheat, Rice and Cotton
Faridkot	2	40.69	3	30.04	2	42.91	2	44.05	Wheat and Rice (and Cotton during 2005-06)
Gurdaspur	2	41.38	2	41.86	2	42.74	2	42.68	Wheat and Rice
Amritsar	2	41.44	2	43.89	2	44.7	2	45.76	Wheat and Rice
Jalandhar	2	36.62	2	37.68	2	40.78	2	39.86	Wheat and Rice
S.B.S. Nagar	2	33.82	2	34.57	2	36.06	2	35.95	Wheat and Rice
Ludhiana	2	41.06	2	42.25	2	42.9	2	43	Wheat and Rice
Fatehgarh Sahib	2	43.82	2	44.24	2	44.65	2	44.27	Wheat and Rice
Moga	2	42.25	2	46.33	2	45.56	2	46.08	Wheat and Rice
Sangrur	2	41.61	2	43.5	2	44.21	2	43.85	Wheat and Rice
Kapurthala	2	40.84	2	40.41	2	41.85	2	41.88	Wheat and Rice
Patiala	2	43.39	2	46.15	2	44.9	2	45.42	Wheat and Rice
Punjab	2	37.94	2	38.89	2	40.19	2	40.5	Wheat and Rice

grains Corporation for the diversification of state agriculture.

Table 4 illustrates the LQ of *rabi* crops (wheat, barley and total pulses) for the time periods of 2000-01, 2005-06, 2010-11 and 2014-15. In case of wheat crop, none of the district was found to be very highly specialised or very less specialised than state. Therefore, in all the 17 districts, the value of

LQ was found to near about one i.e. slightly more than and less than one for all the time periods. Therefore, wheat crop was found to be grown in all the districts. In case of barley crop, the specialisation was found to be highest in Sri Muktsar Sahib and Bathinda districts (LQ= 2.18 for both the districts) during 2000-01 but over a period of time, the specialisation of these two districts started

Table 3: District-wise extent of crop diversification during various time periods

Year	High	Little	Very Little
2000-01	Hoshiarpur	Ropar, Ferozpur, Bathinda, Mansa, S.B.S. Nagar, Jalandhar and Punjab	Faridkot, Kapurthala, Ludhiana, Gurdaspur, Amritsar, Sangrur, Moga, Patiala, Fatehgarh Sahib
2005-06	Ropar, Hoshiarpur	Bathinda, Sri Muktsar Sahib, Ferozpur, Mansa, Faridkot, S.B.S. Nagar, Jalandhar, Punjab, Kapurthala	Gurdaspur, Ludhiana, Sangrur, Amritsar, Fatehgarh Sahib, Patiala, Moga
2010-11	-	Hoshiarpur, Ropar, Ferozpur, Sri Muktsar Sahib, Mansa, Bathinda, S.B.S. Nagar, Punjab	Jalandhar, Kapurthala, Gurdaspur, Ludhiana, Faridkot, Sangrur, Fatehgarh Sahib, Amritsar, Patiala, Moga
2014-15	-	Ropar, Hoshiarpur, Ferozpur, Mansa, Sri Muktsar Sahib, Bathinda, S.B.S. Nagar, Jalandhar, Punjab	Kapurthala, Gurdaspur, Ludhiana, Sangrur, Faridkot, Fatehgarh Sahib, Patiala, Amritsar, Moga

Table 4: District-wise Location Quotient of Rabi crops

District	Wheat				Barley				Total Pulses			
	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15
Ferozpur	0.97	1.02	1	0.99	1.68	1.93	2.22	1.61	1.10	1.09	1.33	1.04
Hoshiarpur	0.90	0.92	0.97	0.95	0.00	0.00	0.00	0.00	0.81	0.77	1.1	0.40
Sri Muktsar Sahib	1.02	1.02	0.99	1.05	2.18	1.86	1.51	1.61	0.93	0.87	0.54	0.32
Bathinda	1.01	0.99	1.02	1.03	2.18	1.49	2.36	1.29	0.74	0.85	0.71	0.64
Ropar	0.95	0.78	0.98	1.02	0.00	0.00	0	0.00	1.62	1.34	1.25	3.62
Mansa	1.03	1.02	1.04	1.02	1.90	2.29	1.8	1.95	0.56	0.61	0.65	0.20
Faridkot	1.05	1.04	1.03	1.04	0.97	0.00	0	0.00	2.16	0.98	1.24	0.29
Gurdaspur	1.02	1.03	1.01	1.02	0.00	0.00	0	0.00	0.84	1.33	1.96	2.28
Amritsar	1.02	1.02	1.03	1.03	0.00	0.00	0	0.00	1.17	1.10	1.11	2.01
Jalandhar	0.94	0.91	0.93	0.90	0.00	0.00	0	0.00	0.36	0.97	0.77	1.03
S.B.S. Nagar	0.94	0.93	0.91	0.93	0.00	0.00	0	0.00	0.34	0.16	0	0.00
Ludhiana	0.99	0.97	0.96	0.96	1.19	1.38	1.1	1.21	1.45	1.61	1.91	1.45
Fatehgarh Sahib	1.03	1.00	1.02	0.99	1.12	0.00	0	3.74	0.23	0.58	0	0.00
Moga	1.02	1.07	1.04	1.03	0.61	1.13	0	0.00	2.00	1.43	1.44	0.75
Sangrur	1.02	1.02	1.02	1.01	1.92	2.36	2.24	2.43	1.22	1.35	1.03	1.05
Kapurthala	0.99	0.93	0.9	0.91	0.00	0.00	0	0.00	0.17	0.10	0	0.00
Patiala	1.02	1.09	1.02	1.02	0.69	0.74	1.22	1.34	0.55	0.30	0	0.00

decline and remained only 1.61 and 1.29 for Sri Muktsar Sahib and Bathinda districts respectively during 2014-15. At the same time, the speciality of Fatehgarh Sahib district in barley crop firstly fell down from with a LQ value of 1.12 during 2000-01 to zero during 2005-06 and 2010-11 and after that went up to 3.74 implying that the district covers the proportionate area under barley crop 3.74 times more than the proportionate area in the entire state. Similarly, Faridkot district was found to be highly specialised in case of total pulses during 2000-01 while in 2014-15, the value of LQ declined to 0.29.

Similarly, Table 5 explains the district-wise specialisation of *kharif* crops with the help of LQ method. Rice is the dominant *kharif* crop and was

found to be grown in all the districts and due to this, no district was found to be very highly specialised in rice. However, Hoshiarpur, Bathinda, Ropar, Mansa, Ferozpur, Sri Muktsar Sahib and S.B.S. Nagar districts were found to be comparatively less specialised than state. In case of cotton crop, except Faridkot, all the South-west belt of Punjab comprising Ferozpur, Bathinda, Sri Muktsar Sahib and Mansa have been doing their best and due to this reason, the South-west belt of Punjab is also known as cotton belt. However, during 2014-15, with the fluctuations in LQ value, the performance of Bathinda and Mansa districts has grown up and that of the Sri Muktsar Sahib districts has come down. In Sri Muktsar Sahib district, the

Table 5: District-wise Location Quotient of *Kharif* crops

Districts	Rice				Cotton				Maize				Sugarcane				Bajra			
	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15
Ferozpur	0.84	0.82	0.81	0.87	2.11	2.30	2.13	2.08	0.00	0.00	0	0.00	0.59	0.11	0.13	0.19	0.00	0.00	2.96	0
Hoshiarpur	0.52	0.51	0.57	0.54	0.00	0.00	0	0.00	8.67	9.83	10.27	10.36	3.01	5.51	5.05	5.18	0.00	0.00	0	0
Sri Muktsar Sahib	0.63	0.51	0.71	0.83	3.38	3.71	3.37	2.78	0.33	0.00	0	0.00	0.59	0.21	0.26	0.00	0.00	0.00	0	0
Bathinda	0.53	0.51	0.54	0.58	4.38	3.84	4.31	4.69	0.09	0.00	0	0.11	0.00	0.00	0	0.00	2.82	2.84	0	0
Ropar	0.71	0.68	0.76	0.57	0.00	0.00	0	0.00	6.41	5.81	6.52	6.85	3.15	1.52	1.34	1.41	0.00	0.00	0	0
Mansa	0.70	0.57	0.59	0.61	3.60	3.55	3.92	4.29	0.00	0.00	0	0.00	0.20	0.00	0	0.00	4.33	4.35	7.17	0
Faridkot	1.11	1.01	1.11	1.15	0.95	1.45	0.96	0.75	0.00	0.00	0	0.00	0.53	0.37	0	0.00	0.00	0.00	0	0
Gurdaspur	1.18	1.13	1.13	1.09	0.00	0.00	0	0.00	1.25	1.39	1.34	1.12	2.42	3.95	4.7	4.66	0.00	3.16	0	0
Amritsar	1.18	1.27	1.22	1.19	0.04	0.02	0.02	0.00	0.29	0.19	0.15	0.08	0.85	0.68	0.41	0.41	0.00	0.00	0	0
Jalandhar	1.00	1.05	1.12	1.09	0.00	0.00	0	0.00	1.87	1.50	1.35	1.20	2.36	2.42	2.49	2.21	0.00	0.00	0	0
S.B.S. Nagar	0.83	0.83	0.88	0.84	0.00	0.00	0	0.00	4.73	5.16	4.67	3.39	4.55	3.75	3.08	2.73	0.00	0.00	0	0
Ludhiana	1.20	1.24	1.2	1.18	0.03	0.02	0.03	0.00	0.33	0.18	0.2	0.32	0.78	0.31	0.38	0.43	0.00	0.00	0	0
Fatehgarh Sahib	1.32	1.32	1.22	1.22	0.00	0.00	0	0.00	0.25	0.00	0	0.33	1.39	0.98	1.2	1.31	0.00	0.00	0	0
Moga	1.23	1.35	1.25	1.26	0.34	0.27	0.13	0.05	0.00	0.00	0	0.00	0.20	0.00	0	0.00	4.05	0.00	0	0
Sangrur	1.20	1.24	1.19	1.17	0.39	0.35	0.39	0.45	0.05	0.06	0	0.14	0.20	0.11	0.26	0.38	3.52	3.59	2.98	0
Kapurthala	1.19	1.18	1.22	1.18	0.00	0.00	0	0.00	0.73	0.59	0.45	0.69	1.25	1.38	1.25	1.24	0.00	0.00	0	0
Patiala	1.30	1.32	1.24	1.25	0.03	0.03	0.03	0.00	0.48	0.38	0.23	0.35	0.33	0.34	0.42	0.47	0.00	0.00	0	0

decline in the speciality in cotton crop is mainly due to the rise of the problem of waterlogging (rise of water level above critical level as well as rise of salinity in water). Over the entire period of time, the performance of maize crop has been remaining highest in Hoshiarpur and has been also increased from 8.67 during 2000-01 to 10.36 during 2014-15 indicates that this district occupies proportionate area under maize 10.36 times more than proportionate area under maize in the state. Besides Hoshiarpur district, Ropar and S.B.S. Nagar have also been doing their best in maize crop with 6.85 LQ value in Ropar and 3.39 in S.B.S. Nagar during 2014-15. Apart from maize crop, Hoshiarpur district also has highest specialisation in sugarcane crop among all the districts holding 5.05 LQ value during 2014-15 increased from 3.01 during 2000-01 followed by Gurdaspur district with a LQ value of 2.42 during 2000-01 and rose to 4.66 during 2014-15. Whereas during the same period of time, the specialisation of Ropar and S.B.S. Nagar districts

in sugarcane crop declined from 3.15 and 3.39 to 1.41 and 3.08 respectively. During 2014-15, the area under bajra crop declined almost to zero and therefore, during the period of 2000-01 to 2010-11, except Mansa, Sangrur and Ferozpur, in all other districts, the value of LQ was declined to zero. During 2000-01 to 2010-11, the concentration of Mansa district rose from 4.33 to 7.17 and Ferozpur district also performed well by uplifting its value from zero to 2.96. Value of LQ in Sangrur district fell down from 3.52 during 2000-01 to 2.98 during 2010-11.

Table 6 describes the district-wise specialisation of non-traditional crops such as fruits, vegetables and oilseeds with the help of LQ method. In case of fruits specialisation was found in Hoshiarpur district with 3.12 LQ value followed by Ferozpur district with 2.15 LQ value during 2000-01 while in 2014-15, Ferozpur district recorded highest specialisation with 3.40 LQ value and Hoshiarpur district shifted to the

Table 6: District-wise Location Quotient of Fruits, Vegetables and Total Oilseeds

District	Fruits				Vegetables				Total Oilseeds			
	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15	2000-01	2005-06	2010-11	2014-15
Ferozpur	2.15	2.46	3.06	3.40	0.30	0.38	0.45	0.46	1.48	1.66	0.87	1.06
Hoshiarpur	3.12	3.20	2.84	2.55	2.88	2.57	1.09	0.90	2.05	2.77	3.82	3.51
Sri Muktsar Sahib	1.62	1.56	1.68	1.57	0.47	0.33	0.32	0.17	0.90	0.60	0.39	0.46
Bathinda	0.91	0.95	0.85	0.84	0.76	1.22	0.98	0.66	1.05	1.21	0.56	0.62
Ropar	2.11	1.87	1.87	2.09	0.72	0.75	0.51	1.19	1.23	1.17	2.34	2.96
Mansa	0.19	0.21	0.31	0.28	0.14	0.22	0.25	0.21	0.93	1.09	0.85	0.93
Faridkot	0.57	0.67	0.62	0.56	0.38	0.26	0.27	0.43	0.71	0.30	0	0.00
Gurdaspur	1.28	1.08	0.98	0.96	0.47	0.24	0.35	0.35	1.26	0.91	1.12	1.19
Amritsar	0.74	0.62	0.52	0.46	0.98	0.55	0.88	0.94	1.44	0.82	0.88	0.88
Jalandhar	0.39	0.40	0.44	0.41	3.05	4.11	1.05	2.52	1.39	2.09	2.87	1.07
S.B.S. Nagar	0.54	0.62	0.68	0.71	1.17	1.44	2.17	2.12	1.18	1.75	2.23	1.95
Ludhiana	0.46	0.44	0.43	0.46	1.29	1.07	2.22	1.96	0.55	0.72	0.7	0.58
Fatehgarh Sahib	0.48	0.40	0.42	0.37	0.59	1.12	1.92	1.48	0.86	0.40	0	1.79
Moga	0.06	0.13	0.15	0.13	1.36	0.00	1.16	1.01	0.57	0.21	0.37	0.45
Sangrur	0.57	0.53	0.28	0.25	0.39	0.49	0.38	0.41	0.41	0.28	0.32	0.58
Kapurthala	0.18	0.23	0.21	0.11	2.62	3.82	4.17	3.87	0.74	1.52	1.41	0.95
Patiala	0.90	0.80	0.52	0.47	1.21	1.02	1.49	1.16	0.37	0.33	0.52	0.64

Table 7: District-wise specialisation in different crops during various years (Crops in descending order as per the magnitude of its location quotient (LQ > 1))

District	2000-01	2005-06	2010-11	2014-15
Ferozpur	Fruits, Cotton, Barley, Total oilseeds and Total pulses	Fruits, Cotton, Barley, Total oilseeds, Total pulses and Wheat	Fruits, Bajra, Barley, Cotton and Total pulses	Fruits, Cotton, Barley, Total oilseeds and Total pulses
Hoshiarpur	Maize, Fruits, Sugarcane, Vegetables and Total oilseeds	Maize, Sugarcane, Fruits, Total oilseeds and Vegetables	Maize, Sugarcane, Total oilseeds, Fruits, Vegetables and Total pulses	Maize, Sugarcane, Total oilseeds and Fruits
Muktsar	Cotton, Barley, Fruits and Wheat	Cotton, Barley, Fruits and Wheat	Cotton, Fruits and Barley	Cotton, Barley, Fruits and Wheat
Bathinda	Cotton, Bajra, Barley, Total oilseeds and Wheat	Cotton, Bajra, Barley, Vegetables and Total oilseeds	Cotton, Barley and Wheat	Cotton, Barley and Wheat
Ropar	Maize, Sugarcane, Fruits, Total pulses and Total oilseeds	Maize, Fruits, Sugarcane, Total pulses and Total oilseeds	Maize, Total oilseeds, Fruits, Sugarcane and Total pulses	Maize, Total Pulses, Total oilseeds, Fruits, Sugarcane, Vegetables and Wheat
Mansa	Bajra, Cotton, Barley and Wheat	Bajra, Cotton, Barley and Wheat	Bajra, Cotton, Barley and Wheat	Cotton, Barley and Wheat
Faridkot	Total pulses, Rice and Wheat	Cotton, Wheat and Rice	Total pulses, Rice and Wheat	Rice and Wheat
Gurdaspur	Sugarcane, Fruits, Total oilseeds, Maize, Rice and Wheat	Sugarcane, Bajra, Maize, Total pulses, Rice, Fruits and Wheat	Sugarcane, Total pulses, Maize, Rice, Total oilseeds and Wheat	Sugarcane, Total pulses, Total oilseeds, Maize, Rice and Wheat
Amritsar	Total oilseeds, Rice, Total pulses and Wheat	Rice, Total pulses and Wheat	Rice, Total pulses and Wheat	Total pulses, Rice and Wheat
Jalandhar	Vegetables, Sugarcane, Maize and Total oilseeds	Vegetables, Sugarcane, Total oilseeds, Maize and Rice	Total oilseeds, Sugarcane, Maize, Rice and Vegetables	Vegetables, Sugarcane, Maize, Rice, Total oilseeds and Total pulses
S.B.S. Nagar	Maize, Sugarcane, Total oilseeds and Vegetables	Maize, Sugarcane, Total oilseeds and Vegetables	Maize, Sugarcane, Total oilseeds and Vegetables	Maize, Sugarcane, Vegetables and Total oilseeds

Ludhiana	Total pulses, Vegetables, Rice and Barley	Total pulses, Barley, Rice and Vegetables	Vegetables, Total pulses, Rice and Barley	Vegetables, Total pulses, Barley and Rice
Fatehgarh Sahib	Sugarcane, Rice, Barley and Wheat	Rice and Vegetables	Vegetables, Rice, Sugarcane and Wheat	Barley, Total oilseeds, Vegetables, Sugarcane and Rice
Moga	Bajra, Total pulses, Vegetables, Rice and Wheat	Total pulses, Rice, Barley and Wheat	Total pulses, Rice, Vegetables and wheat	Rice, Wheat and Vegetables
Sangrur	Bajra, Barley, Total pulses, Rice and Wheat	Bajra, Barley, Total pulses, Rice and Wheat	Bajra, Barley, Rice, Total pulses and Wheat	Barley, Rice, Pulses and Wheat
Kapurthala	Vegetables, Sugarcane and Rice	Vegetables, Total oilseeds, Sugarcane and Rice	Vegetables, Total oilseeds, Sugarcane and Rice	Vegetables, Sugarcane and Rice
Patiala	Rice, Vegetables and Wheat	Rice, Wheat and Vegetables	Vegetables, Rice, Barley and Wheat	Barley, Rice, Vegetables and Wheat

Table 8: Crop Versatility Index during various time periods

Crops	2000-01	2005-06	2010-11	2014-15
Fruits	104.08	111.02	137.03	152
Vegetables	77.53	96.98	76.3	74.75
Rice	63.23	65.85	60.68	60.44
Wheat	51.37	51.5	50.72	50.5
Maize	170.07	191.37	202.21	199.69
Bajra	199.95	199.95	222.76	0
Barley	123.44	137.52	148.34	133.24
Total pulses	74.87	76.52	88.45	108.38
Total oilseeds	74.31	79.06	80.79	65.77
Sugarcane	81.06	135.9	143.7	143.05
Cotton	169.97	166.07	171.29	177.37

second rank with 2.55 LQ value. During 2000-01, the performance of Jalandhar was best in vegetables with 3.03 LQ value followed by Hoshiarpur district with 2.88 LQ value and Kapurthala with 2.62 LQ value. But over the period of time, the performance of Kapurthala district improved for vegetables with 3.87 LQ value, however, its performance declined in case of Jalandhar and Hoshiarpur districts with 2.52 and 0.90 LQ values, respectively. Hoshiarpur district also found to be specialised in oilseeds cultivation among all the districts holding 3.51 LQ value during 2014-15 increased from 2.05 during 2000-01 followed by Ropar district with a LQ value of 1.23 during 2000-01 that increased to 2.96 during 2014-15.

On the basis of preceding analysis the districts were classified according to specialization in different crops during four periods between years 2000-01 to 2014-15 and reported in Table 7. Out of the total 17 districts in the state, only four acquire specialization in cotton and maize each in all the four periods. Further, seven districts obtained specialization in

sugarcane and barley each in 2014-15.

Table 8 contains the versatility index for major crops grown in Punjab. It is observed that wheat (51.37) is more versatile crop followed by rice (63.23), pulses and oilseeds (around 74 each) and vegetables (77.53) during 2000-01. Bajra (199.95) and maize (170.07) are less versatile crops and grown in the specific regions of the state. Bajra is more region specific during 2010-11 reflected by its versatility index value (222.76). Further, during 2014-15, wheat (50.5), rice (60.44) and oilseeds (65.77) are versatile crops grown in wider areas while, maize (199.69) and cotton (177.37) are more region- specific crops grown in the specific areas of the state. The analysis shows that wheat, rice, oilseeds and vegetables are more versatile crops as compared to maize, cotton, fruits and sugarcane in state.

The district versatility results for different time periods are presented in Table 9. The analysis of table reveals that Hoshiarpur district (151.48) is

Table 9: District Versatility Index during different time periods

District	2000-01	2005-06	2010-11	2014-15
Ferozpur	177.48	172.08	119.40	175.15
Hoshiarpur	154.68	144.53	154.88	151.48
Muktsar	173.56	171.67	171.04	182.17
Bathinda	174.85	168.94	175.22	176.34
Ropar	167.38	148.69	165.61	163.28
Mansa	177.42	172.22	177.2	173.81
Faridkot	195.34	184.39	196.75	202.78
Gurdaspur	195.72	190.59	194.41	195.01
Amritsar	204.22	201.44	205.41	206.44
Jalandhar	182.29	169.18	184.95	181.02
S.B.S. Nagar	169.33	158.93	163.42	164.88
Ludhiana	203.97	193.84	196.16	197.36
Fatehgarh Sahib	207.38	203.15	205.03	203.00
Moga	202.79	213.67	209.69	213.22
Sangrur	205.19	199.02	202.8	201.53
Kapurthala	198.73	183.09	190.51	191.07
Patiala	208.30	212.66	206.12	209.44

more versatile amongst all the districts which imply that more number of crops grown in the district during entire period under analysis. However, Patiala district (208.30) is less versatile district implying less number of crops are grown in district during 2000-01 while in 2014-15, Moga is less versatile district with 213.22 district versatility value and Patiala became the second less versatile district with 209.44 versatility value. The versatility index for districts viz. Moga, Patiala, Muktsar, Bathinda, Amritsar and Faridkot showed the increasing trend that implies that these regions are moving towards specialization. Thus, the results suggest that in these districts, there is essential need for crop diversification.

CONCLUSION

The performance of all the districts of Punjab growing various crops has been assessed through ICD, LQ, Crop Versatility Index and District Versatility Index over the period of 2000-01 to 2014-15. The study reveals that the area under two crops i.e. wheat-rice grew from 30 per cent during 1950-51 to above 80 per cent during 2014-15. The reasons behind increasing preference of wheat-rice monoculture among Punjab farmers are assured irrigation facilities and regulated market along Minimum Support Price by the Government

of India. Hoshiarpur and Ropar are only two districts that recorded a higher index of crop diversification during 2005-06. In case of barley crop, the specialisation was found to be highest in Sri Muktsar Sahib and Bathinda districts during 2000-01 with value of LQ to be more than two but over a period of time in 2014-15, the specialisation of these two districts started decline and the value LQ remained only 1.61 and 1.29, respectively. Hoshiarpur district was also found to be the highest specialised in oilseeds cultivation among all the districts holding 3.51 LQ value during 2014-15. Further, during 2014-15, wheat (50.5), rice (60.44) and oilseeds (65.77) were found to be the versatile crops grown in wider areas while, maize (199.69) and cotton (177.37) were more region-specific crops grown in the specific areas of the state. The district versatility results revealed that Hoshiarpur (151.48) is the more versatile district while Moga (213.22) is the less versatile district during 2014-15. Thus, there has been a move towards specialization rather than crop diversification in the state. Further, the government's strategy of shifting area out of wheat-rice does not seem to be working effectively in the state. The Punjab government should enhance region-specific diversification on basis of district specialization along with infrastructure such as processing firms, cold stores etc. and assured

marketing of new crops through contract farming and supermarkets procurement.

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