

Spatial Analysis of Cropping Pattern in Malwa Region of the Indian Punjab

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ABSTRACT

The present paper spatially analysis the cropping pattern in Malwa region of the India Punjab by using secondary sources of data i.e. from 2000-2001 to 2010-2011. Districts has been selected as a spatial unit of the present study. The study yields some interesting findings is that the cropping pattern of the study area had drastically changed. It has been observed that the traditional crops of the region have shifted to modern paddy crops specially to rice and wheat during the one decade. Choropleth maps clearly depicting the shifting nature of these crops i.e. wheat, rice, cotton and oil seeds in this paper. The spatial variability of these crops was affected by many local factors like climatic conditions, relatively high preference to particular crop, irrigation facilities, types of relief, etc. But the emergence of rice in Malwa region during this period was one of the key factors in this regard which will have several socio-economic and environment consequences.

KEYWORDS: *Cropping pattern, Malwa region, Traditional crops, Paddy crops*

INTRODUCTION

With the passage of time, India has nearly achieved a break-through in agricultural production and self-sufficiency in food grains production. However, the green revolution has been confined to few states like Punjab, Haryana, Western Uttar Pradesh and some districts of Andhra Pradesh and Tamil Nadu. Meanwhile this agricultural development has generated a heated debate among the economists and other social scientists with a view to evaluating the impact of green revolution on local environment (Randhawa, 1977). Indian Punjab was not exception in this regard. As a result, many scholars from the state gives their valuable contribution in this respect because of having the agricultural relevance of the study area.

Punjab is the Food Basket of India. Livelihood of the people of Punjab depends upon the agricultural activities. Historically, the state was largely confined to growing the traditional crops but gradually they shifted to modern types of crops which diversified across the region. People of the region highly depends upon the alternative crops like wheat and paddy. But

with the passage of time, rotation of these crops gives birth to many socio-economic problems in the state. Although these crops might have contributed in economic prosperity in Punjab for a few decades but they have now brought in a socio-economic-ecological crisis to the famers of Punjab and to the state itself (Mann, 2017). With this view in mind, the local government projecting the diversification policy as a panacea for solving Punjab's current agrarian problems to encourage the farmers to shift to other crops. In view of this confusion, the question of wheat and paddy cultivation and diversification of cropping pattern needs to be examined in a holistic political economic framework to find out the optimal cropping pattern for the study area. The present study is limited to the one geographical traditional region i.e. *Malwa* region because in comparison to the other both regions *Majha* and *Doaba* it is the largest (65.2 percent area of the state), relatively feudal, relatively low socio-economic levels and semi-arid region of the state. In this way it is necessary to examine the spatial variations in cropping pattern of this most attractive region of the state (Map 1).

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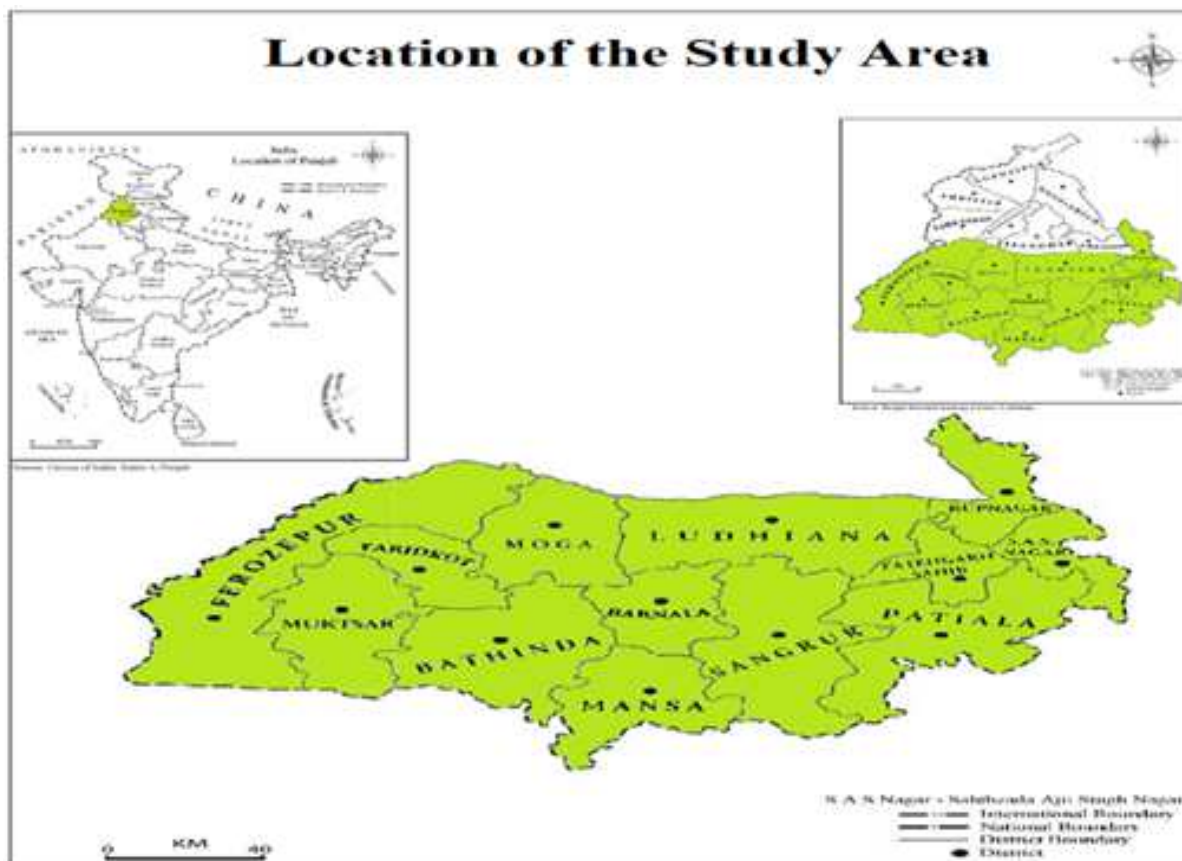
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Map 1**OBJECTIVES OF THE STUDY**

1. To know the spatial variations in cropping pattern.
2. To find out the problems and factors responsible for existing the cropping pattern.
3. To know the certain type of crop dominant in the region.

SOURCES OF DATA

The present study is based on secondary data which is collected from various sources i.e. Statistical Abstracts of Punjab, books, journals and government reports. For deriving the results, maps and tables are prepared. Cartographic techniques are applied for mapping results.

MAJOR CROPPING PATTERNS IN THE MALWA REGION

Cropping Pattern express the share of different cultivated area in a total agricultural year. It is an important indicator of farmer's decision-making ability witness dynamic other space and time in responsible to change in physical and socio-economic factor. Cropping pattern of a region may show a shift from traditional varieties of crops to new high yielding varieties of crops, which are relatively more remunerative than the earlier ones, or some new crops may also be introduced in the existing cropping pattern (Dhindsa and Sharma, 1995, p.70). In the Malwa belt, there are different cropping pattern in different season. But the rice, cotton, wheat and oil-seeds crops are under analysis in this paper.

Spatial Patterns of Wheat Cultivation (2000-2001 to 2010-11)

In 2000-2001, out of all the 13 districts of the study area, the highest area (393 thousand hectare) under wheat cultivation was recorded in Sangrur closely followed by Ferozpur (378 thousand hectare), Patiala (261 thousand hectare), Ludhiana (258 thousand hectare) and Bathinda (243 thousand hectare). After one decade in 2010-11, Ferozpur district reported highest area (397 thousand hectare) under wheat cultivation closely followed by Sangrur (287 thousand hectare), Ludhiana (257 thousand hectare), Bathinda (253 thousand hectare) (Table 1).

To examine the spatial patterns of wheat cultivation during this period the study area can be classified into following three categories:

1. Areas with relatively high percent of wheat cultivation (above 10 percent);
2. Areas with moderate percent of wheat cultivation (between 5-10 percent);
3. Areas with relatively low percent of wheat cultivation (below 5 percent).

Table 1: Area under Wheat Crop

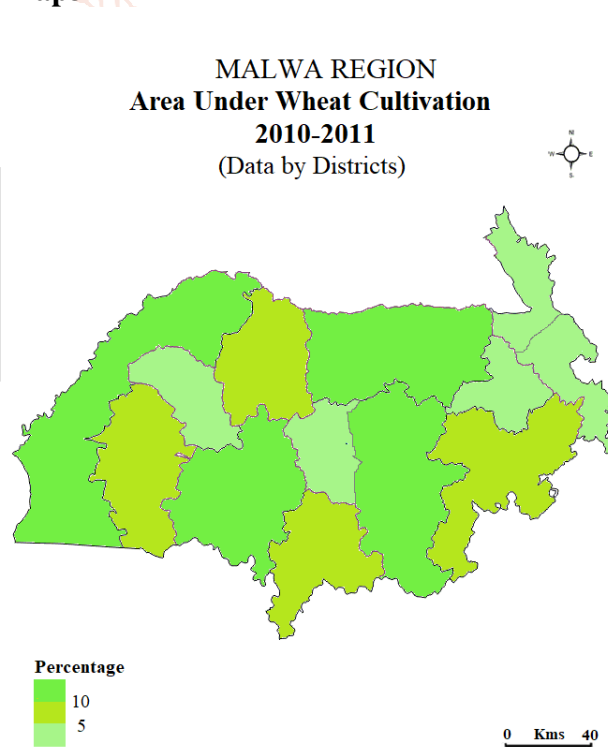
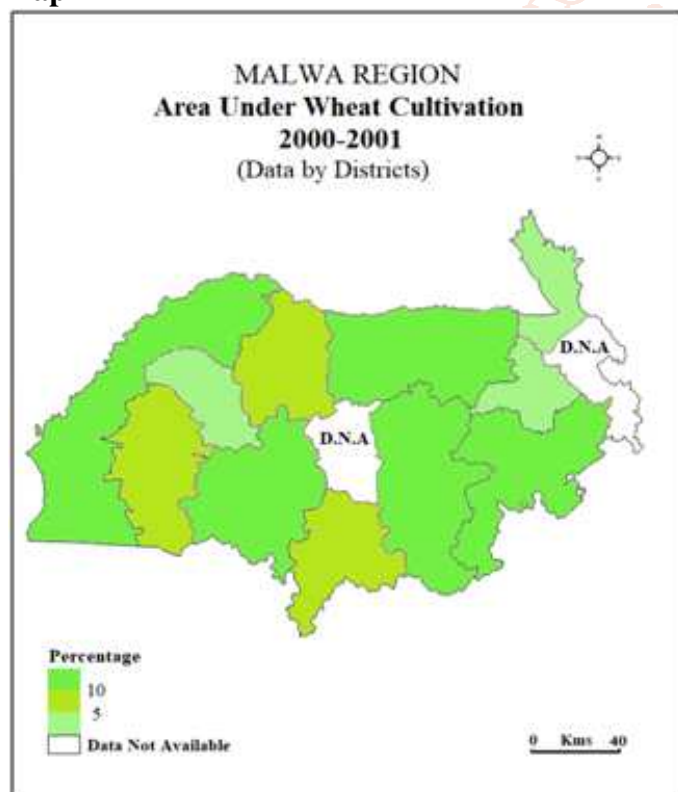
Name of District	2000-2001		2010-11	
	Area in 000's Hectare	Percent of Wheat to the Total cropped area	Area in 000's Hectare	Percent of Wheat to the Total cropped area
Sangrur	393	16.30	287	11.93
Firozpur	378	15.68	397	16.51
Patiala	261	10.82	236	9.81
Ludhiana	258	10.70	257	10.69
Bathinda	243	10.08	253	10.52
Muktsar	189	7.84	192	7.98
Moga	172	7.13	177	7.36
Mansa	163	6.76	170	7.07
Faridkot	111	4.60	117	4.86
Fatehgarh Sahib	86	3.56	85	3.53
Rupnagar	86	3.56	65	2.70
Barnala	D.N.A*	D.N.A*	115	4.78
S.A.S Nagar	D.N.A*	D.N.A*	53	2.20

Source: Statistical Abstract of Punjab, 2001, 2012.

D.N.A denotes to data not available.

Map 2

Map3



I. Areas with relatively high percent of wheat cultivation (above 10 percent):

In 2000-2001, five districts (38 percent) of the Malwa region recorded relatively high percent wheat cultivation. Out of these, highest percent (16.30 percent) of wheat cultivation was reported by Sangrur district closely followed by Firozpur (15.68 percent), Patiala (10.82), Ludhiana (10.70 percent) and Bathinda (10.08 percent). Ten years later (2010-2011), the number of districts had further decreased to four which showed relatively high percent of wheat cultivation. Firozpur district was occupied the top position in this regard by recording 16.51 percent followed by Sangrur (11.93 percent), Ludhiana (10.69 percent) and Bathinda (10.52 percent) (Table 1).

It has been observed that mostly central and southern parts of the study area emerged with relatively high percent of the wheat cultivation during the whole study period (Map 2 and 3). It is worthwhile to mention here that Ludhiana district is a home of the largest agricultural university in Asia and one of the largest in the world i.e. Punjab Agricultural University. Secondly, the wheat crop productivity was very high in this district which

has been achieved with assured irrigation, use of HYV seeds with the help of Punjab Agricultural University, Ludhiana, GADVASU, Department of Agriculture and other agencies (Grover et al, 2017). Additionally, farmers of this district had preferred wheat to grams cultivation because it gives maximum and assured returns than grams. Consequently, surrounding districts also comes under the impact of this area which ultimately leads these areas to high wheat cultivation.

II. Areas with moderate percent of wheat cultivation (between 5-10 percent):

This category includes three districts of the study region namely, Muktsar (7.84 percent), Moga (7.13 percent) and Mansa (6.76 percent) which were registered moderate percent of wheat cultivation in 2000-2001. After ten years in 2010-11, total four districts namely, Patiala (9.81%), Muktsar (7.98%), Moga (7.36) and Mansa (7.07%) were lie in this category (Table 1). Main reasons for moderate wheat cultivation in these are having traditional methods for agricultural, water logging problems in these areas, relatively high preference for rice cultivation and relatively less developed infrastructure. Therefore, these areas were covers under moderate category.

III. Areas with relatively low percent of wheat cultivation (below 5 percent):

Out of all the districts of the study region, three districts recorded relatively low percent of wheat cultivation in 2000-2001. Rupnagar and Fatehgarh Sahib districts reported lowest percent (3.56 percent) of wheat cultivation in the study area followed by Faridkot (4.60 percent). The study reveals some interesting findings is that over the time (2010-11) the number of districts had been increased to five which recorded relatively low percent of wheat cultivation (Table 1). Faridkot district was occupied the top position in this regard by acquired 4.86 percent value. Most of these areas are sandy and hilly in nature (Map 2 and 3). In this way, people of these area have relatively less preference for growing wheat due to have different relief features. On the other hand, the areas along the capital of the state Chandigarh were also comes under this lowest category because the commercial activities are practices here and most of the people indulge in it which ultimately leads the area to relatively low percent of wheat cultivation (ENVIS, 2017).

Spatial Patterns of Rice Cultivation (2000-2001 to 2010-11)

For examine the spatial patterns of rice cultivation the study area has been classified into following three categories:

1. Areas with relatively high percent of rice cultivation (Above 10 percent);
2. Areas with moderate percent of rice cultivation (between 5-10 percent);
3. Areas with relatively low percent of rice cultivation (below 5 percent).

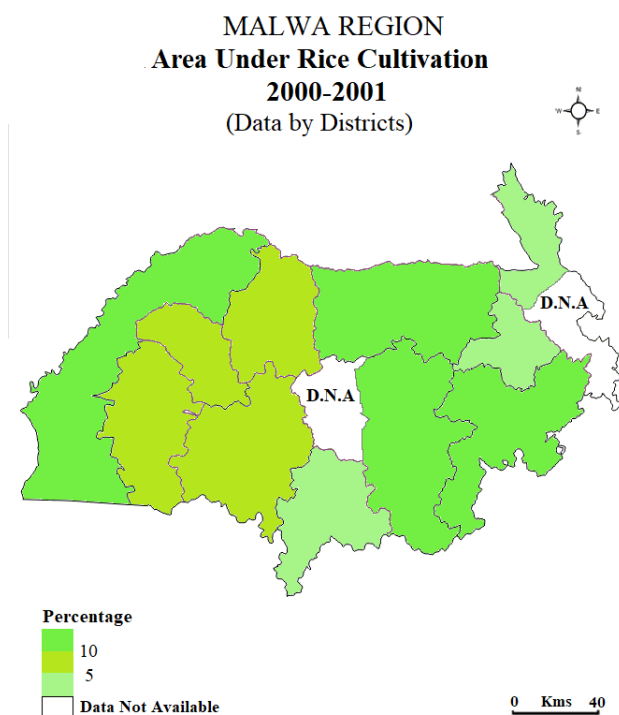
Table 2: Area under Rice Crop

Name of District	2000-2001		2010-11	
	Area in 000's Hectare	Percent of Rice to the Total cropped area	Area in 000's Hectare	Percent of Rice to the Total cropped area
Sangrur	357	20.36	272	14.68
Ferozpur	248	14.14	258	13.93
Patiala	256	14.60	234	12.63
Ludhiana	238	13.57	257	13.87
Bathinda	99	5.64	107	5.77
Muktsar	89	5.07	111	5.99
Moga	159	9.07	172	9.28
Mansa	84	4.79	78	4.21
Faridkot	90	5.13	101	5.45
Fatehgarh Sahib	84	4.79	82	4.42
Rupnagar	49	2.79	38	2.05
Barnala	D.N.A*	D.N.A*	105	5.66
S.A.S Nagar	D.N.A*	D.N.A*	37	1.99

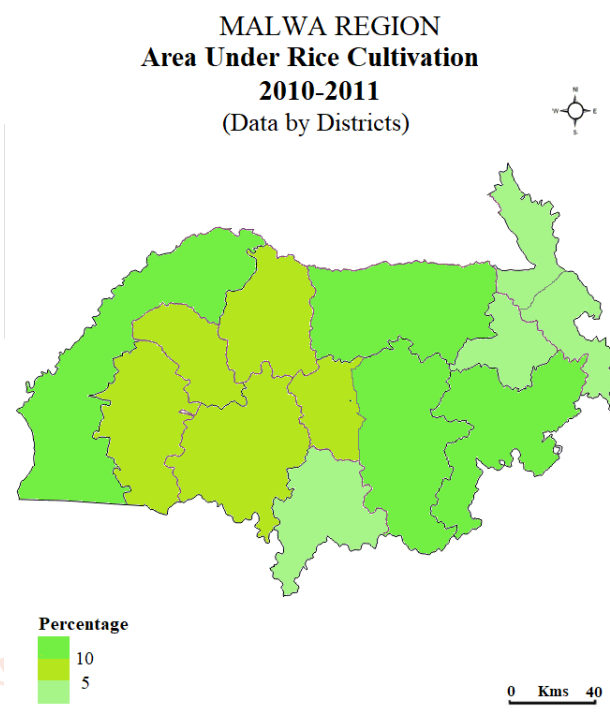
Source: Statistical Abstract of Punjab, 2001, 2012.

D.N.A denotes to data not available.

Map 4



Map 5



I. Areas with relatively high percent of rice cultivation (above 10 percent):

As per 2000-2001 data, only four districts (31 percent) of Malwa region appeared with relatively high percent of rice cultivation. Out of these, Sangrur district recorded highest percent (20.36 percent) of rice cultivation in the study region followed by Patiala (14.60 percent), Firozpur (14.14 percent) and Ludhiana (13.57 percent). Most of the areas of this category belonged to the north, central and south-eastern parts of the study region (Map 4). Ten years later in 2010-2011, the number of the districts which recorded relatively high percent of rice cultivation had remained the same (Table 2).

It has been noted that there are several key factors which are responsible for relatively high cultivation of rice among these areas are; availability of favourable relief, well-developed sources of irrigation, well network of transport, developed agricultural infrastructure and having large number of rice mills (Singh and Kalra, 2002).

II. Areas with moderate percent of rice cultivation (between 5-10 percent):

Four districts of the region namely, Moga (9.07 percent), Bathinda (5.64 percent), Faridkot (5.13 percent) and Muktsar (5.07 percent) have moderate cultivation of rice in 200-2001. In 2010-2011, this number of the areas was increased to five under this category (Table 2). One very shocking finding comes out of an analysis is that these are the semi-arid areas of the study region which are not suitable for rice cultivation. Because the rice is a predominately crop of wet areas but despite these areas of the region are rapidly adopted this crop (Kumar and Sidana, 2019). The scenario of rotation of crops by rice cultivation among these semi-arid areas give birth to many severe socio-economic and environmental problems.

III. Areas with relatively low percent of rice cultivation (below 5 percent):

About 23 percent districts of the study area showed relatively low percent of rice cultivation in 2000-2001. Rupnagar district recorded lowest percent (2.79 percent) of rice cultivation followed by Mansa and Fatehgarh Sahib with 4.79 percent value. After one decade, four district of this region namely, Rupnagar, Mansa, Fatehgarh Sahib and S.A.S Nagar reported relatively low percent of rice cultivation (Table 2).

Main reasons for the low cultivation of rice in these areas are having Sandy and Kandi soil and relatively high preference of the farmers to cotton crop especially in Mansa district.

Spatial Patterns of Cotton Cultivation (2000-2001 to 2010-11)

Cotton is an important fiber crop and is very sensitive plant also. From acreage point of view, it is the third largely growing and the second most important Kharif crop of the State. Punjab is well known for its higher yield and superior quality of American (*Narma*) cotton in the country. Cotton is produced in the central and western districts of Malwa. Surprisingly, almost no cotton was produced in the eastern districts- Rupnagar,

Fatehgarh Sahib and S.A.S Nagar. South-western semi-arid districts produce most of the cotton of Malwa in Punjab. Malwa region produce nearly 99.8% cotton of Punjab. To analysis the spatial variability in of the cotton crop the study has been divided into following three categories:

1. Areas with relatively high percent of cotton cultivation (Above 10 percent);
2. Areas with moderate percent of cotton cultivation (between 5-10 percent);
3. Areas with relatively low percent of cotton cultivation (below 5 percent).

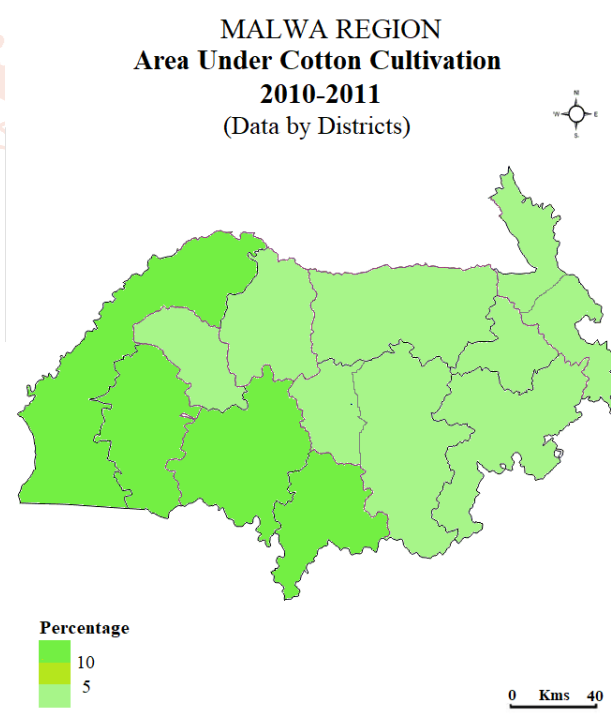
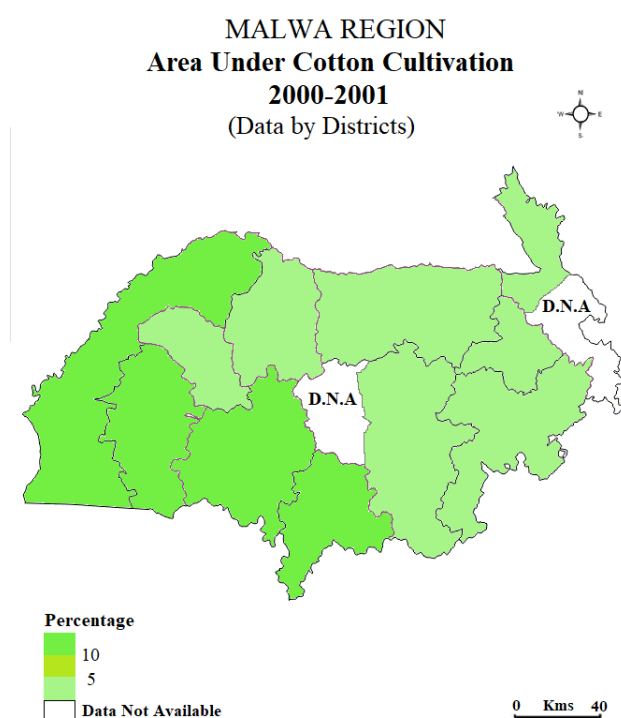
Table 3: Area under Cotton Crop

Name of District	2000-2001		2010-11	
	Area in 000's Hectare	Percent of Cotton to the Total cropped area	Area in 000's Hectare	Percent of Cotton to the Total cropped area
Sangrur	6.0	1.67	09	1.91
Firozpur	98.0	27.37	114	24.30
Patiala	0.1	0.02	09	1.91
Ludhiana	0.1	0.02	01	0.21
Bathinda	114.7	32.03	145	30.91
Muktsar	71.8	20.05	88	18.76
Moga	2.2	0.61	03	0.63
Mansa	56.7	15.83	86	18.33
Faridkot	8.4	2.34	14	2.98
Fatehgarh Sahib	0	0	0	0
Rupnagar	0	0	0	0
Barnala	D.N.A*	D.N.A*	06	0.80
S.A.S Nagar	D.N.A*	D.N.A*	0	0

Source: Statistical Abstract of Punjab, 2001, 2012.
D.N.A denotes to data not available.

Map 6

Map 7



I. Areas with relatively high percent of cotton cultivation (above 10 percent):

About 27 percent districts of the study area emerged with relatively high percent of cotton cultivation in 2000-2001. Highest contribution (32.03 percent) in this respect was given by Bathinda district followed by Firozpur

(27.37 percent), Muktsar (20.05 percent) and Mansa (15.83 percent). After one decade in 2010-11, again the same districts registered in this category (Table 3). These areas are relocated in the semi-arid zone which lies on eastern and south-eastern sides of the study region (Map 6 and 7). It is important to mention here that not any other area of this region enter into relatively high percent of category even after ten years.

The most important factor for cotton cultivation is owing to pedological and climatic conditions among these semi-arid areas. Moreover, these were also traditionally cotton growing areas of the study region (Kumar and Sachdeva, 2016).

II. Areas with moderate percent of cotton cultivation (5-10 percent):

One bitter truth comes out of an analysis is that not even a single district of the study area reported moderate percent of cotton cultivation during this one decade (2000-2001 to 2010-2011) (Map 6 and 7). It is very shocking to note out that the nature of cropping pattern of these areas was gradually changed to paddy crops especially to rice.

III. Areas with relatively low percent of cotton cultivation (below 5 percent):

About one-third areas of Malwa region recorded relatively low percent of cotton cultivation in the initial financial year of the study period (2000-2001). Both Ludhiana and Patiala districts showed the lowest percent (0.02 percent) of cotton cultivation followed by Moga (0.61 percent), Sangrur (1.64 percent) and Faridkot (1.34 percent). Ten years later (2010-2011), almost same number of districts were found in this category (Table 3).

Factor affecting for the low cultivation of the Cotton in these areas is due to highly preference to Rice. Here farmers were grown bajra, pulses and oilseeds which fetched more economic returns to them as compared to cotton.

Spatial Patterns of Oilseeds Cultivation (2000-2001 to 2010-11)

Rapeseed and Mustard, Sunflower, Sesamum, Groundnut and Linseed are the important oil seeds produced in the state. Though the area under oil seed crops as compared to cereal crops is very small but in terms of area undervarious groups of crops, oilseeds come next only to cereal and cotton. Oil seeds crops are also cultivated in Malwa region but their percent of cultivation has been decreased with space and time. So, to examine the spatial distribution of oilseeds cultivation the region may be classified into following categories:

1. Areas with relatively high percent of oilseeds cultivation (above 10 percent).
2. Areas with moderate percent of oilseeds cultivation (between 5-10 percent).
3. Areas with relatively high percent of oilseeds cultivation (below 5 percent).

Table 4: Area under Oilseeds Crops

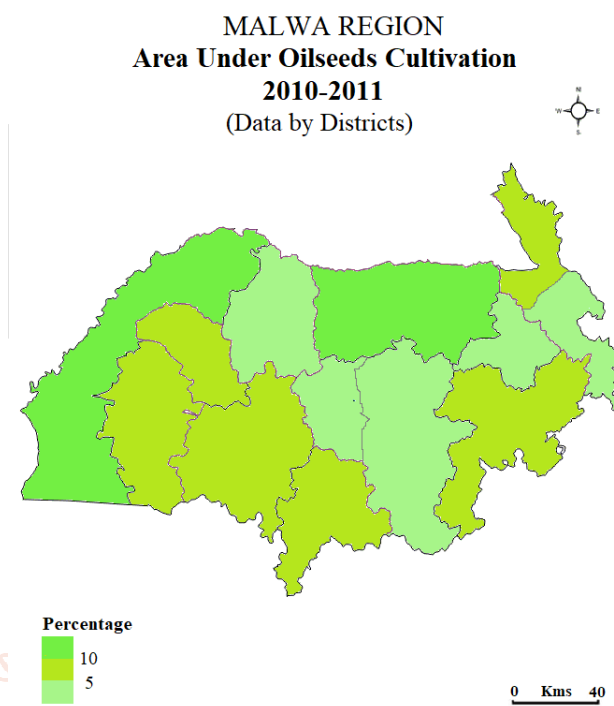
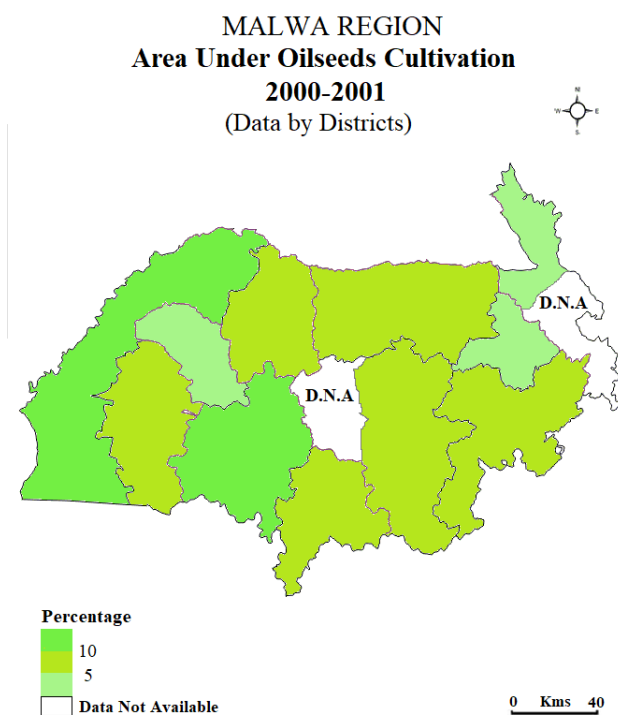
Name of District	2000-2001		2010-11	
	Area in 000's Hectare	Percent of Oilseeds to the Total cropped area	Area in 000's Hectare	Percent of Oilseeds to the Total cropped area
Sangrur	4	8.51	1	4.34
Ferozpur	14.4	13.63	5.5	23.09
Patiala	2.4	5.10	1.9	8.26
Ludhiana	3.6	7.65	2.9	23.91
Bathinda	6.4	13.61	2.1	9.13
Muktsar	4.2	8.93	1.2	5.21
Moga	2.4	5.10	1	4.34
Mansa	3.7	7.80	2.2	9.56
Faridkot	1.9	4.04	1.9	8.26
Fatehgarh Sahib	1.8	3.82	0	0
Rupnagar	2.7	5.74	2.2	9.56
Barnala	D.N.A*	D.N.A*	0	0
S.A.S Nagar	D.N.A*	D.N.A*	0	0

Source: Statistical Abstract of Punjab, 2001, 2012.

D.N.A denotes to data not available.

Map 8

Map 9



I. Areas with relatively high percent of oilseeds cultivation (above 10 percent):

Unfortunately, only two districts of the study area namely, Firozpur (13.63 percent), Bathinda (13.61 percent) reported relatively high percent of oilseeds cultivation in 2000-2001. After one decade, Ludhiana district emerged with highest percent (23.91 percent) of oilseeds cultivation followed by Firozpur (23.09 percent). It is significant to mention here that Bathinda district had not been a member of this category for a long time. Oilseed's cultivation percent of this district had been decreased by 4.48 percent (Table 4). Map 8 and 9 depicts that in 2000-2001 the semi-arid areas of the study region mainly contributed to oilseeds cultivation by high percentage share. But after ten years these areas were escape from the map and gives more preference to rice cultivation.

In Firozpur district the main reasons for high oilseeds cultivation are; (i) Arid and Semi-arid climate, (ii) loamy good soils and, (iii) ample irrigation facilities are some key factors which are favourable in this respect.

II. Areas with moderate percent of oilseeds cultivation (between 5-10 percent):

Seven districts of this region recorded moderate percent of oilseeds cultivation in the years of 2000-2001. Top position was occupied by Muktsar district by recording 8.93 percent. After one decade, six districts appeared with moderate percent of oilseeds cultivation. Mansa and Rupnagar districts possessed the highest rank in this regard by reporting the same value 9.56 percent (Table 4). It is interesting to note that firstly moderate oilseeds cultivation areas were located in the north, central and south-eastern parts of the study region but with the passage of time the areas who belong to this category emerged from south, south-western and eastern parts of the region (Map 8 and 9). The study gives crystal clear indication that the cropping culture of these areas are rapidly shifted from traditional crops to modern crops specially to rice cultivation.

Additionally, relatively Sandy loam soils, moderate rainfall and extension of irrigation facilities are the responsible factors for moderate percent of oilseeds cultivation in these areas.

III. Areas with relatively low percent of oilseeds cultivation (below 5 percent):

In 2000-2001, only two districts of Malwa region showed relatively low percent of oilseeds cultivation. Fatehgarh Sahib district recorded the lowest percent (3.82 percent) in this regard followed by Faridkot (4.04 percent). In 2010-2011, again same districts had an unfortunate percentage of oilseeds cultivation. Unfortunately, three districts out of all the districts of the study area have no cultivation of any oilseed (Table 4). It has been pointed out that these areas are also rapidly shifted to paddy cultivation. Secondly uneven topography of some western areas of the region is also contribute to low percent of oilseeds cultivation.

SUMMING UP

The study clearly indicates that the cropping pattern of the study region has been dynamic in nature. It has been observed that the cropping culture has totally shifted from local traditional crops to consumeristic crops like wheat and rice. Data reveals some interesting findings is that the areas of having relatively high percent cotton and oilseeds cultivation rapidly shifter to the paddy crops. The production and area under wheat and rice cultivation has increased with space and time. Those areas who were recorded lowest percent of cotton and oilseeds cultivation in the initial year of the study period losing their traditional identity of growing these crops after one decade. The people of these areas now grow the rice crop even despite having semi-arid climatic conditions. The level of rice had increased almost in all the districts. It gives birth to many socio-environmental problems in the society like impact on ground water table especially among the semi-arid zone, depletion of ground water quality, impact on food nutritional levels due to excess use of chemical fertilizers for growing rice in semi-arid areas, etc. It has been concluded that the study area has reported high spatial variability in terms of cropping pattern which emerged with time. Cropping pattern of Malwa region has under rapid changing and it may would disturb the stability of the study area in many ways i.e. socially, economically and environmentally.

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