

Ecology of Changing Cropping Pattern in Bharmaur Tribal Area of Himachal Pradesh

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KEYWORDS Cropping Pattern. Changes. Spatial Variations

ABSTRACT With the fast increasing population, the land – man ratio is decreasing fast in Himachal Pradesh. Undoubtedly, land is the most prominent resource endowment in the agricultural economy of the tribal areas in the state. Bharmaur being a hilly region has lesser proportion of area available for cultivation. The present study is based on secondary data of sample villages spread across four Valleys of Bharmaur region. An attempt has been made to analyse the changes in cropping pattern of Bharmaur tribal area over the period 1974-77 to 1998-01. The study reveals that Gaddis have changed their traditional cropping pattern from cultivating local cultivars to the more remunerative crops. This change is more discernible in case of cereals and plantation crops. The apple (*Pyrus mallus*) cultivation has diffused along valley slopes during the recent study period. The area under this fruit in sample villages was merely 0.32 per cent of total cropped area in 1974-77 which increased to 4.29 per cent during 1998-01. Some of the traditional kharif crops namely kodra (*Paspalum scrobiculatum*), chinae (*Panicum miliaceum*) and bhrace (*Fagopyrum esculentum*) grown during mid 1970s have now been replaced by cash crops namely – rajmah (*Phaseolus vulgaris*) and urd (*Phaseolus radiatus*). In case of rabi crops, wheat (*Triticum aestivum*) is the staple food crop. But the cultivation of barley (*Hordeum vulgare*) has recorded a decline. The study shows that there are significant spatial variations in cropping pattern during both the periods under discussion.

INTRODUCTION

Bharmaur tribal area comprising Bharmaur tehsil, is situated in Chamba district in the north western part of Himachal Pradesh. It is one of the notified tribal areas of the state and is largely inhabited by the Gaddi tribal community. Having a low resource base and fragile ecosystem, Bharmaur supports only 37230 persons i.e. 20 persons per sq km (Census of India, 2001). Having very unfavourable climate, peculiarly cold and dry, poor geographical accessibility and lack of basic infrastructural facilities, Bharmaur is still one of the backward regions in the state. Cultivation of crops in the region is mainly confined between 1500m and 3700m above mean sea level. The slope is considerable for the greater part and in many places it is too steep for average agriculture (Bhasin and Bhasin, 1993). Thus being a hilly region, Bharmaur has a very small proportion of area available for cultivation. The cultivation of crops is largely restricted to the suitable sites in the river valleys. Its further extension along the steep slopes is likely to create environmental hazards such as land slides and destruction of vegetal cover.

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The Integrated Tribal Development Project (ITDP) initiated in 1974 in this tribal region is aimed at socio-economic development (Hasnain, 2001). One of its main objectives is also to transform the subsistence agricultural economy. The changing cropping pattern in favour of remunerative crops and declining strength of traditional crops may be taken as an indicator of economic development. The study of cropping pattern in relation to agro-climatic conditions helps the planners and decision makers to evolve a suitable and scientific crop policy. The changing cropping pattern also indicates the path of development undertaken in this agriculturally backward hilly region. Introduction of the alien crops may also influence the fragile ecosystems of the region and thereby the sustainability of agricultural development.

Objectives of Study

The present study is aimed at realising the following objectives:

1. To examine the changes in cropping pattern during last quarter of 20th century, i.e. since the introduction of ITDP.
2. To study the spatial variations in cropping pattern in relation to diverse agro-ecological conditions and geographical accessibility of various areas.

MATERIAL AND METHODS

The present study has been undertaken with reference to two trienniums. The first period of reference is 1974-77. This is the time when tribal sub-plan was introduced. The second triennium selected for the present study is 1998-01, the latest period for which secondary data are available. The data of cropping pattern are presented as triennium averages of above mentioned periods so as to neutralise the influence of inter-annual fluctuations of climatic factors on cropping pattern. The present study is based on the data collected from sixteen sample villages located across four physiographic regions in Bharmaur. The sample villages have been selected randomly from different elevation zones in each area. The

data relating to area under different crops have been collected from Lal Kitab and Khasra Girdawari. The changes in cropping pattern have shown by comparing the tables and with the help of pie-diagrams.

Ecological Setting of Study Area: Bharmaur Tehsil of Chamba district is located between 32°11'N and 32°41'N and 76°22'E and 76°53'E (Fig. 1). Spreading over the area of approximately 1818 sq km, Bharmaur has a mountainous topography having the altitudinal variation from 1350m to 5935m above mean sea level (Government of Himachal Pradesh, 1984).

The river Ravi, in its infancy, passes through Bharmaur. It rises from Bara-Banghal, a remote corner of Kangra district, and a part of Bharmaur known as Bara-Barsu. Budhil river originates

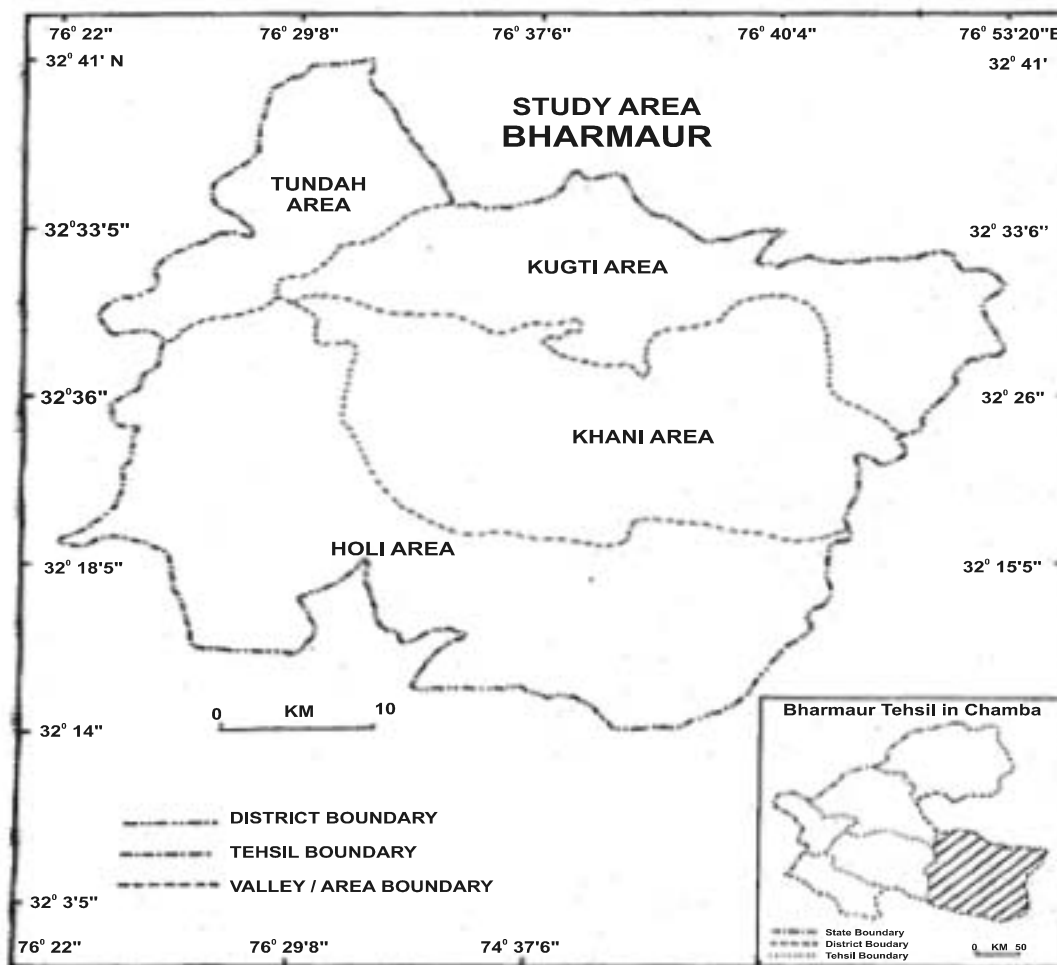


Fig. 1. Study area Bharmaur

from Garechu glacier, at the bottom of Kugti pass. At lower Kugti village, a small rivulet, locally known as Bhujla descending from backside of Manimahesh lake conflues with Budhil river. Another stream Manimahesh Nalla, also joins Budhil river at Hadsar. Apart from this, two streams Tundahen river and Chobia Nallah also drain the Bharmaur region. Chobia Nallah descends from Kalicho pass and merges with Budhil river at the bottom of Sandi village near Hadsar. Ravi river and its tributaries in Bharmaur tehsil act as physical barriers and thereby demarcate the physiographic regions. Broadly, the tehsil is divided into four regions. The area lying south of Ravi river is Holi area. On the north of this region lies the Khani area, lying between Ravi in the south and its tributary Budhil on the north. Bharmaur settlement i.e. tehsil head quarter, is also located in this region. Further north of Budhil river upto the border of Pangi tehsil lies the Kugti area. Marked by the Tundah nalah in the east, lies the Tundah area in the north western part of Bharmaur tehsil.

July is the warmest month in the region. Figure 2 shows that Bharmaur experiences the highest mean monthly temperature (26.08°C) in July. The lowest mean monthly temperature (3.96°C) is recorded in the month of February. The highest mean monthly rainfall during the period 2000-02 was recorded in the month of April (296.87 mm). In contrast, the lowest mean rainfall (6.17 mm) occurred in the month of October. March and April are the wettest months in Bharmaur. This reveals that western disturbances are the main source of precipitation in the region. The

average annual precipitation (2000-02) in the region was 1191.58 mm. The climate of the region has a discernible altitudinal effect. Despite being located in the subtropics, the region experiences severe winters and receives snowfall during the period from December to March (Sharma, 1973). Agriculture is mainly rainfed. The sowing and harvesting periods vary with the variation in the altitude of the cultivated farms. The sowing of summer (kharif) crops in the region is done between the middle of April to the end of July. These crops are harvested from October to November. The rabi (winter) crops sowing is done in September and October. These crops are harvested from late May to August (Himachal Pradesh University, 1988). Farmers prefer to live scattered in the neighbourhood of their fields. This holds true particularly of the region around Bharmaur (Bose, 1963). On the higher altitudes, e.g. in eastern parts of Kugti area, fields are generally cultivated every alternate year as crops require longer time for attaining the maturity.

RESULTS AND DISCUSSION

As mentioned earlier, Bharmaur region has two distinct cropping seasons, namely kharif (summer) and rabi (Winter). The region grows a variety of subtropical and temperate crops during these cropping seasons and some of them are very little known outside this agroecological region. The main crops grown in kharif reason include maize (*Zea mays*), rajmah (*Phasseolus vulgaris*), urd (*Phaseolus radiatus*) and phullan (millets). On the other hand, wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*) are the main crops sown during rabi season. The other minor crops grown in the region include chinae (*Panicum miliaceum*), bhrace (*Fagopyrum esculentum*), kodra (*Paspalum scrobiculatum*) and sieul (*Amaranthus amaranthoides*), peas (*Pisum sativum*), mustard (*Brassica compestris*), kulth (*Dolichos biflorus*) and potato (*Solanum tuberosum*). The botanical names of the crops have been derived from Sambamurty and Subrahmanyam (1989). Beside this, some temperate and subtropical fruits are also grown in the region.

Table 1 and Figure 3 show the proportion of area under different crops in the sample villages in each of the four areas during the period 1974-77 and 1998-01. It is evident that foodgrains were main constituents of cropping pattern both

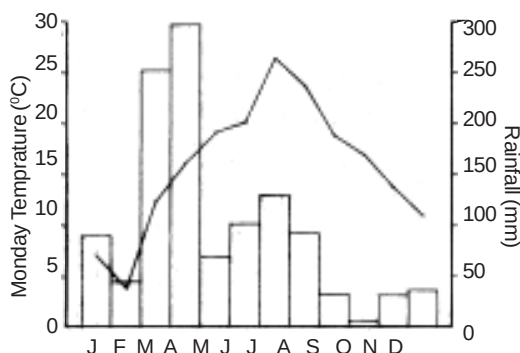


Fig. 2. Bharmauri distribution of temperature and rainfall

Source: Indian Meteorological Department, Bharmaur Station, Himachal Pradesh, India.

in kharif and rabi seasons in 1974-77. Wheat (26.25 per cent) and maize (19.61 per cent) were two main cereals cultivated in the region during mid 1970s. Other important cereal during this

Table 1: Bharmaur, Distribution of temperature and rainfall

Month	Monthly temperature (°C) 2002	Mean monthly rainfall (mm) 2000-2002
January	7.19	87.16
February	3.96	44.70
March	12.48	251.87
April	15.91	296.87
May	19.48	70.17
June	20.48	110.77
July	26.08	129.77
August	24.27	92.27
September	19.72	33.53
October	17.08	6.17
November	13.80	31.87
December	10.69	36.43
Annual	15.02	1191.58

Source: Indian Meteorological Department, Bharmaur Station, Himachal Pradesh, India

period was barley and it occupied about 14.75 per cent of total cropped area. Inferior foodgrains which include chinae, phullan and bhrace (*millets*), sieul and kodra occupied nearly one-fourth (24.09 per cent) of total cropped area. Pulses namely urd (7.99 per cent) and rajmah (0.90 per cent) together accounted for about 9 per cent of total cropped area. Other crops which include potato, mustard, kulth, peas and fruit crops like almond, peach and apricot etc. occupied about 7 per cent of total cropped area.

The proportion of area under wheat cultivation has remained unchanged between 1974-77 and 1998-01. It continues to occupy about one fourth of total cropped area. However, maize cultivation in the region has declined slightly over this period. But the acreage of barley and other inferior cereals has declined significantly. The acreage under barley has reduced to about 10 per cent of total cropped area. Other inferior cereals occupied only about 9.08 per cent of total cropped area in 1998-01.

The area under pulses has witnessed a phenomenal rise during last 25 years. This increase is more significant in case of rajmah. The two pulses namely urd and rajmah occupied about one-fourth (24.40 per cent) of total cropped area in 1998-01.

As stated earlier, Bharmaur region has diversity in agro-climatic conditions. It has warmer valley areas as well as perennial snow covered peaks. This climatic heterogeneity presents ideal and conducive conditions for growing variety of fruit crops like apple, almond and other temperate fruits which are highly remunerative. Among these fruit crops, apple (*Pyrus mallus*) occupies the first position from the acreage point of view. The apple cultivation has diffused along lower and middle valley slopes. At present, its plantation occupies 4.29 per cent of total cropped area. There is a great potential of apple cultivation in the region which remained unexploited. Other crops which include potato, mustard, kulth, peas and fruit crops like almond, peach and apricot etc. occupy about 8 per cent of total cropped area in the region.

The cropping pattern in the region varies across the altitudinal zones and

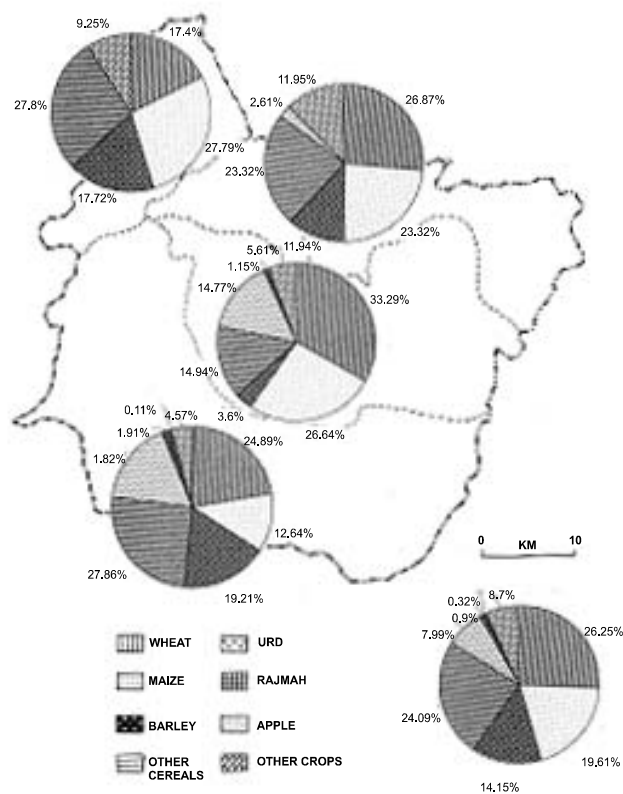


Fig. 3. Bharmaur Cropping Pattern, 1974-77

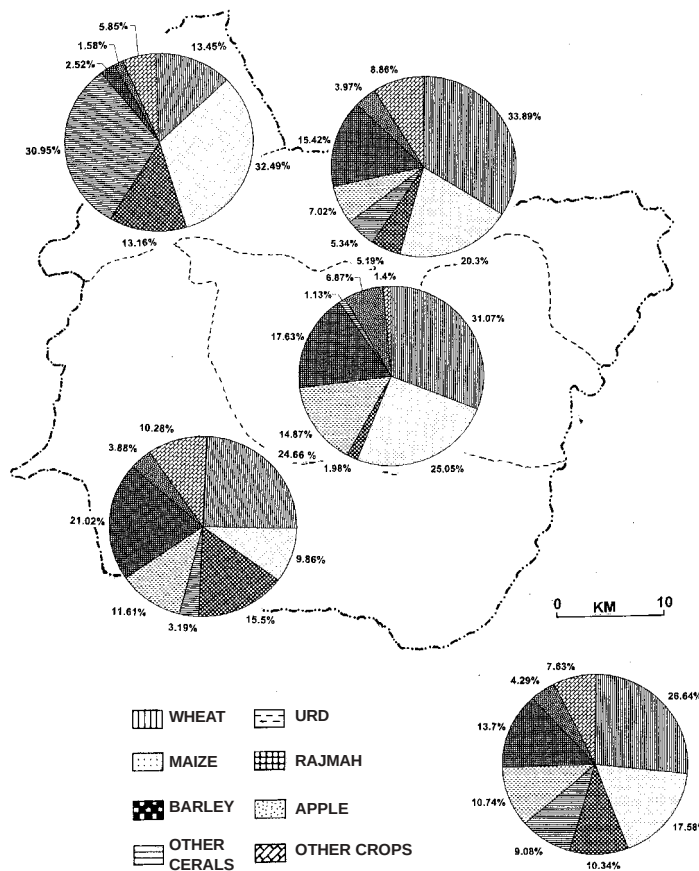


Fig. 4. Bharmaur cropping pattern, 1998-01

different physiographic areas. The influence of agro-climatic factors and accessibility on the cropping pattern is evident on the cropping pattern of different areas in Bharmaur tehsil.

Khani Area

Bharmaur and Khani are the main settlements in this relatively better accessible area. It is evident from Figure 3 that wheat and maize were the major cereals in Khani area during mid 1970s. These two crops accounted for as much as 33.29 per cent and 26.64 per cent of total cropped area in 1974-77. But their proportion in total cropped area declined slightly to 31.07 per cent and 25.05 per cent respectively in 1998-01 (Fig. 4). Barley (3.60 per cent) was not a major crop in Khani area during mid 1970s.

Its proportion in total cropped area further declined to 1.98 per cent in late 1990s. Other cereals grown in Khani area during 1974-77 included chinae (1.34 per cent), phullan (10.83 per cent) kodra (1.02 per cent) and bhrace (1.75 per cent). Together all these inferior cereals occupied 14.94 per cent of total cropped area. As an individual crops kodra and bhrace have been wiped out from the region. However, the cultivation of phullan has increased slightly during the study period. Urd accounting for 14.77 per cent of total cropped area was the major pulse grown in Khani area during mid 1970s. Its acreage, further increased to 17.63 per cent in 1998-01. Another pulse crop, rajmah was not grown during mid 1970s. However, it occupied 1.13 per cent of total cropped area in 1998-01. The agro-climatic conditions in the area are suitable for apple cultivation. It accounted for 1.16 per cent of total cropped area during mid 1970s. But it has increased to 6.87 per cent of total cropped area in 1998-01. This may also attributed to

relatively better transportation and infrastructure in this area. The area under other crops was 5.61 per cent of total cropped area during mid 1970s. But it declined to 1.40 per cent of total cropped area during late 1990s.

Holi Area

This region lies south of Ravi river bordering Kangra district in the south and south east and Chamba tehsil in the west. The proportion of area under wheat has remained stagnant i.e. about one fourth of total cropped area during the study period in Holi area (Fig. 3 and 4). Maize occupied about 12.64 per cent of total cropped area in 1974-77. Its proportion decreased to 9.86 per cent in 1998-01. The acreage of barley has also declined in this area.

The area devoted to its cultivation was 19.21 per cent of total cropped area in 1974-77. It decreased to 15.50 per cent in 1998-01. Other cereals cultivated in the region included chinae (18.54 per cent) phullan (4.27 per cent) and sieul (5.05 per cent). Together, these cereals occupied as much as 27.86 per cent of total cropped area during mid 1970s. But by the end of 20th century, the area under these crops occupied only 3.19 per cent of total cropped area. The cultivation of chinae which was a very important crop during 1970s has ceased to exist.

Holi area is located at relatively lower elevation in Bharmaur region. Hence, it is climatically best suited for growing pulses. During mid 1970s, the land allocated to pulses namely urd (8.82 per cent) and rajmah (1.91 per cent) together accounted for about 10.73 per cent of total cropped area. The pulses are replacing the inferior foodgrains in the region. The proportion of area under pulses has registered a three fold increase during last quarter of 20th century. At present, these pulses account for as much as 32.63 per cent of total cropped area. Rajmah alone occupies about one fifth of total cropped area. Apple plantation was only for namesake in this area in mid 1970s. But at present area under apple plantation is about 4.00 per cent of total cropped area. The area under other crops was 4.54 per cent in 1974-77 which increased to 9.52 per cent of total cropped area in 1998-01.

Kugti Area

Unlike Khani and Holi areas, Kugti area is a relatively inaccessible part of Bharmaur region. The settlements in this area are located at higher altitudes. Hence, the climatic conditions are not conducive for plant germination and growth. Figure 3 reveals that during mid 1970s, wheat and maize were the dominant crops grown in Kugti area. They constituted about 26.87 per cent and 23.32 per cent of total cropped area respectively. However, in the following period, acreage under wheat increased to 33.89 per cent of total cropped area. But the area under maize has registered a decline i.e. 20.30 per cent of total cropped area in 1998-01 (Fig. 4). The area allocated to barley has also declined significantly from 11.94 per cent in mid 1970s to 5.19 per cent of total cropped area in 1998-01. Other cereals which include phullan (8.39 per cent)

Table 2: Bharmaur, percentage of area under different crops area in ha.

Valley/Area	Period	Kharif crops										Total Rabi	Other crops	Total cropped area		
		Maize					Total Kharif									
		Urd	Chinae	Phullan	Kodra	Rajmah	Sieul	Bhrace	Apple	Rabi crops						
											Wheat	Barley				
Khani Area	1974-77	26.64	14.77	1.34	10.83	1.02	0.00	0.00	1.75	56.35	1.16	33.29	3.60	36.88	5.61	100.00
	1998-01	25.05	17.63	0.42	14.45	0.00	1.13	0.00	0.00	58.68	6.87	31.07	1.98	32.23	2.22	100.00
Holi Area	1974-77	12.64	8.82	18.54	4.27	0.00	1.91	5.05	0.00	51.22	0.11	24.89	19.21	44.10	4.57	100.00
	1998-01	9.86	11.61	0.00	1.25	0.00	21.02	1.94	0.00	45.68	3.88	24.66	15.50	40.16	10.28	100.00
Kugti Area	1974-77	23.32	2.61	0.00	8.39	0.00	0.00	0.00	14.93	49.26	0.00	26.87	11.94	38.81	11.93	100.00
	1998-01	20.30	7.02	0.00	3.97	0.00	15.42	0.00	1.37	51.22	3.97	33.89	5.19	39.09	8.84	100.00
Tundah Area	1974-77	27.79	0.00	0.00	11.98	4.91	0.00	10.91	0.00	55.59	0.00	17.44	17.72	35.16	9.25	100.00
	1998-01	32.49	0.00	0.00	28.29	0.00	2.52	2.66	0.00	65.96	1.58	13.45	13.16	26.61	5.85	100.00
Total Sample Villages in																
Bharmaur	1974-77	19.61	7.99	9.01	7.46	0.84	0.90	3.71	3.07	52.58	0.32	26.25	14.15	40.40	6.70	100.00
Religion	1998-01	17.58	10.74	0.09	7.50	0.00	13.70	1.22	0.27	51.10	4.29	26.64	10.34	36.98	7.63	100.00

Source: Lal Kitab and Khasra Girdawari

and bhrace (14.93 per cent) together occupied 23.32 per cent of total cropped area in 1974-77. But by 1998-01, the area under these cereals declined to 5.34 per cent of total cropped area. These inferior foodgrains have been replaced by the pulses. Area under pulses occupied only 2.61 per cent of total cropped area in 1974-77. It increased to 22.44 per cent during late 1990s. The major contributor to this is rajmah accounting for about 15.42 per cent of total cropped area. Apple plantation did not exist in Kugti area during mid 1970s. At present, it accounts for about 3.97 per cent of total cropped area. Thus the cereals dominated cropping pattern in Kugti area has undergone transformation. More remunerative cash crops namely rajmah, urd and apple have come up by late 1990s. This has happened despite the fact that Kugti area is relatively inaccessible region of Bharmaur tehsil.

Tundah Area

Like Kugti area, Tundah area is also a geographically inaccessible land in Bharmaur. It is not connected with road transport. Agro-climatic conditions in this region are also slightly different from Khani and Holi areas but quite similar to Kugti area because of higher altitudes. Maize was the dominant crop grown in the region during mid 1970s. It occupied about 27.79 per cent of total cropped area (Fig. 3). Its proportion has further increased to 32.49 per cent of total cropped area during 1998-01 (Fig. 4). It indicates that maize is still a staple food crop in Tundah area. Wheat and barley occupied 17.44 per cent and 17.22 per cent of total cropped area respectively during 1974-77. Their proportion has declined to 13.45 per cent and 13.16 per cent of total cropped area respectively in 1998-01.

Among the other cereals, phullan (11.98 per cent), kodra (4.91 per cent) and sieul (10.91 per cent) were grown during mid 1970s. These inferior foodgrains together accounted for about 27.80 per cent of total cropped area. During 1998-01, these cereals namely phullan (28.29 per cent) and sieul (2.66 per cent) occupied about 30.95 per cent of total cropped area. The cultivation of kodra cease to exist in Tundah area. Among the inferior foodgrains, phullan crop has flourished during last quarter of 20th century in the region. Pulses were not grown in Tundah area during mid 1970s. However, during 1998-01 rajmah found a

place in cropping pattern and occupied 2.52 per cent of total cropped area. Non-foodgrains like potato and fruits like apple were not grown during mid 1970s. But in the recent past, these crops and fruits have been introduced in the cropping pattern of this region. Other crops account for about 9.25 per cent of total cropped area during mid 1970s. Their proportion has declined to 5.71 per cent of total cropped area during next last 25 years.

It is evident that the cropping pattern of Tundah area has not undergone the change at the pace experienced in other regions in Bharmaur tehsil. Cereals continue dominating the cropping pattern, accounting for about 90.05 per cent of total cropped area in this region. Remunerative crops and fruits namely urd, rajmah and apple do not find significant land occupancy in the present cropping pattern. Tundah area in Bharmaur tehsil is located at high altitudinal belt and it is least accessible. It has a subsistence crop and livestock economy.

CONCLUSION

It is evident from the preceding discussion that the tribal areas of Bharmaur has experienced a perceptible transformation in the cropping pattern. The traditional cropping pattern had been dominated by cereals and inferior foodgrains. This fact has also been observed by Bose (1963) and a study by Agro-Economic Research Centre (HPU, 1988). The cropping pattern in Bharmaur was dominated by cereals which accounted for 84.10 per cent of total cropped area during mid 1970s. The highest proportion of cultivated area devoted to cereals was in Tundah area (90.75 per cent) and lowest in Khani area (78.47 per cent). But during late 1990s, the proportion of area under cereals in Bharmaur tehsil declined to 63.64 per cent of total cropped area. During the study period the area under cereals has declined considerably in three out of the four regions. Tundah area is an exception, where about 90 per cent of the cultivated land is still under cereals.

The pulses were not significant crops in Bharmaur region till mid 1970s. These crops occupied only about 9 per cent of total cropped area in 1974-77. The highest proportion of area under pulses was in Khani area (14.77 per cent) and Holi area (10.73 per cent) during mid 1970s. The share of pulses in the cropping pattern had started increasing since 1980s. The study by Agro-

Economic Research Centre (Himachal Pradesh University, 1988) reveals that these crops occupied about 13.40 per cent of total cropped area in 1983-86. By the end of 20th century, pulses (rajmah and urd) occupied about one fourth of total cropped area in the entire Bharmaur region. In the Holi area, pulses accounted for about one-third of the total cropped area. Kugti area is another area in Bharmaur region where pulses occupy a very significant position in cropping pattern. About 22.44 per cent of the total cropped area in this area is devoted to the cultivation of pulses. Urd is a significant crop in Khani area (17.63 per cent). But rajmah does not find a significant place in the cropping pattern of Khani area and Tundah area.

In the traditional cropping pattern of Bharmaur region, the share of non-foodgrain crops was negligible (Himachal Pradesh University, 1988). It is also evident from the present study. The apple cultivation has diffused along some valley slopes in the Bharmaur region during the last quarter of 20th century. It was an insignificant plantation crop during mid seventies. In 1974-77, there were some apple orchards in Khani area. At present, apple cultivation accounts for about 4.29 per cent of total area. The highest proportion of area under apple plantation is in Khani area. This area has comparatively better transportation facilities and infrastructure. Bharmaur settlement is located in this area area.

It is evident from the study that the cropping

pattern in the Bharmaur region has undergone a significant change during last quarter of 20th century. The inferior foodgrain crops cultivated in the region have been replaced by fine cereals and pulses. Surely this is a sign of qualitative change in traditional agriculture. The pace of transformation in this tribal area is higher in the areas lying at comparatively lower altitude and enjoying better accessibility. But the cropping pattern of the region is still overwhelmingly dominated by the foodgrains. This region still has subsistence agricultural economy where crops are largely produced for self consumption.

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