

# Extent of Crop Diversification in Malana Village of Kullu District in Himachal Pradesh

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**Abstract**— Agriculture is the prime economic activity of the western Himalayan people, supplemented by animal husbandry and forest activities. In the present paper an attempt has been made to examine the average size of holdings, cropping pattern, production, productivity and the extent of crop diversification in the study area with the help of primary and secondary data by using Herfindhal Index. It was found that the average size of holdings, production, productivity (except rajmash) and extent of crop diversification shows decreasing tendency during the years 1990-91 to 2016-17 in the study area. The productivity of traditional crops like maize, wheat, barley is very low and cultivation of these crops is considered uneconomical due to primitive nature of crop production and harsh climatic conditions. In the study area there should be introduction of new high value crops like pulses, vegetables and fruits to enhance crop diversification.

**Keywords**— Crop Diversification, Kullu, Himachal Pradesh.

## I. INTRODUCTION

Agriculture system, all over the world, has changed in response to technological innovations and market forces. Agriculture in the Himalayan regions is based upon the traditional knowledge. But the linkages between traditional knowledge and development have not received significant recognition yet. Analysis of land use and cropping pattern are essential components of a development plan for any area. Subtle geographic and geo-climatic differences in the Himalayan regions create a fine mixture of micro-environments of discrete land use types. In the past pressure on the land was less resulting in balance between environment and society, but recently, ever increasing population pressure has interrupted the congenial relationship between mountain society and the habitat.

The study area (i.e. village Malana) is concentrated at an elevation of nearly 260m, above the mean sea level in the remote mountainous region of northwest part of Kullu district of western Indian Himalayas. The village comprises of two hamlets; the upper hillside hamlet, located as ‘Dhara Behr’ and the lower hamlet as ‘Sara Behr’. Both hamlets are demarcated by a sacred place locally known as Harcha, a rendezvous and promenade area. Steep vertical mountain peaks and open rocks surround the entire village. Due to difficult geographical setup and dense vegetation cover from all sides, the village is invisible from the nearby locality. The village is located on a relatively barren strip of ground close to the right bank of Malana stream that finally gets merged in the Parbati tributary near Jari. East to Malana is Manikaran, Kasol and Rasol while on the south is Jari. Similarly, from the west side, it is surrounded by high peaks of Chanderkhani pass and the north

is dominated by the glittering peak of the Deo Tibba Mountain of Spiti hill of Trans Himalaya.

The landscape has undulating terrain, high peaks, steep slopes, narrow gorges, route and dense vegetation cover. Most of the mountain peaks and slopes are surrounded by ice. The landscape is characterized by the low density of population, small landholdings, poor infrastructure, traditional farming practices and dependency on natural resources and the rich diversity of biological and cultural heritage. The landscape is dominated by coniferous species, and herbaceous plants, including medicinal plants and other wild edibles.

## Objectives

- i. To study the changes in land holdings, cropping pattern and crop diversification and the study area.
- ii. To analysis the production and productivity of major field crops in the study area.
- iii. To give a set of suggestions in the light of findings.

## II. RESEARCH METHODOLOGY

Both the primary and secondary data have been used for two agricultural years viz; 1990-91 and 2016-17. During 1990-91, there were 170 households and in 2016-17, it increased to 317 households. In order to achieve the objectives, the magnitude of crop diversification among the farmers in the study area has been worked out with help of Herfindhal Index.

$$\text{Herfindhal Index} = \sum_{i=1}^n p_i^2$$

Where

P<sub>i</sub> = is the proportion of area under i<sup>th</sup> crop and

$$P_i = \frac{A_i}{\sum_{i=1}^n A_i}$$

In which

A<sub>i</sub> = actual area under i<sup>th</sup> crop.

I = 1, 2, 3-----n (Number of crops)

n = total number of crops.

The index is defined as sum of the squares of all 'n' proportions and is a measure of concentration. For increasing diversification, H is decreasing and vice-versa. It is bounded by '0' (complete diversification) and 1 (complete specialization). Herfindhal index is an inverse measure of crop diversification. It is assumed that a wide range of production options are available. When it comes to crops, the Herfindhal Index presupposes that there are a huge number of crops that farmers can plant. If the total land was evenly distributed across the

several crop options, the share of each crop would be close to zero. As a result, this index compares real shares of each crop against an equal share of all conceivable alternatives, which is set to zero.

### III. RESULTS AND DISCUSSION

#### 1. Changes in size of land holdings

In Malana village, the average size of holdings during 1990-91 and 2016-17 was 0.85 and 0.25 hectares respectively, which shows a decreasing tendency (Table 1). The main reason for this tendency is fragmentation of land due to increase in population. The entire land owned by Malaneese was under self-cultivation during the study period. There has been no report of crop sharing. The entire agriculture land is depending on rainfall. The area has plenty of natural gravity water channels flowing all round the year, however, people show less interest in using these perennial water sources for crop production.

TABLE 1: Changes in size of land holdings  
(Area in Hectares)

Particulars	1990-91	2016-17	Percentage change
<b>Total holdings</b>	170	317	86.47
<b>Total land</b>	145.11	79.92	-44.92
<b>Operated/cultivated</b>	116.49	74.40	-36.13
<b>Uncultivated land</b>			
<b>Total</b>	28.62	5.52	-80.71
<b>Average size of holding</b>	0.85	0.25	-70.59

Crops grown in the fields determine the level of agriculture in a region. The nature of cultivation remains primitive among Malaneese farmers. Earlier the major crops grown by Malaneese were small millets in Kharif season and wheat and barley in Rabi season. At the present time almost all Malaneese are not growing small millets during Kharif season for their food requirements due to the availability of the alternative sources of income. For food requirements, Malaneese have completely shifted towards superior food grains obtained from the market and Public Distribution System.

TABLE 2: Changes in cropping pattern  
(Area in Hectares)

Particulars	1990-91	2016-17	Percentage change
<b>Kharif Season</b>	62.89	68.46	10.97
<b>Kathu (S.Millet)</b>	49.73	-	-
<b>Choulai (S.Millet)</b>	5.25	-	-
<b>Potato</b>	3.07	7.14	132.57
<b>Rajmash</b>	3.26	9.57	193.56
<b>Maize</b>	1.06	51.75	4782.07
<b>Kooth (Herb)</b>	0.50	-	-
<b>Vegetables</b>	0.02	-	-
<b>Rabi Season</b>	61.69	63.75	3.34
<b>Wheat</b>	52.88	60.20	13.84
<b>Barley</b>	7.43	3.55	-52.22
<b>Mustard</b>	1.38	-	-
<b>Gross Cropped Area (GCA)</b>	124.58	132.21	6.12

Earlier, Malaneese were growing seven crops during Kharif season and three crops during Rabi season, while at present, only three crops in Kharif season and two crops in Rabi season are grown by Malaneese (Table 2). The area under Kharif season, crops such as rajmash (pulse) and potato (vegetable) has

also increased from 3.26 and 3.07 hectares in 1990-91 to 9.57 and 7.14 hectares in 2016-17, respectively. In Rabi season area under wheat crop has increased from 52.88 hectares in 1990-91 to 60.20 hectares in 2016-17. The area under barley crop has decreased to 3.55 hectares in 2016-17 from 7.43 hectares in 1990-91. The overall gross cropped area has increased from 123.58 hectares in 1990-91 to 132.21 hectares in 2016-17. Further, in 2016-17, maize and wheat were the major crops during Kharif and Rabi season. Other crops grown by Malaneese include potatoes, rajmash and barley. Earlier, the Malaneese were growing a high value herb crop called kooth but at present, it is not grown by any single farmer due to less marketing facilities.

#### 2. Indicators of change in cropping pattern

During the last two decades, a number of new crops have been introduced in Malana village. In 1990-91, pulses, vegetables and medicinal crops were introduced for cultivation. During 2016-17, the area under traditional crops (small millets) declined and shifted towards wheat and barley, among Rabi season and maize, pulses and vegetables, among kharif season. There has been an overall increase in acreage during the study period. The main indicators of negative and positive growth are; supply of food grains through Public Distribution System, availability of superior grains in open market and low productivity/returns from traditional crops. Thus, Malaneese are growing those food grains which fulfil their family requirements, and also now Malaneese have enough money to purchase various commodities for consumption requirements, from open market (Table 3).

TABLE 3: Indicators of change in cropping pattern  
(Area in Hectares)

Particulars	1990-91	2016-17	Growth Indicators
<b>Kharif Season</b>			
<b>Maize</b>	1.06	51.75	More importance for cut and carry feeding of animals as fodder crop.
<b>Millets</b>	54.98	-	Low productivity and availability of superior grains from PDS (Public Distribution System) and market
<b>Pulses</b>	3.26	9.57	Awareness of nutritional value and suitable climate for crop production
<b>Potato &amp; Other vegetables</b>	3.09	7.14	Suitable vegetable crop of the area
<b>Kooth (herb)</b>	0.50	-	Availability of high value herb crop from support land
<b>Rabi Season</b>			
<b>Wheat</b>	52.88	60.20	Only superior grain crop in the area
<b>Barley</b>	7.43	3.55	Low productivity
<b>Mustard</b>	1.38	-	Availability of other oilseed output from market
<b>Total crops</b>	124.58	132.21	High dependence on PDS (Public Distribution System) and market.

#### 3. Changes in extent of crop diversification

The value of Herfindhal Index in 1990-91 was 0.3464, which slightly increased to 0.3694 in 2016-17 (Table 4). Thus,

it means that the extent of crop diversification was comparatively high in 1990-91 as compared to 2016-17.

TABLE 4: Extent of crop diversification

Particulars	1990-91			2016-17		
	Ai	Pi	Pi <sup>2</sup>	Ai	Pi	Pi <sup>2</sup>
Kathu	49.73	0.3992	0.1593	0	0.0000	0.0000
Choulai	5.25	0.0421	0.0018	0	0.0000	0.0000
Potato	3.07	0.0246	0.0006	7.14	0.0540	0.0029
Rajmash	3.26	0.0262	0.0007	9.57	0.0724	0.0052
Maize	1.06	0.0085	0.0001	51.75	0.3914	0.1532
Kooth (Herb)	0.5	0.0040	0.0000	0	0.0000	0.0000
Vegetables	0.02	0.0002	0.0000	0	0.0000	0.0000
Wheat	52.88	0.4245	0.1802	60.2	0.4553	0.2073
Barley	7.43	0.0596	0.0036	3.55	0.0269	0.0007
Mustard	1.38	0.0111	0.0001	0	0.0000	0.0000
$\sum_{i=1}^n P_i^2$	124.58	1	0.3464	132.21	1	0.3694

Note: Ai indicates actual area under each crop  
Pi indicates proportionate area under each crop.

#### 4. Production of major field crops

During the crop year 2016-17, a total of 485.57 quintals of cereals were produced by Malaneese and out of which wheat alone accounted for 79.37 percent of the total grain production. However, during the crop year 1990-91, a total of 817.70 quintals of cereals and millets were produced and out of which wheat accounted for 42.42 percent. Over the last 25 years, food grain production has decreased by 41 per cent, due to the complete disappearance of small millets in both kharif and rabi season and a drastic reduction in the cultivation of maize cereal as food grains.

TABLE 5: Production of major field crops  
(Production in Quintals)

Particulars	1990-91	2016-17
Maize	10.20	87.01
Rajmash (Pulse)	15.42	54.60
Potato	186.75	333.6
Wheat	346.85	385.4
Barley	47.85	13.16
All crops	607.07	873.77

Maize share in total food grain is only 18 percent. The other main crop grown by farmers was rajmash and its production was insignificant (54.60 quintals). Rajmash is the only pulse crop which was grown in 1990-91 and is still produced in Malana. Further, potato was the only vegetable crop grown by Malaneese in 2016-17 and its production was 333.6 quintals. During 1990-91, barley crop was produced by Malaneese and its share in food grains was 6 percent and in 2016-17, it reduced to less than 3 percent (Table 5).

#### 5. Productivity of major field crops

There is a reducing trend in the productivity of crops grown by Malaneese over the last decades. There was 82.54 percent decrease in maize productivity between 1990-91 and 2016-17. Potato is the only vegetable crop grown by Malaneese and its productivity has declined to 23.19 percent during last 25 years. Per hectare productivity of rajmash has increased from 4.73

quintals in 1990-91 to 5.71 qtls in 2016-17 and its production increased to 20.72 percent during the same period (Table 6).

TABLE 6: Productivity of major field crops

Particulars	(Per Hectare)		
	1990-91	2016-17	Percentage change
Maize	9.62	1.68	-82.54
Rajmash (Pulse)	4.73	5.71	20.72
Potato	60.83	46.72	-23.19
Wheat	6.56	6.40	-2.44
Barley	6.44	3.71	-42.39

The analysis of data indicates that the productivity of various field crops showing decreasing tendency (except rajmash) during the study period. The productivity came very low even to the state average and far below the optimum level. Never the less, the soil and climatic conditions of the region have vast potential to achieve higher growth. Further, in 2016-17 farmers were getting more returns from each crop than in 1990-91 crop year (Table 7).

#### IV. CONCLUSIONS AND RECOMMENDATIONS

From the above analysis and discussion it can be concluded that the average size of land holdings, cropping pattern, crop diversification and production and shows decreasing tendency. The production of traditional crops are considered to be uneconomical, due to primitive nature of crop production, harsh climatic conditions and availability of alternate options to get more returns from the small land base. The productivity of traditional crops like maize, wheat, barley and potato is very low. Presently, Malaneese are adopting cultivation of high value cash crop on their small land holdings in place of traditional crops. To maintain the economic viability and sustainability of crop production some steps are urgently needed to be adopted by the village and government level institutions to enhance production, productivity and crop diversification Following measures is needed for long term-sustainability of the area;

- i. Introduction of new high value crops like pulses and vegetables.
- ii. Introduction of good potential disease free high quality seeds of traditional vegetables.
- iii. Introduction of fruit crops like almond, walnut, cherry and other high hills wet zone fruits.
- iv. Provision for the dissemination of appropriate technical know-how about the improvement in productivity of existing crops.
- v. Introduction of new crops like hops and wild grapes.

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