



Traditional crops and indigenous farming practices in Kharal valley of Kullu district, Himachal Pradesh

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Abstract

Food is the basic need of human and agricultural activities provide food. Agriculture is the major occupation in India and is contributing 15.87 percent in GDP of India. The paper is based on the study carried out in selected panchayats of Kharal valley, Kullu district. These panchayats are dependent on agriculture and horticulture for food and economy. The study was carried out to analyze the traditional farming practices, which include the preparation of land by oxen plough, manuring of fields by using cow dung and irrigation through *kulh* system. Traditional post-harvesting techniques include the threshing by using pounder and animals on threshing floor. Sowing of traditional crops has been affected by climate change and many of them are on the verge of extinction due to less tolerance against drastic climate.

Keywords: agriculture, traditional crops, indigenous farming practices, pre-harvesting processes, post-harvesting techniques, traditional farm implements

Introduction

Agriculture is the basis of food production and food is the basic need of human. Agriculture fulfils the requirement of food in entire world. Agriculture plays a major role in world's economy, mainly in the developing countries. Rural population is mostly dependent on agriculture, horticulture and livestock rearing. Agriculture generates employment for rural areas. Presently, agriculture and allied sector contributes 15.87 per cent in gross domestic product (GDP) of India which was 56.5 per cent during 1950-51. Agriculture has direct relationship with climate, since it has a major role in agricultural processes and production. Traditional crops are more affected due climate change; many of them are on the verge of extinction due to less tolerance against drastic climate. Every Indian state has its speciality in food. Crops such as wheat, maize, millets, buckwheat, soybean, barley, rice and pulses are traditional crops of Kullu district of Himachal Pradesh. Traditional foods like *Siddu*, *Madhra*, *kadhi*, *fambra*, *baadi*, *rayeta*, *bhalle*, *seera*, *chilre*, and *babru* are prepared using these crops in Kullu. Traditionally, people use millets, barley and rice to make local wine for marriages and festive occasions like *fagli*. Due to varying climatic conditions and availabilities, people have stopped cultivating traditional crops. Farmers are the ones who face the impact of climate change on their farm-fields. Himalayan region is youngest mountain with fragile ecosystem and is susceptible to climate variations and disasters such as drought, cloud burst, landslides, and flash floods. In Kullu district, farmers practice the mixed farming to cope up with the climate variation. Mixed farming includes agriculture, horticulture with livestock rearing, apiculture and weaving. Farmers rear livestock for selling milk, meat and eggs. Sheep and goats are reared for meat and wool for making blankets, carpets and cloths. Agroforestry is common in the area, which produces fodder for livestock, besides fuel wood and fruits. Agroforestry helps in conservation of natural resources and controls soil

erosion. Wild edibles also fulfil the need of farmers. Indigenous farming include the No-Till farming, that is growing crops without disturbing the soil ecosystem, using manure, crop rotation, intercropping and harvesting water resources such as *kulhs*, *baudi*, and *chrudu*. These water harvesting techniques have declined due to replacement with modern irrigation system like sprinklers, water pumps and pressure pumps.

In Kullu district grains and pulses were major crops but due to modern farming practices, reduced yield of traditional crops, farmers are shifting towards off-season vegetable production in poly houses. Establishment of poly houses have enabled the diverse cultivation of crops and at the same time it degrades the land. New farmers are unaware of traditional practices and are growing new varieties of crops with their interest in the technology. Due to decline in yield of traditional crops consumptions of the traditional foods has also declined and has affected the health of local people. The trend of replacement has increased due to lower yield of traditional crops which cannot handle the climatic variations like drought and unexpected floods. Indigenous farming practices have decreased due to vanishing of natural water resources and introduction of technology. An exploration was carried out in selected panchayats of Kharal valley of Kullu district. It is based on crops diversity and related knowledge of traditional farming practices. The area is mainly dependent on agriculture and horticulture for food, daily needs and income. Cropping pattern has undergone a significant change in the recent years. Promotion of horticulture, off-season vegetable cultivation and floriculture has resulted in intensification of agriculture which in turn is affecting the income and lifestyle of farmers. But, on the other hand the climate change is becoming a governing factor for determining the cropping pattern. The cropping patterns in any area are the results of past and present choices by people, communities or governments in

addition to existing topography and climatic factors. These choices are usually based on knowledge, customs, anticipated profit, individual choices, availability of resources, socio-political stress and so on.

2. Material and Methods

The primary data was collected from the farmers. For this purpose, an interview schedule was prepared. Information was gathered on:

- Indigenous Farming Practices;
 - A. Pre-harvesting processes
 - B. Post-harvesting techniques
- Traditional Farm Implements;
- Traditional crops and their utilization (including the information on Local Name, Cultivation time, Cropping pattern, Harvesting, Post-Harvesting Techniques, Drying, Threshing, Storage); and
- Ethnic foods preparations

Study Area

Kullu district is situated in the middle part of Himachal Pradesh and lies between 31°20'25'' and 32°25'00'' N and 76°56'30'' and 77°52'20'' E. Total Geographical area of the district is 5503 sq. km. District is surrounded by five districts of Himachal Pradesh, on the north and east by Lahaul-Spiti district, on the south-east by Kinnaur district, on the south by Shimla district, on the south west and west by Mandi district and the north-west by Kangra district. Kullu is surrounded by the three mountain ranges, viz. these are Pir Panjal, Great Himalayan and lower Himalayan ranges. Kullu district is rich of natural resources like abundant water resources, fertile lands, forests mainly of pine, deodar and oak and rich biodiversity of flora and fauna. According to the census data of the 2011, total population of the district is 4,37,903. Population density is 80pers/sq. km. Number of households are 94,807. The total rural area is 5485.87 square kilometer and urban area is 17.13 square kilometer. Rural population is 3,96,512 and urban population is 41,391. Female and male population of the district is 2,12,451 and 2,25,452 respectively and Sex ratio is 942 F: 1000 M. The economy of Kullu district is mainly dependent on agriculture, horticulture and tourism. Agricultural land in the district is 65,186 sq. m. It has returned 197,141 persons as cultivators and holds the 4th position among the districts of the state. The area is famous for apple and temperate fruits such as pear, plum, apricot, cherry and vegetables like tomato, pea, onion and garlic. Kullu is also known for its international fame Dussehra Festival. District is famous for its beautiful traditional handicrafts in weaving. Multi-coloured Kullu caps, shawls, *pattoos* and *patties* (local tweed). District is also known for Hydro Electric Projects and various projects were commissioned during the last decade. Neoli and Puid panchayat of Kharal valley located in Naggar block of Kullu district. Neoli and Puid are situated at north end of Phati Kharal at 31° 57'54 N 77° 08'20 E and 5 km by road from Kullu headquarter. Neoli and Puid panchayats has topography of moderate slope and located in an open, small valley. The geographical area of Neoli and Puid panchayats is 833 hectares and 667 hectares respectively. Soil types are clay loam and alluvial soils. Average temperature during summer is 25°C and during winter is 8°C.

Average minimum and maximum temperature during summer is 16°C and 30°C respectively. Average minimum and maximum temperature during winter is 1°C and 14°C respectively. August and July are the warmest and January is the coolest month. Area is rain fed and has few perennial *nallahs* and *kulhs* for irrigation. Average rainfall is 891 mm; most of the rainfall occurs in the month of February, March and July this rainfall benefits the Rabi crops. Most of the land use pattern in the area follows agriculture and horticulture. Area faces climatic variation like cloud burst and hale-storm. The area has rich diversity of crops and flora-fauna. 70 per cent of the households are dependent on agriculture and horticulture, 20 per cent households are dependent on government services and 5 per cent are depended on business and 5 per cent are labours. People in the area are gaining profit from vegetable culture and horticulture.

3. Results and Discussion

Traditional Farming Practices: Amaranth, Finger Millet, Proso Millets, Buckwheat, Soybean, Barley, Rice, Wheat, Beans, Corn, and Sesame etc. were grown earlier in the valley, but with climate change farmers could not gain profit and shifted towards horticulture for more income. Farmer use chemical sprays that harms the grain crops, that's why cultivation of traditional crops is on the verge of extinction. The area is rain fed and agriculture depends mainly on rain and some traditional irrigation practices such as *Kulh* where water of *nallah* (natural streams) is diverged into the canal and taken to the fields. 40 years ago, area has farms of rice crop known as *Ropa* which need plenty of water but comparing with present, these have turned into apple orchards. This shift shows the decline of water availability with time. While discussing with old people, it was found that many crops which were grown 20 to 30 years ago, are no longer cultivated to the extent it was undertaken earlier. The traditional farming practices included:

A. Pre-harvesting processes

- Land preparation
- Sowing
- Weeding
- Hoeing
- Manuring and
- Irrigation

B. Post-Harvesting Techniques

- Drying
- Threshing and
- Storage

Land Preparation: This step involved removing of weeds, manuring and ploughing. Ploughing and hoeing depends on the how much crop has to be grown. Larger area was prepared by ploughing and small patches of fields were prepared by hoeing. Sowing was done by broadcasting method in which seeds are scattered randomly on land, whereas transplanting is another method where plant is grown at different location, and transplanted to the cropping field at the time of growing season. Previous crop seeds are used for next crop. This method was mainly used for rice and vegetable crops. The pre-harvesting processes involve:

Table 1

Preparation of Land	Land has to be weed free and well-manured during the initial stage of growing at the time of sowing. Land was prepared by ploughing with oxen and hoeing, manuring was done at the time of ploughing
Sowing Method	Broadcasting method for most of the crops
Weeding and Hoeing	When the plant has achieved a height to 5-6 inches, then weeding and hoeing was done so plant can grow without any weed pressure.
Irrigation	Most of the crops are rain fed and others depend on <i>kuhl</i> irrigation during lean period
Manuring	Cow dung was most commonly used manure

Table 2: Traditional Farm Implements used in Kharal valley

#	Local Name	English name	Use
Tillage Implements			
1.	<i>Hal, haul,</i>	Plough	Used for tilling of land, and loosening of land before cropping
2.	<i>Joon</i>	Yoke	Used to tie oxen at the front of plough, so that oxen can pull the plough.
3.	<i>Joll</i>	Leveller	Used to align the land turned up during the ploughing
4.	<i>Gainty</i>	Pick axe	Used for digging
Inter-Cultivation Tools			
5.	<i>Kilni</i>	Arrowhead hoeing tool	Used in weeding out process
6.	<i>Kudali</i>	Flat-end hoeing tool	Used in weeding out process and digging. It is the bigger tool
7.	<i>Pharuwa</i>	Spade	Used to make drains in the fields for irrigation.
8.	<i>Gainty</i>	Double headed hoeing tool	Used to digging
Harvesting Tools			
9.	<i>Darati, dachi</i>	Small sickle	Used to harvest crops
10.	<i>Daraat, dach</i>	Big sickle	Used to cut tree branches and harvesting fodder from trees
Post-harvesting Tools			
11.	<i>Taashu</i>	Iron hook farm tool	Used to gather husk and pine needles
12.	<i>Kilta</i>	Big bamboo basket	Used to carry harvested crop and fodder
13.	<i>Tokri</i>	Small bamboo basket	Used to carry harvested crop
14.	<i>Shoop</i>	Winnower	Used for winnowing
15.	<i>Chanana</i>	Large Sieve	Used for sieving
16.	<i>Ukhal and musal</i>	Pounder with thick wooden pole	Used to crush or pound the grains (threshing tool)
17.	<i>Taret</i>	Hand mill	Used to grind the flour
18.	<i>Khaulda</i>	Sack of goat skin	Used to store the grains
19.	<i>Kothdi</i>	Big wooden box	Used to store grains and pulses
20.	<i>Dahtu</i>	Small wooden box	Used to store flour, grains and pulses

Threshing was traditionally done in *ukhal* (pounder made in rock) & *musal* (pestle of wood) and cattle & flail were used to separate grains from chaff on the threshing floor. Grains are stored in the air tight wooden boxes inside the dark and cool rooms, the wooden boxes are sealed with the soil paste so that the grains can be prevented from fungal growth or any other pest infestation. Pulses are stored in metallic utensils and ash is used to prevent pulses from any pest. Presently, the threshing is done using a thresher machine which separates the grain from chaff and the

same is used as fodder for the cattle. The farmers make use of the traditional farm implements, some of which are listed in the table 1. Traditional crops have nutritional values, such as millet is rich in iron, carbohydrate and fibre and is used for curing haemorrhoids and diabetes. *Siddu, Badi, chilre, bobru, madhra, rayta, bhalle/ bode, kachori, seera, famra, soor*, etc. are the traditional dishes of the area which are cooked on different occasion and even in routine. Some of the traditional crops and their uses are discussed in table 2:

Table 3: Traditional Crops and their uses in Kharal Valley

Amaranthus hypochondriacus	
English Name	Amaranth
Local Name	<i>Saliyaara, Sariyara, Chaolai</i>
Family	Amaranthaceae
Cultivation time	May and June
Cropping pattern	Amaranth was grown as an intercrop with finger millet and in rotation.
Harvesting	At end of the September and beginning of October
Post-Harvesting Techniques	
Drying	After harvesting, crop is dried vertically standing for 3 to 4 days.
Threshing	Amaranth is threshed in <i>ukhal</i> & <i>musal</i> because of its small size of seeds and unwanted material from seeds is removed by hand-picking method.
Storage	Stored in the <i>batunhi</i> , a copper utensil
Ethnic Foods	<i>Famra</i> and <i>dhanna</i> are made with the amaranth seeds.

<i>Chenopodium album</i>	
English Name	Chenopod, Pigweed
Local Name	Takk, bithu, bathua
Family	Chenopodiaceae
Cultivation time	June to September
Cropping pattern	Chenopod is cultivated in small patches of fields
Harvesting	Harvested after four months of sowing.
Post-Harvesting Techniques	
Drying	Crop is dried for three to four days before threshing
Threshing	Threshed in <i>ukhal</i> & <i>musal</i> and cleaned with hand picking method, after threshing, seeds are dried for 2 to 3 days.
Storage	After drying, seeds are stored or grinding to make flour and stored in <i>kothadi</i>
Ethnic Foods	<i>Famra</i> , <i>sabji/ saag</i> , chenopod leaves are also cooked with spinach.
<i>Eleusine coracana</i>	
English Name	Finger Millet
Local Name	<i>Kodra</i>
Family	Poaceae
Cultivation time	May and June
Cropping pattern	Millet is grown as an intercrop with amaranth and grown in rotation
Harvesting	Harvesting is done in October
Post-Harvesting Techniques	
Drying	Crop is dried for a day after harvesting
Threshing	Millets are threshed in <i>ukhal</i> & <i>musal</i> and cleaned with hand picking method, after threshing these seeds are dried for 2 to 3 days.
Storage	Millets are stored in <i>kothadi</i> or drums.
Ethnic Foods	<i>Kodre ki roti</i> and <i>Soor</i> is the liquor, obtained from millets.
<i>Fagopyrum esculentum</i>	
English Name	Buckwheat
Local Name	<i>Kathu</i> , <i>Pomphra</i> , <i>gangadi</i>
Family	Polygonaceae
Cultivation time	February and March
Cropping pattern	Buckwheat is cultivated in the weed-free field which is well-manured.
Harvesting	Green leaves of the buckwheat are harvested when it attains the height of 4 to 6 inches and the seeds are harvested in the month of September and October.
Post-Harvesting Techniques	
Drying	After threshing, the seeds are dried and husk of some seeds is removed in <i>ukhal</i> with <i>musal</i> .
Threshing	Seeds are separated by <i>musal</i> (thick wood stick) on floor.
Storage	Some of the seeds are stored for next cropping season and some are grinded to make flour.
Ethnic Foods	Fresh green leaves are cooked as vegetable, while <i>chilre</i> (pan cakes) are made using buckwheat flour.
<i>Hordeum vulgare</i>	
English Name	Barley
Local Name	Jau
Family	Poaceae
Cultivation time	October to December
Cropping pattern	Barley is grown in weed-free and well-manured field
Harvesting	Green barley is harvested as fodder for cattle but the crop is harvested in the month of June.
Post-Harvesting Techniques	
Threshing	Harvested crop is dried for 2 to 3 days the seeds are traditionally separated by using <i>musal</i> (thick wood stick) on the floor or by employing cattle on the threshing floor.
Drying	After threshing, the seeds are dried.
Storage	Before storage, the barley is winnowed for removing the husk. Some seeds are stored for next crop in <i>kothadi</i> and rest are grinded for making flour and fodder for cattle.
Ethnic Foods	<i>Chilre</i> , <i>sattu</i> and local beer.
<i>Oryza sativa</i>	
English Name	Rice, Red Rice
Local Name	<i>Chaul</i> , <i>dhan</i> , <i>lal dhan</i> , <i>lal chaul</i>
Family	Poaceae
Cultivation time	May and June
Cropping pattern	Rice is grown in the well-irrigated fields and requires a plenty of water in the initial stages.
Harvesting	Harvesting starts in the month of October
Post-Harvesting Techniques	
Threshing	Seeds are separated by employing cattle on the threshing floor and winnowed with fan or by hand picking method to remove husk. Later, the threshing is done with machine.
Storage	Some seeds are kept aside for next crop and remaining are grinded for making flour.
Ethnic Foods	<i>Lal bhaat</i> , <i>famra</i> , <i>khichadi</i> , <i>lugri</i>

<i>Panicum miliaceum</i>	
English Name	Proso millets
Local Name	<i>Cheeni</i>
Family	Poaceae
Cultivation time	June to August
Cropping pattern	Proso millets are grown in the weed-free and well-manured field.
Harvesting	October and November
Post-Harvesting Techniques	
Threshing	Before threshing, the crop is dried for one to two days. Seeds are detached by <i>musal</i> in <i>ukhal</i> then winnowed using a winnower and cleaned by sieving or hand picking method.
Drying	After threshing, the seeds are dried
Storage	Stored in <i>dahtu</i> , a small-sized wooden box or in <i>kothadi</i>
Ethnic Foods	<i>Bhaat</i>

<i>Setaria italica</i>	
English Name	Foxtail millet
Local Name	<i>Kauni</i>
Family	Poaceae
Cultivation time	May and June
Cropping pattern	Foxtail millet is grown as intercrop with maize or grown singly in well-manured field.
Harvesting	October
Post-Harvesting Techniques	
Threshing	After harvesting, crop is dried for two to three days and seeds are separated by <i>musal</i> in <i>ukhal</i> .
Drying	After threshing, the seeds are dried again.
Storage	Some of the seeds are stored for next cropping season and remaining are grinded in <i>ukhal</i> for removing the seed coat and then stored in <i>batunhi</i> , a copper utensil.
Ethnic Foods	<i>Bhaat and famra</i>

<i>Triticum astivum</i>	
English Name	Wheat
Local Name	<i>Gehnu, Kaunak</i>
Family	Poaceae
Cultivation time	November and December
Cropping pattern	Wheat is grown in well-manured field.
Harvesting	May or June.
Post-Harvesting Techniques	
Threshing	After harvesting crop is dried for three to four days. Seeds are separated by <i>musal</i> or employing cattle on threshing floor followed by winnowing.
Drying	After threshing, the seeds are dried.
Storage	Some seeds are kept for next crop and remaining are grinded to make flour.
Ethnic Foods	<i>Bhaturu, daliya, seera, siddu, baadi and bedue roti</i> (stuffed leavened bread)

<i>Zea mays</i>	
English Name	Maize, Corn
Local Name	<i>Makki, Choahli, Kukdu</i>
Family	Poaceae
Cultivation time	May- June
Cropping pattern	Crops like black gram, green gram, cowpea and kidney beans are grown with maize as intercrops.
Harvesting	October
Post-Harvesting Techniques	
Threshing	After harvesting, the cobs are dried on the roof tops on the house and seeds are separated by hand or by pounding with <i>musal</i> (thick wooden stick) in a bag.
Drying	After threshing, the seeds are dried for four to five days.
Storage	Some of the seeds are stored for next crop and some are grinded to make flour.
Ethnic Foods	<i>Makki Ki Roti, Dhana, Baadi, Bhutta.</i>

<i>Glycine max</i>	
English Name	Soybean
Local Name	<i>Soya, Soya Bean</i>
Family	Fabaceae
Cultivation time	May and June
Cropping pattern	Soybean is grown as intercrop with maize
Harvesting	October
Post-Harvesting Techniques	
Threshing	Seeds are separated by <i>musal</i> (thick wooden stick) on the floor.
Drying	After threshing, the seeds are dried for three to four days.
Storage	Some grains are kept as seeds for next crop and stored in <i>batunhi</i> .

Ethnic Foods	<i>Halwa, Dhana, Sepu Badi</i>
	<i>Lens culinaris</i>
English Name	Lentils
Local Name	<i>Masar</i> (lentils with seed coat), <i>Malka</i> (without seed coat)
Family	Fabaceae
Cultivation time	October to February
Cropping pattern	Lentils are grown in the weed-free and well-manured fields.
Harvesting	July- August
	Post-Harvesting Techniques
Threshing	Before threshing, the plant is dried for two to three days. Seeds are separated by <i>musal</i> (thick wooden rod) in <i>ukhal</i> or on the floor then sieved and cleaned by handpicking method.
Drying	After threshing, the seeds are dried and covering of seeds are removed by soaking the seeds in water. When outer covering softens then it is rubbed with hands to remove the outer seed coat.
Storage	Both <i>Malka</i> and <i>Masar</i> are stored separately in the <i>batunhi</i> .
Ethnic Foods	<i>Dal</i>
	<i>Macrotyloma uniflorum</i>
English Name	Horse gram
Local Name	<i>Kolth, Kulthi</i>
Family	Fabaceae
Cultivation time	May- June
Cropping pattern	Horse gram is grown as an intercrop with maize.
Harvesting	October
	Post-Harvesting Techniques
Threshing	Before threshing, the harvested crop is dried for two to three days. Seeds are separated by <i>musal</i> (thick wooden stick) on the floor and then cleaned by handpicking or sieving
Drying	After threshing, the seeds are again dried.
Storage	Good quality seeds are stored for next cropping season and stored in <i>batuhi</i> or bags.
Ethnic Foods	<i>Dal</i> and <i>Kichadi</i>
	<i>Phaseolus vulgaris</i>
English Name	Kidney beans;
Local Name	<i>Rajmah, Baali</i>
Family	Fabaceae
Cultivation time	May- June
Cropping pattern	Beans are grown as intercrop in the field of maize
Harvesting	September- October
	Post-Harvesting Techniques
Threshing	Before threshing, the harvest is dried for two to three days. Seeds are separated by <i>musal</i> (thick wooden stick) on the floor and cleaned with sieving and handpicking method.
Drying	After threshing, the seeds are dried for four to five days.
Storage	Some of the seeds are stored for next crop in the <i>batunhi</i> or <i>dahtu</i> as per the quantity.
Ethnic Foods	<i>Dal</i>
	<i>Sesamum indicum</i>
English Name	Sesame
Local Name	<i>Til</i>
Family	Pedaliaceae
Cultivation time	May- June
Cropping pattern	Grown in weed-free field.
Harvesting	October
	Post-Harvesting Techniques
Threshing	Before threshing, the harvest is dried for one to two days. Seeds are separated by <i>musal</i> in <i>ukhal</i> followed by sieving and handpicking cleaning.
Drying	After threshing, the seeds are dried.
Storage	Some seeds are stored for next crop in <i>batunhi</i> .
Ethnic Foods	Used for stuffing in the Ethnic Foods
	<i>Vigna mungo</i>
English Name	Black gram, Urad bean;
Local Name	<i>Mash, Maah</i>
Family	Fabaceae
Cultivation time	July-August
Cropping pattern	Black gram is cultivated as an intercrop with maize
Harvesting	Harvesting is done in the month of October
	Post-Harvesting Techniques
Threshing	After harvesting, the crop is dried for two to three days. Seeds are separated by <i>musal</i> (thick wooden stick) on floor and cleaned by sieving and handpicking method.

Drying	After threshing, the seeds are dried.
Storage	Some seeds are stored for next crop in <i>batunhi</i> remaining is used for self-consumption.
Ethnic Foods	<i>Dal, Bhalle/baude</i> (doughnut shaped), <i>Kichadi</i>
	<i>Vigna radiata</i>
English Name	Mung Beans, Green Gram
Local Name	<i>Moong, Moongi</i>
Family	Fabaceae
Cultivation time	July- August
Cropping pattern	Mung beans are grown along with maize
	Post-Harvesting Techniques
Threshing	Seeds are separated by <i>musal</i> (thick wood stick) on the floor and cleaned by sieving or handpicking methods.
Drying	After threshing seeds are dried.
Storage	Some of the seeds are stored for next season and some are stored for later consumption in the <i>Batunhi</i> .
Ethnic Foods	<i>Daal, Famra</i> and <i>Rayta</i> .
	<i>Vigna unguiculate</i>
English Name	Cowpea, Black-Eye Pea
Local Name	<i>Rongi</i>
Family	Fabaceae
Cultivation time	May- July
Cropping pattern	Cowpea is cultivated as an intercrop with maize
Harvesting	October

Post-Harvesting Techniques	
Threshing	After harvesting, the pads are dried for two to three days. Seeds are separated by <i>musal</i> (thick wooden stick) on floor and cleaned by sieving and handpicking method.
Drying	After threshing, the seeds are dried.
Storage	Some seeds are kept for next cropping season in <i>Batunhi</i> and rest for later consumption.
Ethnic Foods	<i>Dal, Madhara</i>

Spices and Condiments: Food is incomplete without spices and condiments; these are essential for the flavor and play an important role in maintaining the health. Spices and condiments grown in the valley are described in table 3:

Table 4: Spices and Condiments Cultivated in Kharal Valley

Scientific Name	<i>Allium cepa</i>
English Name	Onion
Local Name	<i>Pyaz</i>
Part Used	Bulb
Mode of use	Used as a condiment in the food preparation and green leaves cooked as vegetable and used for making chutney
Scientific Name	<i>Allium sativum</i>
English Name	Garlic
Local Name	<i>Lehsun, Lahsun</i>
Part Used	Bulb
Mode of use	Used as a condiment in the food preparation and green leaves cooked as vegetable and used for making chutney
Scientific Name	<i>Brassica juncea</i>
English Name	Brown Mustard
Local Name	<i>Shayi</i>
Part Used	Leaves, seeds
Mode of use	Oil is extracted from the seeds
Scientific Name	<i>Brassica nigra</i>
English Name	Black mustard seeds
Local Name	<i>Rai</i>
Part Used	Leaves, seeds
Mode of use	Used as condiment in the foods such as <i>raita</i> and is an essential ingredient of pickle.
Scientific Name	<i>Capsicum annum</i>
English Name	Chilly
Local Name	<i>Mirch, Pipli</i>
Part Used	Fruit
Mode of use	Used as spice and as salad
Scientific Name	<i>Coriander sativum</i>
English Name	Coriander
Local Name	<i>Dhaniya</i>
Part Used	Leaves, seeds

Mode of use	Seeds and green leaves used as spice and condiment in food or chutney preparation
Scientific Name	<i>Foeniculum vulgare</i>
English Name	Fennel
Local Name	<i>Saunf</i>
Part Used	Seeds, leaves
Mode of use	Seeds used as spice in sweet and salted food dishes and leaves cooked as vegetable
Scientific Name	<i>Mentha arvensis</i>
English Name	Mint
Local Name	<i>Pudina</i>
Part Used	Leaves
Mode of use	Leaves used for making tea and chutney
Scientific Name	<i>Trigonella foenum-graecum</i>
English Name	Fenugreek
Local Name	<i>Methi, Mitha</i>
Part Used	Leaves, seeds
Mode of use	Leaves cooked as vegetable and seeds are used as spice
Scientific Name	<i>Origanum majorana</i>
English Name	Marjoram
Local Name	<i>Babhri</i>
Part Used	Leaves
Mode of use	Leaves used to make chutney and also added to the stuffing for making <i>siddu</i> and leaves are consumed raw

The traditional system of farming was purely organic and healthier. If we compare traditional people with present generation, we see that they were healthier and stronger. The reason behind is that their lifestyle and healthy food habits. In the contemporary world of technology, farming practices have become comforting and less time consuming but the traditional farming practices involved hard work which made the people stronger. The main disadvantage of traditional farming is that farmer has to opt for subsidiary employment to improve their socioeconomic conditions. Trend of cultivating traditional crops has decreased with the passage of time and changing climatic conditions. Agriculture department has introduced schemes for crop diversification, zero cost farming and improving the soil health besides some irrigation schemes to promote sustainable agriculture. Sati and Vangchhia (2018) in Mizoram found that the agriculture and cropping pattern has changed due to climate change. Crop production and yield of *Jhuming* (wet rice cultivation)

tobacco, cotton, rice, maize, oilseeds, potato, turmeric and ginger cultivation has decreased due to climate change and cultivation of horticultural crops such as banana, cabbage, turmeric, ginger and orange.

The changing climatic conditions were observed by the researcher including the increase in temperature and decrease in rainfall. Mizoram government has sponsored NLUP (new land use policy) for benefiting rural farmers and discouragement of shifting cultivation. Chhogyel and Kumar (2018) ^[4]. in Bhutan observed shifting in the cropping pattern due to climate change. It was seen that the climate change has increased the infestation of diseases which has mandated the spraying of pesticides in Kharal valley of Kullu district. Lone and Guroo (2017) ^[7]. observed the impacts of climate change on agriculture and horticulture in Baramulla district of Jammu and Kashmir where it was observed that the climatic variation such as drought, floods, heat and cold wave has affected the agriculture and horticulture and in turn the economy and livelihood of local people.

Iron hook tool (*Taashu*)Big sickle (*dach*)Arrowhead hoeing tool (*kilni*)



Small sickle (*dachi*)



Big seive (*chanana*)



Flat-end hoing tool (*kudali*)



Large bamboo basket (*kilta*)



Locally made small broom made of pine needles

Fig 1: Traditional Farm Implements



Changeri made of bamboo



Kothdi, grain storage large wooden box



Different sizes of bamboo baskets

Post harvesting implements (*shoop*)Small bamboo basket (*tokri*)**Fig 2:** Post-harvest gears in the study area

4. Conclusions

There has been change in the traditional agriculture practices in the valley, though the modern techniques have captured the attention of the farmers, but the need of the hour is to draw the best of both the technologies to find solutions to the existing problems, keeping in view the climate change. The modernisation and climate change have changed the agricultural systems and there is shifting of crop varieties from grains to vegetables and fruits. Farmers are adapting to zero cost farming scheme which will be beneficial from ecological point of view. It is concluded that traditional and modern farming both have advantages and disadvantages but the traditional farming practices are more important for the nature as well as for human health. Hence, the modern farming practices can be mixed with some of the traditional practices such as production of grains and leguminous crops which will improve the soil health without the use of any chemical, *kulh* system will help in the rejuvenation of ground water and grinding flour by water mill will not destroy the nutrients of grains, while the modern practices such as use of power tiller will prepare the land in less time and grass cutting machines will save the time of farmers. Thus, in order to face the threats posed by climate change we have to identify and evolve successful adaptation strategies; develop impact assessment plan; assess vulnerability and identify long-term plans; develop suitable agronomic adaptation measures for reducing the adverse impacts of climate; and revive the indigenous methods of crop protection, retaining of moisture content in soil and maintaining of soil fertility.

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