# Indigenous Technical Knowledge for Subsistence Agriculture: A case Study of Seraj valley, District Mandi, Himachal Pradesh

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*Abstract*: Until recently, it was traditional wisdom that provided a vast majority of the people with a basic understanding of life activities. Concerns and efforts related to the application of traditional knowledge systems have been rejuvenated but to utilize its complete potential there is a need of assimilating Indigenous Technical Knowledge with contemporary scientific knowledge. More than 10,000 years old Indian farming was developed by farmers and sages using many practices to effectively cultivate crops in the diverse agro-climatic zones. This paper is based on the study carried out in selected pockets of Seraj valley, District Mandi, Himachal Pradesh. The area is dependent on farming. The study area was explored to analyze the traditional farming practices and traditional crops, which has been affected by climate change and many of them are on the verge of extinction.

## *Index Terms*: Farming, Traditional Crops, Indigenous Technical Knowledge, Pre-Harvesting Processes, Post-Harvesting Techniques, Traditional Farm Implements

#### I. INTRODUCTION

Owing to its massive applications in diverse fields such as farming, hydrology, livestock rearing, natural resource management and healthcare, traditional knowledge is all-inclusive [1,2]. Livestock rearing and farming are among the long-standing practices through which man has been interacting with nature and handling ecosystem services [3]. Conventional farming is the result of the practices evolved by the local communities in thousands of years [4]. These practices have contributed substantially in the creating of scientific knowledge base in the field of agriculture [5]. For centuries, these practices have nurtured civilizations and continue to sustain them in the future as well [6].

Farmers across the globe, mainly in the developing nations use traditional crops (Jackson et al. 2007). Although contemporary farming has been accepted by farmers in every nation, but billions of ethnic communities still use conventional farming practices [7]. Farming communities are curators of time-honoured agrarian practices, and internationally about 84 percent of farms have area less than 2 hectares that operate 12 percent of farmland [8]. Small-scale growers adapt to the ecological changes using their traditional wisdom and lifelong experience transforming the farming practices and adapting to the changing preferences and environmental conditions [9]. Indigenous farming, a primitive type of food production involves the rigorous use of indigenous wisdom, land use, traditional farm implements, natural resources, organic farming and cultural beliefs of local communities. It is still the leading farming food production system in many parts of the world. Traditional farming makes use of local or indigenous wisdom, and spiritual beliefs in making farming decisions. Agriculture is the main occupation in Himachal Pradesh and is contributing Rs, 1.82 lakh Cores GDP. Agriculture plays a very important in economy mainly in developing countries. Agriculture fulfils the requirement of food in entire world. Rural population depends on agriculture, horticulture and control soil erosion and livestock rearing. Agriculture generates employment for rural areas. Agriculture has unequivocal connection with climate, since it has key role in farming processes and production. More inclusive research focused on the identification and probe into conventional farming and a concrete policy framework to safeguard and use time-honoured farming practices is the need of hour. This paper attempts to highlight the indigenous farming practices and traditional crops of Seraj valley, located in district Mandi, Himachal Pradesh.

#### **II. MATERIAL AND METHODS**

**Study Area:** The study was undertaken in Thunag tehsil of district Mandi (located in the middle region of the State between, 31° 13' 30" - 32° 04' 22" N latitude - 76° 36' 08" - 70° 23' 26" E longitude) and two developmental blocks namely Gohar and Seraj. The tehsil and blocks are known as the abode of Goddess Shikari Devi and Dev Kamurnag, the two major deities of the area. The study area is located in the subtropical - temperate region of the Western and Central Himalayas at an altitude ranging from 1, 233-3,268 m above the mean sea level. The region is surrounded by River Beas and *Tirthan khad* from north, Sunder Nagar tehsil from south, Banjar region of Kullu district from East and on the west by Balh Valley of Sunder Nagar tehsil. The two main streams in study area are *Jiuni khad* and the Janjehli or *Bakhali khad* being the main tributaries of River Beas. The terrain is hilly with steep valleys with inclined area near foothills.

Shikari Devi Sanctuary, about 125 km from the Mandi town on the South East direction on Mandi-Janjehli Road, is located between latitude 31° 28' 43.13" N & 77° 09' 55.86" E - 31° 28' 25.34" N & 77° 02' 58.85" E of tehsil Thunag at an altitude about 72 sq. km. The temple of Goddess Shikari Devi is situated on the hilltop of the sanctuary at an altitude of 3,216 mts. Surrounding area of the sanctuary with lush green Deodar (*Cedrus deodara*), Silver fir (*Abies pindrow*) forest and alpine meadows is famous as Seraj Valley. Due to heavy snowfall in winters, the place experiences extreme cold climatic conditions. One can trek to Shikari Devi shrine by following Janjehli-Bhulah- Shikari Devi, Jahal- Devidarh- Shikari Devi route or from Karsog. River Bakhli originating from Bhulah, Shikari Devi after running through Janjehli valley drains into River Beas near Pandoh Dam.

**Data Collection:** The primary data for the study was collected from the farmers using a pre-designed semi-structured questionnaire. The information was gathered on:

- Indigenous farming practices
- Pre-harvesting processes
- Post-harvesting practices
- Traditional farm implements and
- Traditional crops and their utilization (including local name, cultivation name, cropping pattern, harvesting, Post harvesting techniques, drying, threshing and storage)
- Ethnic food preparations

### **III. RESULT AND DISCUSSION**

Agroforestry is undertaken by the farmers in Seraj valley, which besides producing fuel wood and fodder, helps in conservation of natural resources. Indigenous farming is undertaken without disturbing the soil strata, using organic manure, crop rotation, intercropping and harvesting water of natural sources. The cropping patterns in any area are results of past and present choices by people, communities or government in addition to existing topography and climatic factor. These choices are usually based on knowledge, customs, and availability of resources. The area is mainly dependent upon agriculture and horticulture but cropping pattern has undergone a significant change in recent years. In Seraj Valley, fruits and vegetables are the major crops and it has reduced the yield of traditional crops. Farmers are shifting towards the cultivation off-season vegetables and floriculture in the poly-houses. Poly-houses have enabled the cultivation of diverse crops but at the same time it has resulted in degradation of land. Young farmers are unaware of traditional farming practices and prefer undertaking cultivation of off-season vegetables and flowers. Due to noncultivation of traditional crops, consumption of the ethnic food has also declined. People have abandoned cultivation of traditional crops owing to lesser yield, climatic factors, viz. drought, flood, excessive rainfall, and erratic behaviour of the climate. Buckwheat, soybean, barley, rice, wheat, beans, maize, and black eyed pea etc. were grown earlier, but due to changes in preferences and climatic variations farmers are shifting towards horticulture for more income. Farmers are using chemical sprays that harm grain crops. The area is rain fed and agriculture depends mainly on rain and some traditional irrigation sources. Forty years ago, area has paddy fields known as Ropa which required plenty of water but now these have converted into apple orchards, which indicate declining availability of water. 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 crops, bharesa, bithu and kangni have shown a sharp reduction from last few years. In spite of this, the elderly farmers in some areas still undertake cultivation of traditional crops using the indigenous farming practices, which are as under:

**Traditional Farming Practices:** A pre-harvest system is a scheme of existing technologies for agricultural raw material production. Thus, the term describes the fundamental technical and economic relations with agriculture. It includes:

- A. Pre-harvesting processes
- Land preparation
- Sowing
- Weeding
- Hoeing
- Manuring and
- Irrigation
- B. Post-Harvesting Techniques
- Drying
- Threshing and
- Storage

	Table 1: Pre-Harvesting Processes
Land	Land has to be weed free and well-manured before sowing. Land was prepared by
Preparation	ploughing with oxen followed by hoeing, and maunring
Sowing	Broadcasting method for most of the crops
Weeding and	When plant has achieved a height of 5-6 inches, weeding and hoeing is done so that plant
hoeing	can grow without any weed pressure
Irrigation	Most of the crops are rain-fed and others depend on water streams for irrigation during
	lean period
Manuring	Cow dung is most commonly used manure

**Post-Harvesting Processes:** Post-harvesting system is concerned with the post-agricultural practices, viz. storage, transportation, and processing of farm raw materials into food products. It includes:

**Drying:** Drying is the phase of post-harvest system during which the product is dried until it reaches the safe moisture level. The aim of drying is to lower the moisture content of the grain for safe storage.

**Threshing:** Threshing was traditionally done in ukhal (pounder made in stone) and musal (pestle of wood) and cattle and flail used to separate grains from chaff on the threshing floor. Grains are stored in an airtight wooden box inside the dark and cool room, the wooden boxes are sealed with the mud and cow dung paste so that the grains can be prevented from pest or microbial infestation.

Pulses are stored in metallic utensils and ash is sprinkled to prevent from any pest attack. Presently, the threshing is done using a thresher machine, which separates the grain from the chaff, and the same is used as a fodder for the cattle. **Storage:** Proper storage helps in preserving the quality and nutritional value of the grains, and can help in preventing foodborne illness caused by harmful bacteria.

Table 2:	<b>Post-Harvesting</b>	Processes
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ThreshingAfter harvesting, the pads are dried for two to three days. Seeds are separated by musal<br/>(thick wooden stick) on floor and cleaned by sieving and hand-pricking method.

Drying	After threshing, the seeds are sun-dried.
Storage	Seeds are kept for next cropping season in batunhi

The farmer makes use of traditional farm implements, some of which are listed in the table 3. Traditional crops have nutritional values, such as millets are rich in iron, carbohydrates and fiber and are used for curing diabetes. *Siddu, badi, chilre, babru, madhra, rayta, bhale, kachori, khichadi, laddu, sheera*, etc. are the traditional dishes of the area, which are cooked on different occasion and even in routine.

Tillage Implements						
#	I ocal name	English name	Usa			
π 1	Hal Haul	Plough	Used for loosening of land before cropping			
1. 2	Inai, Itaai Ioon	Voko	Used to the even at the front of plough, so that even			
۷.	JOON	Токе	osed to the oxell at the mont of plough, so that oxell			
2	I - 11	T suullus	List to all on the local terms days during the placehing			
<u>э</u> .	Jou	Leveller	Used to align the land turned up during the plougning			
4.	Gainty	Pick axe	Used for digging			
	<b>T</b> 1	Inter-Cultiva	ation Tools			
#	Local name	English name	Use			
5.	Kilni	Arrowhead hoeing tool	Used in weeding out process			
6.	Kudali	Flat-end hoeing tool	Used in weeding out process and digging			
7.	Pharuwa	Spade	Used to dig drains in the fields for irrigation			
8.	Gainty	Double-headed hoeing tool	Used for digging			
		Harvestin	ng Tools			
#	Local name	English name	Use			
9.	Darati/ dachi	Small sickle	Used to harvest crops.			
10.	Darat/ dach	Big sickle	Used to cut branches and harvesting fodder from			
			trees			
		Post-Harves	sting Tools			
#	Local name	English name	Use			
11.	Tashu	Iron hook farm tool	Used to gather husk and pine needles			
12.	Kilta	Big bamboo basket	Used to carry harvested crops and fodder			
13.	Tokri	Small bamboo basket	Used to carry harvested crops			
14.	Shoop	Winnower	Used for winnowing			
15.	Chanana	Large sieve	Used for sieving			
16.	Ukhal & Musal	Pounder & Pole	Used to crush or pound the grains			
17.	Taret	Hand mill	Used to grind the flour			
18.	Khaulda	Sack of goatskin	Used to store the grains			
19.	Kothdi	Big wooden box	Used to store grains and pulses			
20.	Dahtu	Small wooden box	Used to store flour, grains and pulses			

### Table 3: Traditional Farm Implements in the Study Area

Vernacul ar name	Scientific name	Cultivat ion time	Cropping Pattern	Traditional Farm Practices (harvesting, drying, threshing and Storage)	Ethnic preparations
Bathua, Bathu, Takka, (Chenopo d)	Chenopodiu m album L.	June - October	Cultivated in small patches of fields	<ul> <li>Harvested after four months of sowing</li> <li>Crop is dried for three to four days before threshing</li> <li>Threshed in <i>ukhal &amp; musal</i> and cleaned with hand picking method, after threshing, seeds are dried for 2 to 3 days.</li> <li>After drying, seeds are stored or grinding to make flour.</li> </ul>	Leaves cooked as vegetable
<i>Kodra,</i> <i>Koda,</i> (Finger millets)	Eleusine corcana gaertu	May- Septemb er	Millet is grown as an intercrop	<ul> <li>Harvesting is done in October</li> <li>Crop is dried for a day after harvesting</li> <li>Millets are threshed in <i>ukhal &amp; musal</i> and cleaned with hand picking method, after threshing these seeds are dried for 2-3 days</li> <li>Millets are stored in drums</li> </ul>	Cooked as <i>Roti</i> , the unleavened flat bread <i>Soor:</i> Traditional liquor
Kathu, Fafra, ogla, (Buckwh eat)	Fagopyrum esculentum monech.	April- July (higher hills), July- October (lower hills)	Buckwheat is cultivated in the weed- free, well- manured field	<ul> <li>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</li> <li>After threshing, the seeds are dried and husk of seeds is removed in <i>ukhal &amp; musal</i></li> <li>Seeds are separated by <i>musal</i> on floor</li> <li>Some of the seeds are stored for next cropping season and some are grinded to make flour.</li> </ul>	Leaves cooked as vegetable Cooked as <i>Chilre</i> , the pancakes
Bhatt, Bharth (Soybean )	Glycine max (L.) Mer.	June- October	Grown as intercrop with maize	<ul> <li>Harvesting is done in October</li> <li>Seeds are separated by <i>musal</i> on the floor</li> <li>After threshing, the seeds are dried for three to four days.</li> <li>Seeds are stored for next cropping season in a <i>batunhi</i>.</li> </ul>	Halwa: Semi-solid pudding Badi: The nuggets Dhana: Roasted seeds

Table 4: Traditional Food Grains and Ethnic Preparations in the Study Area

Vernacul ar name	Scientific name	Cultivati on time	Cropping Pattern	Traditional Farm Practices (harvesting, drying, threshing and Storage)	Ethnic preparations
Jau (Barley)	Hordeum vulgare L.	October- March in (lower hills) and March/ April/ - Septembe r/October (higher hills)	Barley is grown in weed-free and well-manured field	<ul> <li>Green barley is harvested as fodder for cattle but the crop is harvested in the month of June</li> <li>Harvested crop is dried for 2 to 3 days the seeds are traditionally separated by using <i>musal</i> on the floor or by employing cattle on the threshing floor</li> <li>After threshing, the seeds are dried.</li> <li>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</li> </ul>	Chilre: Pancakes Sattu: Powdered roasted grains Soor: Traditional liquor
Kuth, Kulthi, Gehat, (Horse gram)	Macrotylo ma uniflorum Lam.	June- October	Horse gram is grown as an intercrop with maize.	<ul> <li>Harvesting is done in October</li> <li>Before threshing, the harvested crop is dried for two to three days. Seeds are separated by <i>musal</i> on the floor and then cleaned by handpicking or sieving</li> <li>After threshing, the seeds are again dried.</li> <li>Good quality seeds are stored for next cropping season and stored in <i>batuhi</i> or bags.</li> </ul>	<i>Dal:</i> A spicy lentil soup <i>Kichari:</i> Preparation of rice and lentil
Laldhan (Red rice)	Oryza sativa L.	June- Novembe r	Rice is grown in the well-irrigated fields and requires a plenty of water in the initial stages	<ul> <li>Harvesting starts in the month of October</li> <li>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</li> <li>Some seeds are kept aside for next cropping season and remaining are grinded for making flour</li> </ul>	Lal Bhaat: Boiled rice Kichari: Preparation of rice and lentil Lugri: Traditional liquor

vernacui ar name	Scientific name	Cultivat ion time	Cropping Pattern	Traditional Farm Practices (harvesting, drying, threshing and Storage)	Ethnic preparations
Til/ Gingelly, (Sesame)	Sesamum indicum L.	August- Novemb er	Grown in weed-free field.	<ul> <li>Harvesting is done in October</li> <li>Before threshing, the harvest is dried for one to two days. Seeds are separated by <i>musal &amp; ukhal</i> followed by sieving and handpicking cleaning</li> <li>After threshing, the seeds are dried.</li> <li>Some seeds are stored for next season in <i>batunhi</i>.</li> </ul>	<i>Siddu:</i> Stuffed steamed bread <i>Kachori:</i> Stuffed bread
Rajmah, Bali, (Red Kidney Beans)	Phagselu s vulgaris L.	June- October	Beans are grown as intercrop in maize field	<ul> <li>Harvesting is done in September- October</li> <li>Before threshing, the harvest is dried for two to three days. Seeds are separated by <i>musal</i> on the floor and cleaned with sieving and handpicking method.</li> <li>After threshing, the seeds are dried for four to five days.</li> <li>Some of the seeds are stored for next crop in the <i>batunhi</i> or <i>dahtu</i> as per the quantity.</li> </ul>	<i>Dal:</i> A spicy lentil soup <i>Khichadi:</i> preparation of rice with lentil
Kanak, Genhu (Wheat)	Triticum astivum L.	October- Novemb er to April (lower hills) and March – April to Septemb er- October (higher hills)	Wheat is grown in well- manured field.	<ul> <li>May or June</li> <li>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</li> <li>After threshing, the seeds are dried.</li> <li>Some seeds are kept for next crop and remaining are grinded to make flour.</li> </ul>	Bhaturu: Fermented bread Dalia: Cracked wheat grains Seera: Fermented powdered preparation Siddu: Stuffed fermented steamed bread Baadi: Semi-solid salted preparation Bedue roti: Stuffed leavened bread Chilre: Pancakes

Vernacul ar name	Scientific name	Cultivat ion time	Cropping Pattern	Traditional Farm Practices (harvesting, drying, threshing and Starage)	Ethnic preparations
<i>Rongi,</i> <i>Labia,</i> (Black- eyed pea)	Vigna ungulcul ata (L) walp	May- Septemb er	Cowpea is cultivated as an intercrop with maize.	<ul> <li>Harvesting is done in October</li> <li>After harvesting, the pads are dried for two to three days. Seeds are separated by <i>musal</i> on floor and cleaned by sieving and handpicking method.</li> <li>After threshing, the seeds are dried.</li> <li>Some seeds are kept for next cropping season in <i>batunhi</i> and rest for later consumption.</li> </ul>	<i>Dal:</i> A spicy lentil soup <i>Madhara:</i> Traditional curry
Makki, Chhali, kukdi, (Maize)	Zea mays L.	June- Septemb er	Crops like black gram, green gram, cowpea and kidney beans are grown with maize as intercrops.	<ul> <li>Harvesting is done in October</li> <li>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> in a bag</li> <li>After threshing, the seeds are dried for four to five days.</li> <li>Some of the seeds are stored for next crop and some are grinded to make flour.</li> </ul>	Makki ki roti: Unleavened flat bread of maize Dhana: Puffed grain Baadi: Semi-solid salted preparation
Mash/Ma ah, (Black gram)	Vigna mungo (L) hepper	July- Septemb er	Black gram is cultivated as an intercrop with maize.	<ul> <li>Harvesting is done in the month of October</li> <li>After harvesting, the crop is dried for two to three days. Seeds are separated by <i>musal</i> on floor and cleaned by sieving and handpicking method.</li> <li>After threshing, the seeds are dried.</li> <li>Some seeds are stored for next crop in <i>batunhi</i> remaining is used for self-consumption.</li> </ul>	Bhalle/baude: Deep fried doughnuts

Food security is both directly and indirectly linked with climate change. Any alteration in the climatic parameters such as temperature and humidity which govern crop growth will have a direct impact on quantity of food produced [10]. The agriculture practices in the Himalayan region are shifting from traditional cereal crops to cash crops such as fruits and vegetables [11]. Climate change is likely to have impact on food production across the globe. Increase in the mean seasonal temperature can reduce the duration of many crops and hence reduce final yield. The traditional system of farming was purely organic and healthier. 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 farmers have to opt for subsidiary employment to improve their socioeconomic conditions. Trend of cultivating traditional crops has decreased with passage of time and changing climatic conditions. Farmers owing to persistent work and low profit are shifting from traditional to modern farming. Contemporary agriculture, however, enhanced food productivity but due to increasing ecological problems, for example climate change, biodiversity loss, soil degradation and pollution, has affected the same [12]. Contemporary farming is one of the main reasons for the loss of crop genetic resources [13]. Traditional farming practices are generally confined to small farmers. Traditional crops grow well in hilly areas. Traditional farming is under serious threat because of habitat loss, introduction of new varieties, etc. [14]. To achieve sustainable food production in changing climate, switching over to climate-smart traditional practices is becoming the need of the hour.

#### **IV. CONCLUSION**

Traditional farming is still a growing concern for pervasive use. Traditional farming practices have promises to adapt and mitigate climate change through their agro-ecological characteristics for increasing agro-biodiversity and pliability of agro-ecosystems. Furthermore, they are low-cost, energy-efficient and based on locally accessible resources. Mountain communities are custodians of conventional farming. Conventional farming can be adopted as a substitute for sustainable food production in changing climate. Besides vindicating climate change, conventional farming is also beneficial for human health, natural resource management, energy conservation and socio-ecological reliability. Agroforestry, intercropping, crop rotation, cover cropping, time-honoured organic manuring and mixed farming can be the exemplary practices for climate-smart approach in farming. These practices not only mitigate climate change but also enhance agricultural sustainability. Traditional practices together with contemporary sustainable farming practices would be a best option for mitigating and adapting climate change. Acceptance of sustainable practices for socio-economic development can be a better choice to establish equilibrium between environment, society and economy. Indigenous mountain cultures, their dialects, rituals, traditions and practices must be cherished and pushed positively for their conservation.

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