

## **Utilising agro-ecology and traditional crop diversity into economic sustainability: A study of Uttarakhand State of Indian Himalaya**

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Uttarakhand is an Indian mountain state, spread over 53,485 square kilometers has a population of about 8.4 million (2001 census), out of which 74. percent live in 15,024 villages. Agriculture is the mainstay of this rural population. The formidable obstacles to agricultural development include a scarcity of arable land and scanty irrigation. The government owns 66 percent of the land which is under forest. The net sown area (excluding Nagar and Hardwar districts, which are plains areas) is about 13 percent of the total reported area. This mountain region has diverse agro-climatic features, including a flat area called tarai, mid mountain and high land nearing the snow line. Though the mountainous tact of the state is food deficient, there is a good repository of diversified agricultural traditions and products. Basmati rice of the Doon Valley, Ogal-Phapahar (*Buckwheat*), mandua (*Finger millet*,) jhangora (*Foxtail millet*,) and a variety of traditional legumes are grown in the high mountains that are unique to the region.



*A plant of the traditional crop Amaranthus conserved for seed (Photo by M. C. Sati)*

### **Economic advantage of traditional crop diversity:**

Agriculture in the mountains of Uttarakhand is monotonous subsistence farming. Food grains account for more than 80 percent of the total cropped area. Pluses are the main commercial crops in the region and average productivity of pluses in the mountainous region of the state is around 6.68 quintals per hectare. Crop diversity of the region and analysis of the price structure demonstrate economic potentials are very high. The crop diversity prevailing in the mountains of the state is given in Table 1.

**Table- 1 Agricultural crop diversity across altitudinal gradients in Central Himalaya**

Crop species	English name	Vernacular name	Altitudinal range (Meters Above mean Sea level)				
			500	1000	1500	2000	2500
Allium cepa	Onion	Pyaz	↔				
Amaranthus oleracea	Amaranth	Chaulai	↔				
A. frumentaceus	Amaranth	Chuwa/Marcha/Ramdana	↔				
Avena sativa	Oat	Jai	↔				
Brassica campestris	Mustard	Sarson	↔				
Brassica spp.	Mustard	Toria	↔				
Cajanus cajan	Pigeon pea	Tor	↔				
Canabis sativa	Hemp	Bhang	↔				
Chenopodium album	Pig-weed	Bethu	↔				
Cleome viscosa		Jakhiya	↔				
Colocasia himalayensis	Taro	Pindalu/Kuchain	↔				
Echinochloa frumentacea	Burnyard millet	Jhangora	←			→	
Eleusine coracana	Finger millet	Kodo	←			→	
Fagopyrum esculentum	Buckwheat	Oggal				↔	↔
F. tataricum	Buckwheat	Phaphar				↔	↔
Glycine soja	Soyabean	Bhatt		←		→	
Glycine spp	Soyabean	Kala Bhatt		←	→		
Glycine max	Soyabean	Soyabean	←	→			
Hordeum himalayensis	Nacked barley	Jowar			←		→
Hordeum vulgare	Barley	Jau	←			→	
Hibiscus subdarifa	Roselle	Sun	←	→			
Lens esculenta	Lentil	Masoor	←		→		
Macrotyloma uniflorum	Horesgram	Gahat	←		→		
Oryza sativa	Paddy	Satti	←		→		
O. sativa	Paddy	Dhan	←		→		
Panicum miliaceum	Hog-millet	Cheena/Bhangna	←			→	
Papaver somniferum	Popy	Post (Aphim)			←		→
Perilla frutescense	Perilla	Bhangjeera		←	→		
Phaseolus vulgaris	Kidney bean	Razma			←		→
Pisum sativum	Pea	Matar	←		→		
Pisum arvense		Kong				←	→
Seasamom indicum	Seasame	Til	←		→		
Setaria italica	Foxtail millet	Kauni	←			→	
Solanum tuberosum	Potato	Alu	←			→	
Triticum aestivum	Wheat	Gehun	←				→
Vigna aconitifolia	Mat bean	Bhirnga	←	→			
V. angularis	Adjuki bean	Rains		←		→	
V. mungo	Black gram	Urd	←		→		
V. radiate	Green gram	Mung	←	→			
V. unguiculata	Cow pea	Sonta	←		→		
V. umbellata	Rice bean	Bhotia				←	→
Zea mays	Maize	Mungri, Makka	←		→		



Zingiber officinale	Zinger	Adrak					
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Source: Semwal et al (2001)

The state produces about 40 different crop species of cereals, pseudo cereals; millets, pulses, oilseeds etc. and many varieties are cultivated throughout the latitudinal gradient (Semwal et al 2001). So much so that in the monsoon, typically farmers of the lower and middle Himalayas can harvest twelve crops, popularly known as *BaraNaza* ( twelve grains) from tiny holdings. Mostly, in an average field, three or four subsidiary crops are raised with one main crop. It is still very common to see farmers cultivate mandua (Finger millet), Gahat (*Horesgram*) Urd (*black gram*), Soyabeans, Riains, (*Adjuki bean*) and Sonta (*Cowpea*) in the same field. Kodo occupies the middle portion of the field and pulses are sown in the upper and lower portions , where soil is less fertile and prone to soil erosion. This practice is used traditionally to utilise the difference in the fertility of the soil for economic advantage and simultaneously conserve the soil. The traditional crops which are not so popular are: Chaulai (Amaranth), Oggal and Phapar (Buckwheat) and Cheena (Hog-millet). Besides being rich in protein content, have good productivity on inferior soil and are more capable to withstand the vagaries of nature. For instance, the average productivity of Chauli is around 15 quintals per hectare, Oggal 13.5 quintal per hectare and Phapar 12.5 quintals.



A field of organic traditional crop barnyard millet (Photo by M. C. Sati)

The main traditional pluses are Tor (*Pigeon pea*), Gahat (*Horesgram*) Urd (*black gram*), Soyabeans, Riains, (*Adjuki bean*), Sonta (*Cowpea*) and Rajma (kidney beans). Farmers practice mixed cropping patterns and sow pluses with main crops of wheat, or *manuda*. It is pertinent to mention that the demand of pluses produced in hills is on an increase, not only for taste and nutritive value but because they are a bio-food. The heavy migration of people from Uttarakhand has created a market for these pluses and grains in other parts of the country; therefore there is a



good market for these grains and crops in Delhi, Mumbai, Ahamadabad, Lucknow and other urban centres, where the population of migrated population from this area is substantial. The market price of pluses from the hills is much higher than pluses produced in the plains. The productivity of these crops is not less in comparison to the productivity of food grains. Farmers rarely raise these crops independently. If any field is used completely for raising pluses, like Gahat, Urd, Tor or Bhatt, than it can be taken for granted that the field is either remotely located, difficult to look after or it has very inferior soil. These pulses can be raised in waste and less fertile land.



*A field of mixed crops (potato and other traditional crops) (Photo by M. C. Sati)*

Till now farmers of the region could not tap the market potential largely because of poor market linkages and lack of a mechanism that could collect small quantities for the market. A barter system is still the most common marketing practice. Farmers exchange traditional crops like Chaulai, Oggal and various types of soyabeans either with grains like wheat and rice, as their own production of these grains fall short of their requirement or with commodities not produced locally. The terms of trade are highly adverse to local cultivators. Traditionally farmers used to exchange one Patha (a vernacular measure to weigh grains, approximately 2 kilogrammes) of Chauli, for six kilograms of salt. Thereby a ratio 1: 3 kilogrammes was used to exchange other grains produced at the higher altitude. Converting this into prices (expressed in Indian Rupees) reveals the extent of poor of terms of trade. Salt in general was priced at one Rupee per kilogramme and Chauli was roughly sold for ten Ruppess kilogramme. Even discounting the transportation cost, opportunity cost of travel of the trader, this ratio of 1:10 in monetary terms are exploitative. Of late this tradition has undergone some changes, with Chauli now exchanged for sugar, cloths and even for money. But the exchange rates are still highly unfavourable to farmers. Thus development of marketing channels which could take care of the interest of farmers, and consumers, is a perquisite to diversification.



A field of organic pulse, kidney bean, potato and other traditional crops (Photo by M. C. Sati)

However, certain pockets in the region have undergone radical transformation by utilising traditional crop diversity to their economic advantage. Many farmers' federations and Women's Self Help Groups (SHGs) are cultivating many traditional crops viz. buckwheat, horse gram, foxtail millet, barnyard millet, kidney bean etc. at a commercial scale. However, the area under these crops decreased by 80 to 100 percent in the last two decades mainly due to wheat and rice that are available at cheap rates in the public distribution system in comparison to these crops. Very recently, Japan's multinational company Yoshifoomi Kihata that produces baby food has purchased foxtail millet (manda) in bulk from the region. The Women's Cooperative Farmers' Association (RWCF) of Yamuna is marketing bio-products which are now available at retail outlets in metro cities of India. Some products which were consumed traditionally on various religious occasions which because of declining demand were on the verge of extinction are being patronised by state, religious and cultural organisations. In 2004, *Ogal and Phapar* have been reintroduced in the daily rituals of offerings (Prasad) at the Gangotri Temple, a temple dedicated to the goddess Ganga in Uttarakashi District, situated at 3,200 m.asl, nine kilometres downstream of Gaumukh glacier, where the river Ganges originates). Some voluntary organisations are doing a good job to conserve the traditional crop diversity and agricultural genetic variability of this region. For example, Sri Vijay Jardhari and his volunteers from the Jardhar village of Hernal valley in Tehri Garhwal district are involved in the collection of seeds of various traditional crops from different parts of the region under their 'Save the Seed' campaign.

These experiences though scattered and scanty are ways that demonstrate farmers' economic sustainability, conservation of traditional crop diversity and comparative advantage of the state. The economic advantage of different traditional crops in this mountainous region, is specifically in their being organic products and because they contain better nutrient content as well as tasting better. There is a great necessity to conserve, utilise and formalise this unique selling point of these products, as is being done with the kidney bean (*Rajama*) of the Harsil area, which is in the process of being certified by the Indian Institute of Organic Certification in Bangalore for certification as an organic product.



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