# Traditional Wheat (*Triticum aestivum* L.) Genetic Resources for Subsistence in District Pauri of Uttarakhand

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Plant genetic resources are the paramount assets for improvement and development of varieties with desirable traits. In order to fulfill the needs of the breeders, the traditional wheat (*Triticum aestivum* L.) genetic resources of district Pauri in Uttarakhand were studied by using random sampling technique during May 2008. Farmer's selections criteria of varieties, seed exchange system and storage methods, which are very important for subsistence needs of the farming communities were also discussed in the light of sustainable development.

**Key Words: Traditional wheat, Traditional knowledge, Pauri, Uttarakhand**



## Introduction

The district Pauri Garhwal has diverse topography that varies from foot hills of the terai of Kotdwar to the soul lifting meadows of Dudhatoli, sprawling at an altitude of 3,000 msl. which remains snow covered during the winter months. The agro climatic conditions of the region are sub-tropical to temperate. Pauri Garhwal is surrounded by districts Almora, Chamoli, Nainital, Bijnor, Haridwar, Dehradun, Rudraprayag and Tehri. Agriculture and allied activities not only provide livelihood to a large population of the region, but play an important role in their socio-economic and cultural development. The impact of the Green Revolution is hardly visible in the hill region of district Pauri. Agriculture is based on the organic matter (farm yard manure), traditional seed varieties and intensive labour by women folk in the region. More than 85 per cent of the agricultural land is rainfed. Irrigation facilities by and large are confined to valley areas (Maikhuri *et al.,* 2004). District Pauri of Uttarakhand is situated in the Central Himalayan region and the Himalayan region is a well known centre of crop diversity (Jain and Sastry, 1978; Arora, 1990; Khoshoo, 1992). Wheat (*Triticum aestivum* L.) is a major winter crop (*rabi*) of the region; mustard, lentil, pea, khesari etc. are also grown as mixed crops in the wheat crop. Agriculture in the region is based on age-old traditional practices based on traditional knowledge. Traditional farming system not only serves to preserve the diversity of local varieties, but also the human knowledge and behaviour practice that have shaped this diversity (Bellon, 1996). Wheat germplasm from International Wheat and Maize Improvement Center (CIMMYT) has been the core of Indian wheat programme. The local germplasm has also played an important role in the breeding, but its relative importance is minute compared to the exotic germplasm (Rajaram *et al.,* 2006). In the hill agro-climatic region, where agriculture is at the vagaries of rain, traditional local germplasm is the only means to sustain agriculture and livelihood. In order to conserve, utilize and know the present status of the local wheat germplasm in the district Pauri of Uttarakhand, the study was carried out to conserve and subsequently utilise the local diversity.

## Materials and Methods

Data on traditional wheat cultivars were collected from primary sources by preparing structured and un-structured questionnaires accompanied with interview schedules at individual farm households *rabi* 2007 and 2008. Sample villages were randomly selected from the entire district. The altitudinal gradients from 450 to 2,100 msl were surveyed. All the development blocks of the district Pauri representing district's agro-ecological niches were covered for the study. In each selected village, 5% households were selected for interview. Thus a total of 75 households were selected as respondent farmers for documentation of wheat varieties in vogue in their villages. During the survey of the district, a non-participant observation method was also employed while recording the information.

Using Participatory Rural Appraised (PRA), information was obtained on the erosion and shift in varietal diversity and changes in farming systems. The information on current status was validated by taking observation in the fields for the primitive cultivars diversity under cultivation. Documentation of wheat cultivars being the major crop is presented in this paper in detail. All possible care was taken to ensure the consistency in farmers naming and

describing wheat cultivars by comparing information from farm households and different social groups. Information obtained was authenticated from knowledgeable elderly farmers in the villages.

**Results and Discussion**

The study revealed that more than 85% cultivated area was rainfed and traditional practices were followed for wheat cultivation. Agriculture was based on organic matter (cowdung and litters) and seed material preserved from the previous harvest as inputs. Primitive cultivars of wheat were named by the farmers on the basis of presence of awns on the spike. Two types of wheat cultivars, awnless and awned were identified by the local farming communities. Awnless cultivars were called as *Mundiya* or *Mundri* and awned cultivars were known as *Jhusia* and *Kishaw* in local dialect in the entire Pauri district. The awned cultivars were further categorized in two local types, *i.e*., *Farmi* or *Deshi*. It was observed in the entire study area that all the improved varieties are awned, none of the awnless variety of improved cultivars was found. The erosion of traditional cultivars of wheat was evident in the region, because of the impact of state driven 'Green Revolution' which pushed the High Yielding Varieties (HYVs), chemical fertilizers, pesticides etc. free of cost initially and at highly subsidized rates later on (Maikhuri *et al.,* 2004). In some valleys of Garhwal, 72 to 95% of traditional landraces have been replaced by HYVs (Maikhuri *et al.,* 1996, 1997, 2001). In the present investigation, in district Pauri 31.12% traditional cultivars of wheat were observed to have been replaced by HYVs. A total of 68.88% of wheat cultivation was still dependent on traditional cultivars *Mundiya* (44.44%) and *Jhusia* (24.44%) due to irregular rain (Table 1). Hence, households were forced to cultivate their age-old traditional cultivars to produce atleast some yield. Local farming communities consider traditional cultivars as drought resistant, as these need less water, whereas HYVs were heavily dependent on irrigation water. Some reduction in traditional crops and varieties had also been reported from several other mountain countries like Nepal, Pakistan, Afghanistan, Bhutan, China (Tibet) etc. (Pratap, 1990; Anwar and Bhatti, 1990; Roder and Gurung, 1990; Sanju, 1990; Regmi, 1990; Houpei *et al.,* 1990).

Another way of naming of varieties was based on seed colour such as red and white called as *Lal gehun* and *Safed gehun* respectively. In *Mundiya* cultivars (awnless), three types of seed colours red, amber and white were observed and collected. It is very interesting to note that in *Jhusia* (awned) cultivars only two types of seed colours red and amber were noticed in the region (Table 2). Drought tolerance is also an important feature for selection of varieties particularly in rainfed areas. Farmers have also classified and selected the local cultivars. *Safed mundri* and *Lal mundri* are considered as drought tolerant by the local farmers. Hence, largely grown in rainfed areas of district Pauri Table 1. Yield of the crop is a major criteria of classification of varieties. *Jhusia, Kishav, Churi* and *Farmi* were some of the landraces with good yield potential. In hills, fodder production is also considered very important to feed the live stocks. Farming communities have classified wheat landraces on the basis of biomass (straw) yield. *Safed mundri, Lal mundri* and *Bhuri mundiya* were identified as having good potential for large biomass locally known as *naluwa* quality. Thus, *Mundiya* landraces were suitable for drought as well as biomass production (Table 4). In view of breeding programme amber colour is most preferred, followed by white. But farmers of the region do not bother for colour. Their first and foremost



**Table 1. Wheat cultivars grown by the farmers of district Pauri, Uttarakhand**

| Cultivars name | Percentage wise grown by the farmers | Desirable traits |
|---|---|---|
| Mundiya/Mundri (awnless) | 44.44 | Awnless, drought tolerant, tasty *chapati,* good biomass (straw) yield |
| Jhusia/Kishaou (awned) | 24.44 | Good yield and suitable for animal damage prone areas near by forest land |
| Farmi/Deshi (HYVs) | 31.12 | Suitable for irrigated areas need more inputs |

**Table 2. Seed colour variability in various traditional cultivars of wheat grown area in district Pauri, Uttarakhand**

| Cultivars name | Seed colour (%) | | | Total |
|---|---|---|---|---|
| | Red | Amber | White | |
| Mundiya/Mundri | 30.77 | 23.08 | 23.08 | 76.92 |
| Jhusia | 19.23 | 3.85 | 0.00 | 23.92 |
| Total | 50.00 | 26.92 | 23.08 | 100.00 |

**Table 3. Mean value of seed length and width of various landraces with various colours in traditional cultivars of wheat in district Pauri, Uttarakhand**

| Cultivars name | Red seeded | | Amber seeded | | White seeded | |
|---|---|---|---|---|---|---|
| | Length (mm) | Width (mm) | Length (mm) | Width (mm) | Length (mm) | Width (mm) |
| Mundiya/Mundri | 5.91 | 2.97 | 6.23 | 3.07 | 5.72 | 2.97 |
| Jhusia | 5.87 | 2.89 | 6.20 | 3.27 | -- | -- |

**Table 4. Ranking of various cultivars on the parameters of desirable traits and area under cultivation**

| Cultivars name | Ranking on parameters | | | | | |
|---|---|---|---|---|---|---|
| | Yield | Drought resistant | Taste/good chapati quality | Good biomass (straw) yield | Animal and bird damage control | Area of under cultivation |
| Mundiya/Mundri (local) | 2 | 1 | 1 | 1 | 3 | 1 |
| Jhusia local | 1 | 2 | 2 | 2 | 1 | 2 |
| Farmi/Deshi (HYVs) | 3 | 3 | 3 | 3 | 2 | 3 |

preference is assured yield. Among the traditional cultivars 50% were red, 26.92% amber and 23.08% white seeded. Local farm households prefer red-seeded cultivars because of its better taste in comparison to others and some assured yield. Another study conducted in district Almora of Uttarakhand revealed that the *Khuswao* (awned) wheat, which is promoted by government agencies for better yield, needs more water and has undesirable taste. It is reported to give better yield in the first year and not in subsequent years (Tiwari and Das, 1996).

Seed size as evident in Table 3 indicates an interesting trend that the average seed length and width is bigger in amber colour cultivars. Red and white seeded cultivars were almost similar in length and width. Amber seeded were bold in size in both types *Jhusia* (awned) as well as *Mundiya* (awnless) and produced more yield than others. Among various genotypes collected from the study area on the basis of seed size, colour, plant types etc. it was observed that there were 12-15 different genotypes, namely, *Safed mundri, Lal mundri, Churi, Lal kishav, Safed kishav, Jhusia, Chota mundri, Bada mundri, Bhuri mundri* (brown spikes), *Nan mundri* (plant small in height) etc., which are the major traditional wheat landraces under cultivation in district Pauri of Uttarakhand.

### Selection Criteria and Seed Exchange System

For selection of wheat varieties some factors considered were assured yield, drought tolerance, good taste, biomass (straw) yield and damage caused by wild animals and birds. Assured crop yield is of paramount importance as considered by the farmers. *Jhusia* (awned) local varieties were ranked first in view of yield potential, followed by *Mundiya/Mundri* and *Farmi/Deshi*. The area in district Pauri is faced with uncertain rain for cultivation of crops. To cope up with such drought conditions people select the drought resistant cultivars. *Mundiya* (awnless) cultivars have been found suitable for this purpose. *Jhusia/Farmi* (HYVs) cultivars were not drought tolerant in the area. A similar study revealed the same trend in district Almora, Uttarakhand (Tiwari and Das, 1996). Taste of *chapati* is also a major consideration for selection of crop varieties *Mundiya* is the most tasty wheat cultivar followed by *Jhusia*. In Central Himalayan region the traditional agro-biodiversity is complex with strong linkage between crop plants, animals and the forest (Palni *et al.,* 1998), hence biomass (straw) yield is considered very important component of crop husbandry and *Mundiya* has been ranked first followed by *Jhusia* and *Farmi/Deshi* (HYVs) types. In the hill region of Uttarakhand, land holdings are scattered over hill slopes, where crop damage by wild animals and birds is inevitable. For protection of crop from wild animals, awned varieties are found very useful. Farmers select the awned varieties for very far-flung and forest surrounded fields. *Mundiya* (awnless) varieties are very prone to loss by animal and birds. After considering all the above criterion of selection, the *Mundiya* (awnless) varieties are ranked first, *Jhusia* (awned) second and *Farmi/Deshi* (HYVs) third in the entire district Pauri of Uttarakhand (Table 4).

At the time of harvest of crop, elderly women, who possessed good knowledge of crop and seed selection, select the healthy completely matured spikes randomly from the entire field and harvest them separately. These harvested bundles are threshed separately and sun dried very carefully. Before storing, they test the seed moisture by crushing them with teeth. By virtue of their age old knowledge of the viability of grains, healthy grains are selected and stored every season, thereby enhancing the

genetic potential of the crop to withstand biotic and abiotic stresses (Ravi Shankar and Selvam, 1998). To protect the seed from insects, cow dung or oak wood ash are mixed with seed material before putting them in the storage bins. Sometimes the leaves of Buch (*Acorus calamus*) or Bakayan (*Melia azadirachta*) are also added in seed material. Traditionally, seeds were stored in hollowed gourdshells (*tumari)* when the quantity to be stored is small, in wooden boxes (*bhakar*) or covered bamboo baskets plastered with cow dung when the quantity is large. Tin containers are now replacing the traditional storage vessels.

Seed exchange system is very informal within the village, the most common being between the farmers of the same village. Women also collect the seeds from the parental villages. Seed are also brought from the neighborhood villages, where there are relatives and friends. In lieu of seed material, farmers return the same amount of grains or another variety of the crop they desire. If the farmer fails to return the seed or grains at that time he returns them after next harvest. Farmers selection and management shape the crop genetic diversity. Several studies have documented the flow of seed of different landraces among small farmers. Seed flow of local landraces takes place as farmers exchange seed among themselves with in the same village, purchase seed from or collect it from other farmers or relatives while visiting or traveling (Sperling and Loevingshon, 1993). Seed exchange and storage systems are all managed by the women folk in the entire Pauri district of Uttarakhand.



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