

Legumes diversity in Chamba block, district Tehri Garhwal (Western Himalaya) with reference to their economic importance and yield

PS Chauhan, Suman Bhisht

Tree Biology Laboratory, Department of Botany HNBGU Campus Badsahithaul Tehri, Tehri Garhwali, Uttarakhand, India

Abstract

The legumes are next in importance to cereals as serve of human food. It provides the much needful proteins to our predominantly vegetarian population. Legumes have been an important crop; ever since man started domestication of plants have been part of cultural heritage. Legumes play an important role not only in food security, but also contribute to the increase in soil fertility in terms of increasing organic manure content in the soil as well as by fixing of atmospheric nitrogen thereby increase productivity of soil in terms of yield of the substance crop or cropping system as a whole. Chamba block is high producing area of the legumes crops in the district Tehri Garhwal (Uttarakhand). The six major villages and ten families from each village were selected for data collection. Production sample of each crop have been taken from the different villages and average production rate of cultivated crop have been calculated. Matar in winter season while as urd and gahat in summer season are common growing crops. These crops showed high average production rate but lowest production rate have been observed in moong, sunta and channa in comparison to other legume.

Keywords: legumes, *fabaceae*, protein, agriculture

Introduction

Pulses are a good source of proteins for a majority of the population in India. Protein malnutrition is prevalent among men, women and children in India. Pulses contribute 11% of the total intake of proteins in India (Reddy 2010) [13]. The legumes or pulses belong to the family Fabaceae, sub-family Papilionaceae. The pulses figure prominently in crop rotations and in the mixed cropping commonly practised in Indian agriculture. About one-seventh of cultivated area in India is under pulses (Mehta 1954) [10]. In India, frequency of pulses consumption is much higher than any other source of protein, which indicates the importance of pulses in their daily food habits. About 89% consume pulses at least once a week, while only 35.4% of persons consume fish or chicken/meat at least once a week (IIPS, ORC Macro, 2007) [4]. In Garhwal Himalaya where local economy is agriculture based and more than 85% agricultural land is rained and practiced on slope of hilly terrains, importance of legumes crops as a soil fertility maintainer can't be ignored. But change in food habit, socio-economic and cultural transformation has led to reduction in area under cultivation, crop intensity and erosion in legume crop diversity. Many of these Himalayan tradition legumes crop have high ecological and economic potential and thrive well in adverse environmental conditional with low external inputs (Maikhuri *et al* 1996) [8]. Production of crops is directly depends on the climatic condition in hilly areas of Garhwal Himalayas. Less rain and drought are the two common factors which decrease the production rate of the legumes crops. Fluctuation in climate is major problem and it affecting the economy of the local farmers. Cultivation depends on rain as less than 10% arable land is irrigated (Swarup 1991) [15]. At village level attempts in Garhwal region, the farmers or villagers that have continued and maintained traditional farming system in remote and marginal areas need to be benefitted with viable incentives, which could be either monetary or non-monetary which may help in

conservation of traditional legume crop diversity (Nautiyal *et al* 2005) [11]. Present study was carried out to assess the production rate of cultivated crops and their economic uses by the local people.

Physiographic and climatic condition of survey area

The Garhwal Himalaya comprises six districts of Uttarakhand state viz. Dehradun, Tehri, Pauri, Chamoli, Rudraprayag and Uttarkashi lies almost centrally in the long sweep of Himalaya between 29° 26' N and 31° 28' latitude 77° 49' and 80° 6' E longitude. This well-defined physical region is bounded by the river tons in the west, district boundaries of Kumaon in the East, foot hills in south and Indo-Tibetan boundary in the north. It covered an area about 40090 Sq. Km. On the whole region constitutes more than a half (59%) of Uttarakhand hills. Garhwal Himalaya comprises high and low mountain peaks, valley dense forest, rivers and stream, due to those natural calamities the climatic conditions also greatly varies of this region. The topography of Chamba block is mountainous with flowering valley and small grasslands and characterized by numerous high ridges deep gorges and narrow valleys.

Materials and Methods

District Tehri Garhwal is situated in north Western Himalayan region in Uttarakhand state. This district is sub divided into 10 blocks. One of them is Chamba block which were selected for the present investigation. Chamba block comprising 200 villages among them only six larger villages were selected. In the present study the villages surveyed are Kanda, Pangar, Chopdiyal gaon, Dharkot, Chhati and Nail. The central point of study area was the Badshahithaul, Tehri Garhwal. Expedition of the present work has to start from the year of January 2014 and it has finished in the month November 2016. Ten families in each village were selected for data collection in different year. Three year data have been observed on basis of productivity of

different pulses crops. During the course of study so many fields, orchards and gardens of the particular plants were surveyed. The production of legumes crop was deeply observed to notice the effect of different season and the changing environment on different plants species. In the meantime also contacted to the many villagers, farmers and other related persons to gain exact knowledge about the seasoning crop. Keeping in view the climatic condition of the area regarding to specific crops the field studies has been made. In the field the nature and type of seed, sowing time of the crop, cultivation methods, nature and characteristic features of plant, flowering season and pattern, types of seed or pod, ripening of crop and harvesting period were observed. Information documented by the personal interview of the local farmers.

Observation

During the study following types of legumes diversity found in study area. Different parameters i.e. taxonomical features, sowing season and methods, harvesting season, average production of the cultivated crops were recorded. On the basis of seasonal cultivation of legume crop, the crop is cultivated in two seasons' winter (rabi crop) and summer season (kharif crop).

1. *Pisum sativum* (Local Name- Matar)

Description

This is cultivated in rabi crop and as mix cropping in near field. The pea plant is climbing or trawling annual with a slender hallow stem (about 1.5m tall). The leaves are pinnately composed with three pairs of leaflets terminated by branched tendrils. The leaflets are ovate or elliptic, entire with undulate margins (1.5 to 5.5x 1.3cm). The pods are swollen of compressed straight or slightly curved, glabrous, 3-12cm long and 1-2.5cm wide, each of which contain 2-10 seeds. The inside wall of the fruit is hard and parchment like and as it dries and contract more rapidly than the fleshy part of the pod, it cause the pod split along its two sutures.

Sowing and harvesting season

The pea crop is cultivated during the month of December and harvested in the month to June.

2. *Lense esculanta* (Local name- Masoor)

In the study area on the basis of colour two types of masoor seeds have been observed. One is black and while other is grey in colour.

Description

The plant is much branched, erect, pubescent, annual herb with a slender angular stem. The leaves are pinate bearing 5-7 pairs of ovate leaflets, ending in the points have terminal tendrils. The flowers are born singly or in cluster of two or three at the tip of flowering branches. The pods are short rarely longer; contain only two lens shaped seeds, which give the plant its name lens. The seeds are normally gray and black in colour. The cotyledons are generally yellow sometimes deep orange.

Sowing and harvesting season

In the study are lentil are cultivated in September and harvested in February- March. It takes 4-6 month for ripening. Generally this is cultivated with wheat fields in the study area.

3. *Cicer arietinum* (Local name-Channa)

Description

In the survey area the chickpea grown in low quantity. The plant is much branched, erect, annual and 25-30cm tall. The leaves are impar pinnate with 9-15 pairs of ovate.

Ovate leaflets with serrate margin. The flowers varying in colour from white to pink are usually born singly. The pods are small (3X2 cm) but in fated and contain one or two seeds which are angular with a prominent beak and small helm at the anterior end.

Sowing and harvesting season

In the study area chick pea is grown wheat as a rabi crop (winter crop) in the middle of October. Seed are sown broad cast. No inter cultivation of hand weeding is necessary. When the crop mature harvested closed to the ground by means of hand sickles or the plants pulled out when the leaves become radish or dry up.

4. *Dolichos lablab* (Syn) *Hycinth bean* (Local name: Chemmi)

Description

Different types of varieties are recognised on the basis of colour and size of seed in the study area (white black, with red spots, red with white spots, radish brown).The white colour seed mostly larger than other. Hyacinth bean is a climber, bushy varieties are known. The leaves alternate and trifoliolate with a thick pulvinus at the base. The leaflets are ovate, entire and soft hairy.

Sowing and harvesting season

In study area chemi bean is sown in the month of June to July and harvested in October and November. Rarely sometimes chemmi also grown as mixed crop with maize.

5. *Dolichos biflorus* (Local name: Gahat)

Gahat is growing in irrigated fields of the study area. This crop is cultivated comparatively in larger quantity than that of chemmi. Perhaps that in the survey area this crop do not require more labours. This crop is occasionally grown along the edge of field.

Description

This is cylindrical, sub erect, 30 to 40 cm high. The leaves are trifoliolate being membranous and filose with entire margins. Flowers are borne in bunches in axillaries racemes. The pods are sickles shaped, about 1.2 to 5cm broad, articulated with persistent style. Each fruit contains 5-7 seeds, which are small, flattened, rhomboidal, 3-6 cm long, variously colour from brown to red, black or matted.

Sowing and harvesting season

The seeds are either sown broad cast or in rows from the month of July last or August and crop attends maturity within 4-5 months, harvested in November.

6. *Cajnus cajan* (syn *C. indicus*) (Local name- Tor)

Description

It is also known as pegion pea red gram. It is observed that in study area *C. cajan* var. bicolor type of variety is widely cultivated because this variety having 5 seeds and mature within 9 months. Pegion pea perennial, shrub, 1-4m tall but it is

generally cultivated as annual crop. The leaves are trifoliolate, compound with relatively narrow, lance late and hairy leaflets. The flowers are yellow or purple in colour and arranged raceme, 4-12mm long, mostly axillary but sometimes terminal. The pods are 3-6cm long usually constructed obliquely between the seeds. In the study area this crop is cultivated in February and harvested in November.

7. *Vigna umbellate* (Local name- Naurangi)

Description

It is sub erect or twining herbs covered with spreading white hairs. Pod compressed 4x 2cm and 8-12 seeded glabrous.

Sowing and harvesting season

This legume is cultivated as mix cropping with finger millet and boundaries of rice crop in rainy season and harvested in October.

8. *Glycine max* (Local name- Kala Bhatt, Gora bhatt “Soya bean”)

Description

The two types of varieties are found in the study area *Gora bhatt*, having light yellow colour and *Kala bhatt*, having in black colour. Soya bean is fast growing, erect, sub erect or trailing annual herb up to 50-70cm height, leaves and stem are covered with down ward pointed reddish brown hairs. The leaves are large trifoliolate. The flowers are small, yellow and clustered at the top of short hairs peduncle.

Sowing and harvesting season

The crop is raised from seeds. The soyabean is cultivated in June- July and harvested in September- October. The pods are flate septate. The early variety i.e. Gora bhatt get mature in 75-110 days, while other i.e. Kala bhatt takes 100-200 days. The Gora bhatt is cultivated of rice field while Kala bhatt is cultivated in separate fields.

9. *Phaseolus sp*

During the study of the specified area it is found that following species of *Phaseolus* being cultivated by the local people. *Phaseolus vulgaris*, *P. aureus*, *P. mungo*, *P. lunatus*.

i) *Phaseolus vulgaris* (Local name- Chemmi, Rajma)

Description

More than five varieties are cultivated in area. Among them two are most important and vary in size and colour, one of the black colours with larger seeds while other is white in colour with small seeds. A fertile soil, rich lime is necessary for good yield. They are low, erect or twinning annuals with small white or coloured flowers, trifoliolate leaves and slender pods.

Sowing and harvesting season

This legume is cultivated as mix cropping with finger millet in

rainy season and harvested in October.

ii) *Phaseolus aureus* (Local name- moong)

Description

It is also known as green gram and golden gram. The plants are erect or sub erect, much branched, annuals 0.5-1.3m in length, leaves are trifoliolate and compound. The purple yellow flower occurring in clusters of 10-20 long peduncle axillary racemes. The pods are grey or brown when mature, measuring 5-10x0.4-0.6 cm and contain 10-15 small seeds. That is usually green but sometimes yellow or even black. Green gram is a fast growing crop cultivated in summer, dry and pulse and mature with 3-4 months.

Sowing and harvesting season

In the study area the moong is cultivated as kharif crop, in the June-July and harvested in September-October.

iii) *Phaseolus moongo* (Local name- Kali dal, Urad)

Description

P. moongo is known as black gram or woolly payroll. Black gram is fast growing, erect, sub erect or trailing herb up to 0.8m in height. The leaves and stems are covered with long, reddish hairs. The leaves are larger, trifoliolate, each leaflets is being ovate lanceolate, entire 5-10cm long subtending by short stipules. The flowers are small, yellow and clustered at the top with short peduncle. The pods are narrow, cylindrical, septate between the seed, erect or sub erect (4-7x0.6cm) covers with long ferocious and possess short hooks beaks. Each pod contains 6-10 seeds with square or flat ends up to 4 mm long. Seeds are black in colour. The seeds coat is smooth and without ridges.

Sowing and harvesting season

Seeds are sown as broad cast and the crop is mature within 3-4 months. In the Chamba block the gram is cultivated with millets (mostly with finger millets) and also cultivated with other crops as mix cropping.

iv) *Phaseolus lunatus* (Local name- Sunta)

Description

This is the pubescent annual herb, 10-30 cm in height. On account of its mat like spreading habit it has been given the name mat bean. The leaves are trifoliolate, each leaflet being subtended by a pair of small stipule. The very small flowers are grouped on long hairy axillary peduncle. They are small (2.5-5x0.5 cm) nearly with short curved beak and are covered with stiff hairs or bristles. Each pod containing 4-9 small seeds, which are, more or less cylindrical, rectangular up to 5mm long.

Sowing and harvesting season

In the Chamba block this legumes is cultivated as mix cropping with finger millet in rainy season and harvested in October.

Table 1: Major cultivated pulses crop and their uses.

Botanical name	Local name	Uses
<i>Dolichos lablab</i>	Sem, chemmi	The young pods as vegetables. Dry and ripe seeds are consumed as spilt pulse. Sprouted beans are boiled and mashed into a paste, then fried.
<i>Dolichos biflorus</i>	(Gahat)	It is largely consumed as it is rather than split pulses. This is also good crop for poor peoples who have not any source of income, because peoples are using this legume as a cash crop, they are directly taking rice instead same quantity of seed. The local peoples were quantifying by the patha which around 2.0 kg. If they will sell one patha (2.0kg.), they will get same quantity of rice. It seems to be good for patients

		suffering from urinary or kidney troubles. Popular use during colds season. According the local peoples, the boiling soup of gahat is very useful for blast of rocks instead using blast.
<i>Cicer arietinum</i>	Channa	The common use of this legume was recorded as food with rice. On the occasion of festivals and ceremonies commonly used by peoples as a mixed dal.
<i>Pisum sativum</i>	Matar	At the immature condition the pea crop used as vegetable. For this purpose garden pea is cultivated in an immature condition. Field pea are grown mature seed, the mature seed may be split and prepared in various forms of consumption.
<i>Phaseolus vulgaris</i>	Chemmi, Rajma	The young pods, unripe and dried ripe seeds are used as dal. Plants are used for fodder.
<i>Phaseolus aureus</i>	Moong	The green seeds are often used. Green gram is an important pulse and is consumed either whole or split, after decapitation. Unlike other pulses green gram is said to be easily digestible free from heaviness of flatulence. Due to this property of moong, it is useful for the person who is suffering from the dysentery, so it is widely used by the local people for good health.
<i>P. moongo</i>	Kali dal, Urad	The seeds is consumed as dal (whole, split, husked, de-husked) or parched. Mass flour of black gram prepare the famous dish of area i.e. pakori. The other types of dishes are also prepared in special occasion and deepawali festivals. It is one of most important cash crop in study area.
<i>P. lunatus</i>	Sunta	It is very delicious dal according the local people, which also used an occasion and festivals, by the mash prepared a famous dish i.e. "sunta pakori".
<i>Vigna umbellate</i>	Naurangi	The seeds are frequently cooked with rice. There are many types and varieties of pulse are cultivated in the study area. The seed colour ranges from ivory, red, violet and black.
<i>Cajnus cajan</i>	Tor	After harvesting the plants are brought to the home and left for the wilting. After drying these are threshed to get the seeds. Whole seeds are cooked and use as dal and different types of meals are prepared. It is a good source of fodder for cattle.
<i>Glycine max</i>	Bhatt, Soya bean bhatt	Soya bean is the cash crop of whole study area. It was becoming the 'god' for poor peoples who have not any other source of income. If farmers have 100 Kg. Soyabean they get same quantity of rice.
<i>Lense esculanta</i>	Masoor	Immature seeds eaten directly. Dry seeds cooked as whole or split and used as dal. Dry leaves are stock empty pods are used as cattle fodder.

Results and discussion

Twelve legumes crops have been cultivated by the local farmers in study area. Table-1 Shows the economic uses of different cultivated legumes crops in Chamba block by the local peoples. The average production rates of the cultivated legumes crop have been recorded in three different years and in different season. The seeds of legumes are frequently sowing within the time in winter and summer season but yield is depending on the rain due to lack of irrigation sources in hilly areas. *Pisum sativum* is cultivated in large scale in study area in winter season and it is fact that high yield of *P. sativum* increase the economy of the local farmers. *Cajnus cajan*, *Phaseolus* spp. and *Glycine max* is another important growing crops in summer season. It also increases the economy of local farmers. High yield of these crops gives good prices to the farmer in the season. Average production rate of the different legumes in different years is depicted in Table 2, 3 (a,b,c). *Phaseolus vulgaris* showed better result in Chopdiyal gaun and Maximum (122.44 Kg) average production have been recorded in this crop which is followed by *Pisum sativum* (105.72 Kg) in comparison to others. Due to low temperature and high soil fertility in the area might be increase the production rate of crops. The productivity of the crops has affected by the low Rain and productivity of crops is under estimated on the rain falls. Drought reflects both the quantity and distribution of rainfall. In eastern Kenya, common bean farmers estimated yield losses of 60% when rains ended too early and 42% when rains came too late. Similarly, farmers in Ethiopia estimated yield losses of 47% from a mid-season gap in rains and 32% when rains came late (Katungi *et al.* 2010) [5]. The impact of drought on common bean is exacerbated by low soil fertility and soil pathogens. Some crops like pigeonpea are particularly sensitive to moisture stress, especially during maturity stage. The important reason for decreased preference of pulses by farmers is continued higher instability in yields of pulse crops than major cereal crops (Chand 2008) [2]. In the sense of earning, *Dolichos lablab*, *Dolichos biflorus* and *Cajnus cajan*

is commonly cultivated crops in the area. These three crops are found more effective in production rate and the maximum (107.38 Kg, 102.06 Kg) av. production rate was recorded in Kanda and in Dharkot villages. Some other legumes crops are ignored by local farmers due to its low productivity. *Cicer arietinum*, *P. aurus* showed negative result and minimum av. (7.62 Kg) production rate have been observed in Chopdiyal gaun. High frequency of crop failure and yield instability due to biotic and abiotic stresses (Materne and Reddy 2007) [7]. *Vigna umbellate* is very popular crop grown in the area it gives better result. Lack of access to quality seed is the main reason why small holders have not adopted improved varieties of grain legumes. Many studies also documented the yield increase of subsequent crop (cereal) after the pulse crop compared to cereal crop or fallow in cropping system. An average of about 20-40 percent increase in yield was observed in Tarai region Nepal (Pandey, SP and Joshi PK 1995). Parcel land and slope farming reduced the production rate in the hilly areas of Garhwal Himalayas. Fragmentation based on differences in land quality not only increases the cost of production but also spreads the risk of harvest failure. For example, the contribution of area expansion to production ranged from 99% in soybean to 40% in pigeonpea (Abate *et al.* 2012) [1]. Sharma *et al* (2000) [14] evaluated the effect of mung bean on the productivity of rice-wheat cropping system in India. Pulses are rich source of protein for less efficient peoples that depends primarily on cereals and rooting crop and have therefore been cause the poor man's meet but the status inferiority has no means universal. Soya bean and other legumes have more recently been suggested both to reduce the risks of cancer and to lower serum cholesterol (Kennedy and Molteni 1995) [6] Pulses contain 17 to 30% protein on a dry weight which is nearly thrice to the value found in cereals and 20 times of *cassava*. Soyabean with as high 42% protein occupies an exacted position amongst the rich legumes. In addition to protein pulses contain up to 60% carbohydrates, mainly in the form of starch. The fat content of most pulses is

low i.e. 1-2% pulses are relatively rich in Cu, Fe etc. Legumes also contain vitamin B, but dried legumes do not contain vitamin C (Kumar 1994) [7] (Fig.1). Transfer of nitrogen from legume to

associated cereal and ultimately it increase the yield and efficiency of nitrogen use of the cropping system (Fujita *et al* 1992) [3].

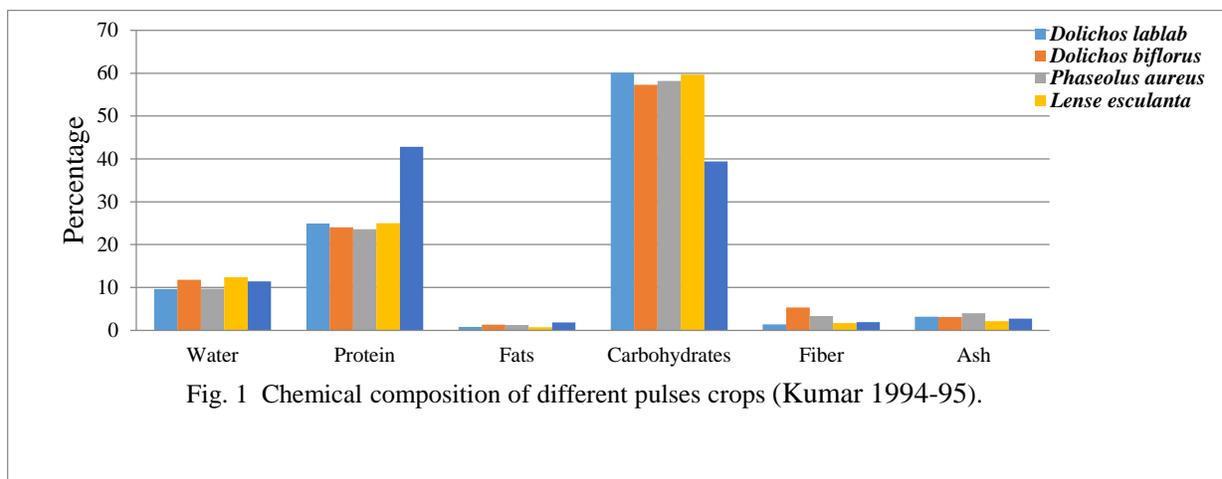


Fig. 1 Chemical composition of different pulses crops (Kumar 1994-95).

Table 1: Average crop production (in Kg.) / ten families (six villages) in three years. a. (2014) b. (2015) and c. (2016).

(a)												
Village name	<i>Pisum sativum</i>	<i>Lense esculanta</i>	<i>Dolichos lablab</i>	<i>Dolichos biflorus</i>	<i>Cajanus cajan</i>	<i>Cicer arietinum</i>	<i>Vigna umbellata</i>	<i>Glycine max</i>	<i>Phaseolus vulgaris</i>	<i>P. aureus</i>	<i>P. moongo</i>	<i>P. lunatus</i>
Kanda	35.60	56.37	112.41	95.75	87.76	12.85	46.97	37.65	124.98	13.88	87.77	33.93
Pangar	58.00	45.92	90.68	52.31	58.40	15.42	75.01	62.42	87.69	15.57	98.32	45.44
Dharkot	77.67	75.51	99.31	95.12	87.36	9.78	57.43	35.88	67.51	25.42	85.20	55.77
Chopdi- yalgaun	94.54	15.35	85.26	**	**	5.42	15.79	25.61	155.91	**	79.63	26.23
Chhati	55.67	53.72	15.92	94.66	85.66	7.16	44.21	70.72	25.59	15.32	55.87	56.17
Nail	47.36	56.17	56.14	83.47	43.43	15.01	65.56	85.29	46.42	22.85	75.31	45.58
(b)												
Kanda	22.76	45.73	117.02	85.68	68.79	10.08	96.42	76.98	90.50	10.94	52.79	55.89
Pangar	45.02	67.38	85.54	95.99	80.86	12.93	67.80	94.23	87.93	25.80	75.63	54.38
Dharkot	56.86	55.26	134.65	86.89	150.5	24.60	64.22	75.67	65.47	15.80	85.72	66.26
Chopdi- yalgaun	116.91	10.59	122.45	**	**	9.83	33.90	15.23	98.83	**	12.98	14.24
Chhati	34.68	65.42	23.08	85.52	98.6	15.95	58.93	97.90	50.59	24.90	90.52	65.60
Nail	45.76	45.97	67.45	78.65	82.6	10.19	54.88	85.13	45.63	22.78	64.28	45.63
(c)												
Kanda	*	*	92.72	97.83	57.80	*	91.89	98.74	76.80	24.00	85.80	37.60
Pangar	*	*	95.77	82.79	55.88	*	83.83	86.80	88.84	11.87	95.88	54.20
Dharkot	*	*	72.22	50.83	63.37	*	58.90	55.39	62.82	54.88	65.89	47.94
Chopdi- yalgaun	*	*	90.50	**	**	*	14.82	11.75	112.59	**	25.70	12.99
Chhati	*	*	35.75	66.70	83.78	*	46.89	53.12	38.13	48.90	75.39	75.59
Nail	*	*	55.30	50.22	65.81	*	68.50	68.30	45.89	25.30	60.52	65.70

*Crop waiting for harvesting, ** Not cultivated in area

Table 2: Mean for different legume crop production in three years (six villages / ten families).

Village name	<i>Pisum sativum</i>	<i>Lense esculanta</i>	<i>Dolichos lablab</i>	<i>Dolichos biflorus</i>	<i>Cajanus cajan</i>	<i>Cicer arietinum</i>	<i>Vigna umbellata</i>	<i>Glycine max</i>	<i>Phaseolus vulgaris</i>	<i>P. aureus</i>	<i>P. moongo</i>	<i>P. lunatus</i>
Kanda	29.18	51.055	107.38	93.09	71.45	11.47	78.43	71.12	97.43	16.27	75.45	42.47
Pangar	51.51	56.65	90.66	77.03	65.04	14.17	75.55	81.15	88.15	17.74	89.94	51.34
Dharkot	67.27	65.38	102.06	77.61	100.41	17.19	60.18	55.64	65.27	32.03	78.94	56.66
Chopdi- yalgaun	105.72	12.97	99.40	*	*	7.62	21.50	17.53	122.44	*	39.44	17.82
Chhati	45.18	59.57	24.92	82.29	89.34	11.55	50.01	73.91	38.10	29.71	73.93	65.78
Nail	46.56	51.07	59.63	70.78	63.94	12.60	62.98	79.578	45.98	23.64	66.70	52.30

Conclusions

Garhwal Himalayas in mix diversity of plants and crop species, which confer the inhabitants with a multiplicity of food. However, as modern cultivation technologies and concern for monetary gain develops, farmers are focused on only selective crop species. Keeping the cheapest source of protein, it is important to increase pulses crop production to increase balanced diet among the socially and economically poor peoples. Advanced multidisciplinary approach is needed, to evolve, a sustainable and efficiently productive farming system, which can provide food and economic security to the people without lose traditional information crop wealth an environment.

References

1. Abate T, Alene AD, Bergvinson D, Shiferaw B, Silim S, Orr A, *et al.* Tropical grain legumes in Africa and South Asia: knowledge and opportunities. Nairobi, Kenya: International Crops Research Institute for the Semi-Arid Tropics. 2012; 112.
2. Chand R. The global food crisis causes, severity and outlook. *Economic and Political Weekly*. 2008; 43 (26):137-144.
3. Fujita K, Ofosu-Badu KG, Ogata S. Biological nitrogen fixation in mixed legumes-cereals cropping system plant and soil. 1992; 141:155-175.
4. IIPS and ORC Macro. National Family Health Survey (NFHS-3), 2005-06: India. Mumbai, India: International Institute for Population Sciences, 2007.
5. Katungi E, Farrow A, Mutuoki T, Gebeyehu S, Karanja D, Alemayehu F *et al.* Improving common bean productivity: An analysis of socioeconomic factors in Ethiopia and eastern Kenya. Baseline research report. TL II/CIAT 2010, 126.
6. Kennedy AR. The evidence for Soyabean products as cancer preventive agents. *J. of Nuts* 1995; 125:5733-5743.
7. Kumar B. Text of Economic botany. Merrut College, Merrut, 1994.
8. Maikhuri KK, Rao KS, Saxena KG. Traditional crop diversity for suitable development of central Himlayan Agroforestry. *Inter. J. of suitable development and world ecology*. 1996; 3:8-31.
9. Materne M, Reddy AA. Commercial cultivation and Profitability (Yadav SS, Mc Neil David, StevensonL and LentilPhilip C, eds.). Netherlands: Springer. 2007; 173-186.
10. Mehta TR. Pulses Ind Coun. Agri. Res, Silver Jubilee Souvenir, 1954; 27-30.
11. Nautiyal S, Shibasaki R, Rajan KS, Maikhuri RK, Rao KS. Impact of land use changes on subsidiary occupation: a case study from Himalayas of India. *Environmental Informatics Archives* 2005; 3:14-23.
12. Pandey SP, Joshi PK. Constraints and prospects of legumes in Norther India and the trai region of Nepal, ICRISAT, Patancheru, India., 1995.
13. Reddy AA. Regional Disparities in Food Habits and Nutritional intake in Andhra Pradesh, India, *Regional and Pectoral Economic Studies*. 2010; 10:2-6.
14. Sharma SN, Prasad R, Singh S, Singh P. On farm traits of the effect of introducing a summer green manure of munghean on the productivity of rice-wheat cropping system. *J. Agric. Sci. comb* 2000; 134:169-172.
15. Swarup R. Agricultural economy of Himalayan region (with special reference to Kumaon Himalaya), Himvikas publication no. Nainital, Gyanodaya prakasan, 1991.