

**IMPACT OF FRONTLINE DEMONSTRATION ON  
PRODUCTION AND ECONOMICS OF PULSES IN  
BILASPUR DISTRICT OF HIMACHAL PRADESH**

**THESIS**

*By*

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(A-2017-30-015)**

*Submitted to*



**CHAUDHARY SARWAN KUMAR  
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## **CERTIFICATE – I**

This is to certify that the thesis entitled, “**Impact of Frontline Demonstration on Production and Economics of Pulses in Bilaspur District of Himachal Pradesh**” submitted in partial fulfillment of the requirements for the award of the degree of **Master of Science (Agriculture)** in the discipline of **Agricultural Economics** of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur is a bonafide research work carried out by **Ms. Shalvi Thakur** daughter of **Smt. Raksha Thakur** and **Sh. Pawan Kumar** under my supervision and that no part of this thesis has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been fully acknowledged.

Place: Palampur  
Dated: 23<sup>rd</sup> July, 2019

**(Dr. Harbans Lal)**  
Major Advisor

## CERTIFICATE- II

This is to certify that the thesis entitled, “**Impact of Frontline Demonstration on Production and Economics of Pulses in Bilaspur District of Himachal Pradesh**” submitted by **Ms. Shalvi Thakur (A-2017-30-015)** daughter of **Sh. Pawan Kumar** to the CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur in partial fulfillment of the requirements for the degree of **Master of Science (Agriculture)** in the discipline of **Agricultural Economics** has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

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(**Shalvi Thakur**)

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## LIST OF ABBREVIATIONS USED

Sr. No.	Abbreviation	Meaning
1	No.	Number
2	%	per cent
3	/	Per
4	@	at the rate
5	et al.	et alii (and others)
6	ha	Hectare
7	Fig.	Figure
8	i.e.	id est (that is to say)
9	kg	Kilogram
10	q	Quintal
11	viz.,	Videlicet (namely)
12	Sq. Kms	Square Kilometres
12	M	Meters
13	MT	Metric Tonnes
14	( )	Parentheses
15	FYM	Farm Yard Manure
16	IFFCO	Indian Farmers Fertiliser Co-operative
17	TFC	Total Fixed Cost
18	AVC	Average Variable Cost
19	TVC	Total variable cost
20	TC	Total Cost
21	BEP	Break Even Point
22	TO	Total Output
23	Rs.	Rupees
24	Dept.	Department
25	&	And
26	hr	Hour
27	FLDs	Frontline demonstrations

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**ABSTRACT**

Pulses are unique leguminous crops which maintain and restore soil fertility through biological nitrogen fixation. Pulses can be produced with a minimum use of resources and are mostly cultivated under rainfed conditions. Keeping in view the economic importance of pulses, the present study was proposed to study the role of KVK, Bilaspur at Berthin on promotion programme of pulses and the impact of frontline demonstrations on production and economics of pulses in the study area. A manageable sample of 50 farmers out of total farmers covered under FLDs was drawn by simple random sampling technique. To assess the impact of FLDs on pulses production, a sample of 25 Non- FLD farmers was also drawn from the same villages covered under sample FLDs farmers. During 2016-17, 98 FLDs were laid down on farmer's fields which comprised of 50 under blackgram and 48 under chickpea. Under lentil crop no FLD was laid down on farmer's field during 2016-17. In 2015-16 and 2016-17 the maximum yield of 9.20 q/ha and 11.90 q/ha, respectively, was recorded in chickpea (GPF-2) whereas in 2014-15 stagnant yield of 6.10 q/ha was recorded under all varieties of pulses (blackgram and chickpea). The maximum per cent increase in yield over check was recorded to be 51.10 and 49.20 per cent under Chickpea (HPG-17) in 2014-15 and 2015-16, respectively. On the other hand, in 2016-17 the maximum per cent increase in yield over check (48.10%) was recorded in Himachal chana-2. The gap between the recommended practices in frontline demonstrations and farmers' practice of blackgram and chickpea revealed that farmers generally did not use recommended technologies. The technological gaps with respect to all the cultural practices were lower on FLD farms. The productivity of pulses on FLD farms was recorded to be 4.22 q/ha, 5.24 q/ha and 4.49 q/ha for blackgram, chickpea and lentil, respectively. The productivity of all the crops in case of Non-FLD farmers was found to be lower than the productivity of these crops on FLD farms. The maximum net farm income of Rs. 5022 was recorded in Chickpea whereas minimum (Rs. 1267) in blackgram in FLD farmers. The influence of experience, area, education and human labour on production was found to be significant for FLD farmers whereas, in case of Non-FLD farmers only influence of area and human labour was significant. The problems faced by the farmers in the study area were adverse effect of unfavourable climatic conditions on the crop production, incidence of disease and insect pests. The study concluded that pulses contributed more than 20 per cent to the total income of the farmers, therefore, it is suggested that more number of FLDs on pulses must be laid down in the areas having potential of pulse production.

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**(Shalvi Thakur)**  
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**Date: 23<sup>rd</sup> July, 2019**

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**Head of the Department**

# 1. INTRODUCTION

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## 1.1 The background

Pulses are important crops that provide high quality protein complementing cereal proteins for predominantly substantial vegetarian population of the country. Pulses are the most important part of our diet, richest and cheap source of proteins, vitamins, minerals and amino acids besides high nutritional value. These are unique leguminous crops in respect of maintaining and restoring soil fertility through biological nitrogen fixation. Therefore, inclusion of pulses in the cropping system improves the performance of intercrop or crop grown in succession. Hence, the economic value of these crops is very high. Pulses can be produced with a minimum use of resources and are mostly cultivated under rainfed conditions (and do not require intensive irrigation). This is the reason that these crops are grown in marginal lands, area left after satisfying the demand for cereals/cash crops. These can be grown as sole crops and also fit in as an inter-crop/ mixed crop. Keeping in view large benefits of pulses for human health; the United Nations has proclaimed 2016 as the International Year of Pulses. Thus, due attention is required to enhance the production of pulses not only to meet the dietary requirement of protein but also to raise the awareness about pulses for achieving nutritional, food security and environmental sustainability.

Globally, pulses are grown in more than 171 countries. India is a premier pulse growing country and is largest producer and consumer of pulses in the world. India is having the largest shares of about 25 per cent in production, about 33 per cent in acreage and about 27 per cent in consumption of total pulses of the world. The total acreage under pulses in the country during 2016-17 is 29445 thousand ha and production is 23130 thousand tonnes. The major pulses cultivated during *kharif* season are pigeon pea, green gram and black gram. The common pulses grown in *rabi* season are chickpea, lentil, field pea, lathyrus and rajmash. The major pulses producing states are Madhya Pradesh (25%), Utter Pradesh (13%), Maharashtra (12%), Rajasthan (11%), Andhra Pradesh (9%) and other states together (30%) during 2016-17. The Government of India has launched a number of schemes/programmes time to time for area expansion and productivity enhancement to increase the pulses production in country. Through, such programmes, efforts were made to demonstrate the improved crop production technologies in cluster

mode to envisage the impact of large scale demonstrations and to build confidence among the farmers. The availability of pulses is quite low than actual recommendation of world health organization (WHO). The country is importing pulses to meet their growing domestic demand. The enhancement of domestic production of pulses, therefore, is more realistic and appropriate to meet growing requirement of the country and for that technological breakthrough is needed. The projected estimates suggests that by 2020 about 26.5 million tonnes of pulses will be required to fulfill growing demand for human consumption to maintain present level of availability at 37 gm/capita/day against at 70 gm/capita/day as per World Health Organization recommendation and demand for seed and miscellaneous uses. Even though pulses production increased significantly during the last decade but continuing the faster growth is a bigger challenge for researchers, extension agencies and policy makers to fulfill the domestic demand of its in India. The productivity of pulses in India (694 kg/ha) is lower than most of the major pulse producing countries. There is a large section of farming community which is still unaware of technological developments in the field of agriculture. The educating of farmers, therefore, through various extension activities is a crucial input for the rapid transfer and adoption of agricultural technology. The agricultural production can be increased if the production development program focusing more and on transferring the new technologies from research institutes to the farmers fields and make them more result oriented.

Agricultural innovations and diffusion of new technologies are key drivers to attain food security in the country besides providing farmers a competitive edge over traditional farming, thus facilitating better standards of living. To realize their true potential, farmers must have access to the state-of-the-art technologies, necessary inputs and related information in all the segments, be it crop, livestock, forestry or fisheries. The Government of India through Indian Council for Agricultural Research (ICAR) has established a wide network of Krishi Vigyan Kendras (KVKs) in all the rural districts of the country. These KVKs under the aegis of the National Agricultural Research and Education System are the real carriers of frontline technologies and impart knowledge and critical input support for the famers. Frontline Demonstration is the new concept of field demonstration evolved by the Indian Council of Agricultural Research with the inception of the Technology Mission on Oilseed Crops during mid-eighties. The field demonstrations conducted under the close supervision of scientists of the National Agriculture Research System is called front-line demonstrations because the technologies

are demonstrated for the first time by the scientists themselves before being fed into the main extension system of the State Department of Agriculture. The main objective of Frontline Demonstrations is to demonstrate newly released crop production and protection technologies and its management practices in the farmers' field under different agro-climatic regions and farming situations. While demonstrating the technologies in the farmers' field, the scientists are required to study the factors contributing higher crop production, field constraints of production and thereby generate production data and feedback information.

## **1.2 Rationale of the study**

In Himachal Pradesh, pulses are grown on an area of 31.38 thousands hectare with an annual production of thousand 63.34 MT (Anonymous 2016-17). The important pulses grown in the state include gram, moong, urd, lentil, rajmash, moth, pea, cowpea, horsegram and lathyrus. However, the farmers in the state are getting high income from pulse production by following modern techniques and recommended package of practices. The soaring prices of pulses in the recent years have also incentivized the farmers to include pulses in their crop production programme. The Krishi Vigyan Kendra of CSK HPKV, located at Berthin in Bilaspur district has a mandate of promoting pulses. The KVK, Berthin has various programmes and demonstrations on pulses. As a result, the farmers' efforts to produce different pulse crops are increasing, leading to higher production and income. Even with the best efforts, pulse acreage and productivity has been stagnant in Himachal Pradesh (Kumar and Prasher, 2012). The productivity of pulses in the state is quite low compared to national and global acreage, mainly due to their cultivation under rainfed and marginal lands besides poor crop management practices (Choudhary 2009; Choudhary et al. 2009a). Besides this, Himachal soils are acidic in reaction with low phosphorous availability (Suri et al. 2011), thus adequate supply of phosphorous through fertilizers becomes more critical for pulses which is lacking in the farm practices of resource poor hill farmers generally supplying sub-optimal doses of chemical fertilizers especially phosphorous (Choudhary 2011). There has been no systematic study on economics of pulses production so far and thus, keeping in view the above mentioned facts, the present study was undertaken in Bilaspur district of Himachal Pradesh. It was relevant to take up a study entitled, "Impact of Frontline Demonstration on production and economics of pulses in Bilaspur of district Himachal Pradesh" with following specific objectives:

**Objectives**

1. To study the role of KVK, Bilaspur at Berthin on promotion programme of pulses in the study area.
2. To examine the impact of Frontline Demonstrations on production and work out economics of pulses in the study area.

**Scope of the study**

The study will be useful to the planners and policy makers for formulating the various policies for the benefit and well-being of pulse growers. The study will be of great use to researchers in understanding the methodology and for its further improvement and refinement for the economic analysis of pulse production in future years. However, the study will also be useful to the pulse growers as it will highlight their problems and suggest the ways and means for their future betterment.

**Presentation of findings and organization of thesis**

This study has been systematically planned and presented in five chapters. The importance of the study and scenario of Pulses frontline demonstration, role of KVK in promotion of FLDs has been given in chapter-1. The chapter-2 presents the comprehensive review of work done in India, abroad and state as a whole, which is relevant to the present topic of investigation. The chapter-3 highlights the procedure adopted in the selection of a sample, data collection, tabulation and statistical analysis to accomplish the objectives. The results of the study and discussion have been presented in chapter-4. Finally, the summary and conclusions suggesting appropriate ways and means for the improvement of pulses growing farmers in the study area have been given in chapter-5.

## 2. REVIEW OF LITERATURE

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A comprehensive review of literature is essential in any research endeavors. It helps to ascertain the level of theoretical and empirical works that are currently being done or have been done in India and abroad on similar field of study. The review of literature related to the study, therefore, becomes an imperative for through understanding of research problem for better precision, conceptual clarity and to design the plan of study. Commensurate with the objectives of the present investigation, the review of literature has been categorized into main headings.

- 2.1 Area, production and yield of pulses
- 2.2 Impact of frontline demonstration on pulses
- 2.3 Economics of pulses production

### **2.1 Area, production of yield of pulses**

Chopra (1982) carried out state wise analysis of the area and production of pulses in India. She examined the growth pattern of area and production of total pulses under 13 states of India for the period 1950-1951 through 1967-77. Further, she worked out the share of *rabi* and *kharif* pulses in total pulses as well as under major pulses at aggregate level. She concluded that in states where production of pulses had declined the area had also shown a decline. In Madhya Pradesh, the area as well as production of pulses had shown clearly rising trend.

Chatha and Singh (1985) analyzed the causes of stagnation in production of pulses and oilseeds in Punjab under four groups of crops i.e. cereals, oilseeds, pulses and cash crops. They concluded that the growth pulses as a group registered significantly negative and that of oilseeds positive significant growth was recorded. Hence, pulses and oilseeds were considered as slow growth crops.

Quazi (1986) studied the cultivation of leguminous crops in Bangladesh. He reported that the agricultural acreage cannot be expanded, cultivation has to be intensified and diversified to ensure an improved supply of food to the population. In this respect, leguminous crops play a prominent role both as a food crop and as a means of improving the soil fertility. He suggested that there has to be emphasis on the necessity not only to consider the various yield components but to concentrate on how far

the cropping system as a whole can be improved by the integration of higher-potential legumes.

Singh and Swarup (1988) examined the trends in growth rates of area, yield and output of pulses in Himachal Pradesh over the period 1972-73 to 1981-82. They observed that production of pulses has been decreasing at the rate of 2.4 per cent per annum. The negative growth rates were observed in terms of the acreage and output of all pulses (gram, blackgram, horsegram, lentils) and only lentils showed a positive yield growth rate. Pulses were found to be grown as a subsistence crop in the state, but out three districts out of 12 were identified as being suitable for the production of pulses on a commercial scale. They recommended that in order to increase farmers should be made aware of the potential profitability of pulses, and be provided with information about improved practices backed up by timely technical advice.

Singh (1996) carried out the analysis of growth rate in area and productivity of pulse crops in Bihar. The data collected for the period 1968 to 1990 were used to examine the growth rate of area, production and productivity of pulse crops. The study concluded that during the period, acreage devoted to the production of gram, tur, peas and khesari decreased, while that of masoor remained unchanged and moong beans increased. The productivity increased in all crops over this period.

Ramasamy and Selvaraj (2002) analyzed the slow growth in pulses production in eastern India. The very smaller area under irrigation and its variability contributed for instability in pulses production. Lack of knowledge on crop management and technological constraints such as the insufficient and untimely availability of high yielding varieties (HYVs) of seeds affected pulses production. The differential impact of technologies, high yielding varieties and irrigation substantially affected area under pulses. The relative decrease in instability of paddy and wheat yield drastically affected pulses production.

Choudhary et al. (2009) studied the improved crop management practices for sustainable pulse production in India. They presented a critical review on capacity of various improved crop management practices to scale-up pulses productivity on one hand and highlight future research priorities on the other with the prime objective of sustaining pulse production in India. It revealed that there was a poor pulse productivity because of unavailability of quality seed at desired time, cultivation on marginal and sub-marginal

lands, imbalanced use of fertilizers and non-adoption of crop improved management practices.

Singh and Renu (2009) analyzed the performance of growth in production and productivity of different pulses in Jharkhand. Compound growth rate and variability were estimated in the area, production and yield of pea, lentil, chickpea and pigeonpea. The study indicated that there had been a positive change in the area of pulses crops. The variability in the area was observed to be high in pea followed by lentil and pigeon pea and minimum in chickpea. Similarly, variability in yield was also found to be high in pea followed by chickpea, lentil and minimum in pigeon pea, respectively.

Banerjee et al. (2010) studied the economics of pulses production and processing in India based on a compilation of Commodity Study Reports of five states, namely, Odisha, Andhra Pradesh, Uttar Pradesh, Haryana and Karnataka. They also examined marketing and international trade in pulses. Finally, constraints in production, processing, marketing and international trade in pulses were discussed and possible policy strategies were suggested.

Gajbhiye et al. (2010) studied growth and instability in chickpea production in Vidarbha region of Maharashtra. The results revealed that the growth rates for area and production of chickpea were found significant. The instability in chickpea indicated that productivity under chickpea exhibited less variation which means that production of chickpea over the period had been almost constant.

Rao (2010) studied the performance of pulses during pre and post-WTO period. The results revealed that growth performance of pulses production was high, but it was accompanied by a high degree of instability. The decomposition analysis revealed that area effect was marginally higher than the productivity effect on the production differential. Therefore, growth in production should mainly come from area attributing factors like assured supply of farm inputs and provision of remunerative prices.

Akibode and Maredia (2011) analyzed the global and regional trends on the pulse crop production, price, trade, and consumption patterns observed in the developing world, developed countries and globally from mid-1990s to 2008. They found that the household level survey data from India showed the continuing importance of pulses as a source of protein in poor people's diet, despite the overall changing dietary pattern, rising income and declining per capita consumption of pulses.

Bodade and Borker (2011) made an attempt to analyze the performance of chickpea production in Buldana district of Vidarbha region. The study was based on the secondary data pertained to the year 1990-91 to 2008-09. The study revealed that the growth rate for area of chickpea was found significant. Instability studied in Buldana indicated that production of chickpea witnessed high instability.

Acharya et al. (2012) analyzed the growth in area, production and productivity of major crops in Karnataka, India. Compound growth rate was used for estimating the growth trends. Growth rates showed a significant positive growth in area under pulses, vegetables, spices and fruits and nuts while cereals showed significant negative growth. The growth in area under oilseeds and commercial crops was negative and insignificant. Similarly the production of cereals, pulses, vegetables and fruits showed a significant positive growth. The production of oilseeds and commercial crops registered insignificant positive growth. The productivity of different crops recorded significant growth in the case of cereals, pulses and fruits. Productivity of oilseeds recorded moderately positive growth.

Sharma et al. (2013) analyzed the growth and trends of pulse production in India. The positive per cent change in area, production and yield of pigeon pea, chickpea and total pulses had been observed during both before and after launch of technology mission on pulses (TMOP) except in case of lentil. The area of chickpea and yield of pigeonpea also showed negative per cent change before launch of TMOP. The area of pulses had been most stable with few exceptions as compared to production and yield of pulses.

Chatterjee et al. (2014) examined the pulse production in major states of India and evaluated the overall trend in area, production and productivity of *kharif*, *rabi* and total pulses as well as their respective growth rates and instability during the period 1986-87 to 2007-08 for the sixteen major pulse growing states of India. The state-wise relative performance of pulses envisaged the fact that Uttar Pradesh, Assam, Madhya Pradesh and Andhra Pradesh has shown stable performance in pulses cultivation in both the seasons taken under consideration. However, Maharashtra and Himachal Pradesh has shown dominance in *kharif* pulses but has registered weaker performance in *rabi* season. Similarly, Tamil Nadu, West Bengal and Bihar three major *kharif* paddy based states has registered high level of performance in *rabi* pulses in regard to mean acreage, production and productivity. They further reported that the productivity of *rabi* pulses showed enough possibility towards a useful strategy to convert possible areas

under double cropping in the respective states with low and instable acreage for *rabi* pulses. This may also increase the productivity per unit of water owing to better solar harvesting and there should be concerted efforts to regain the area under pulses.

Devraj et al. (2014) examined the growth and instability of chickpea production in Maharashtra state. They observed that during the overall period, the growth performance of chickpea in Maharashtra state as a whole showed significant positive growth rate in area (2.33%), production (3.45%) and productivity (2.60%). The highest compound growth rate of chickpea acreage was observed in Yevatmal (7.64%) district. In case of productivity, growth rate was found to be the highest in Aurangabad (3.78%) district of the state. During the overall period of study, the state as a whole recorded instability in area, production and productivity which was to the tune of 37.47, 60.30 and 27.33 per cent, respectively.

Pichad et al. (2014) studied the growth rates and variability in area, production and productivity of chickpea in Amravati district. The results of the study revealed that compound growth rates for area, production and productivity for period II were found positive and significant. The co-efficient of variation indicated that instability in chickpea area exhibited less variation than production and productivity, at overall period. The production witnessed the highest instability as compared to area and productivity, at overall period.

Shimar (2014) analyzed the growth and instability in agricultural production in Haryana. The results of the study showed that, total pulse production had shown a declining trend over the period. Gram showed highest declining trend in both, production and area. Moong registered negative growth rate during 1980's and 1990's while it showed positive growth rate during 2006-07. The trends of instability were high in many crops like gram, moong and massar in all the periods because areas under these crops were shifted towards rice and wheat.

Inbasekar (2014) analyzed the challenges and strategies to increase pulse production in India with special emphasis on chickpea and pigeonpea. The compound growth rates were estimated to study the yield performance in the major states. The study revealed that there was low yield growth in chickpea and pigeonpea in the majority of the states. The yield gap analysis in chickpea also revealed high exploitable potential yield in the western zone.

More et al. (2015) conducted a study to compare the performance of pulse crops in Gujarat state in high growth period and across the earlier periods. The performance of crop was analyzed by decade wise i.e. period-I to period-V and results showed that, pulse area in the state was considerably increased. In recent years, area under pigeonpea (*Cajanus cajan*) and other pulses was decreased and chickpea (*Cicer arietinum*) area was increased. Pigeonpea and other pulse crops i.e. greengram (*Vigna radiata*) and blackgram (*Vigna mungo*) had recorded phenomenal growth during the year 1970-1980. Chickpea (*Cicer arietinum*) crop performed better during high growth period of Gujarat, compared to other pulse crops. Period-III i.e. 1981 to 1990 was recorded as anti-pulse decade in which productivity of all the major pulses was hampered. The pigeonpea crop was more stable compared to other pulse crops in the state. The area expansion was a major reason for increase in production of pigeonpea and chickpea in the state. The production of green gram and blackgram increased because of improvement in the yield and its interaction with area.

Uddin et al. (2015) carried out a study to measure the change and instability in area, production and yield of pulses in Bangladesh based on secondary data during the period 1986 to 2009 collected from Bangladesh Bureau of Statistics. The analysis revealed that the area and production of pulse had not increased. Though the yield of pulse had increased, but it was not sufficient to meet the demand of the country. The analysis also revealed that the area, production and yield of pulses were not stable during the study period.

Kumar and Devraj (2016) carried out the survey to discuss the growth in area, production and productivity of agricultural commodities in Karnataka. The study was based on secondary data collected for a period of 14 years from 2000-01 to 2013-14. The growth rates estimated for changes in area under different crops showed a significant positive growth in area of pulses, commercial crops, while cereals and oilseeds showed significant negative growth area under major cereals and oilseeds like jowar, ragi, bajra and minor millets in cereals and groundnut, sunflower, castor in oilseeds experienced a substantial annual decrement. The productivity of pulses, commercial crops, registered significant growth. The productivity of cereals and oilseeds recorded negative and insignificant growth.

Suman (2016) carried out the study on assessment of agriculture production growth and instability in Rajasthan. The secondary data for 20 years (1995-96 to 2014-

15) were used for the study. Results revealed that Bajra recorded highest growth in production and productivity i.e. 6.43 per cent and 6.07 per cent and barley observed highest growth in area by 2.83 per cent in cereals. The lowest growth was recorded by paddy in area, production and productivity. The moong pulse crop recorded highest growth rates in area, production and productivity. Arhar recorded lowest growth rates in area and production while gram recorded lowest growth in productivity. In case of instability in pulses moth, urd, moong and arhar were found to have very instable yield with very high coefficient of variation values.

Kumar and Grover (2017) made an attempt to evaluate the impact of National Food Security Mission (NFSM)-Pulses on state wise area, production and yield in India. The study revealed that significant growth in area and production was observed in Punjab, Bihar, West Bengal, Madhya Pradesh post NFSM-Pulses initiation. The yield performance after NFSM-Pulses initiation increased in all the states of eastern zones along with significant increase in Karnataka and Gujarat. The study also emphasized on exploiting production potential of pulses in niche states like Karnataka, Tamil Nadu and Gujarat by further strengthening of NFSM-Pulses programme.

## **2.2 Impact of frontline demonstration on pulses**

Tomar (1994) reported that a large gap existed between on farm and research station yields. Frontline demonstration were carried in Bundelkhand zone of Madhya Pradesh, out on cultivar's fields and to disseminate suitable improved varieties, better agronomic practices and improved plant protection measures compared with local practices. The demonstration plots provided returns of Rs 4180, Rs 9945, Rs 9448 and Rs 9662 per hectare for summer moong bean, chickpeas, mustard and soybean, respectively, compared with Rs 1376, Rs 3940, Rs 4471 and Rs 4180 per ha, respectively, for the plots with indigeneous practices. The percentage increase in the cost benefit ratios were observed to be 90 per cent for summer moong bean and mustard, 75 per cent for chick pea and 56 per cent for soybean demonstration plot.

Singh et al. (2005) conducted a number of frontline demonstrations (4488) at different KVKs on major pulses crops with improved varieties in an area of 2194 ha during 1997-2000. These demonstrations were laid out at farmers' fields in selected villages as cluster approach during *kharif* and *rabi* season. High yielding varieties of pigeonpea, urdbean, chickpea, lentil and fieldpea were found suitable under

demonstrations. They observed that KVKs could play a vital role to develop human resources that will speed-up the transfer of pulses production technologies among farmers.

Miller and Cox (2006) studied the transfer of information from researchers to producers in a research process in Utah, USA. They examined the methods used to transfer sustainable agriculture research technology to producers. Both investigators (researchers) and producers were interviewed to determine their preferences for technology transfer. Investigators preferred to transfer research information via workshops and periodicals. Producers preferred to receive information via on-farm trials and periodicals. Producers valued workshops primarily for the dialogue with the other producers. On-farm demonstrations were particularly important for technology that required a drastic transition from the methods used in the farm operation.

Yadav et al. (2007) revealed that in the state of Haryana the productivity of pulse crops continued to be quite low due to technological gaps in adoption of pulse technologies and other factors also. They emphasized that yield of pulses can be increased by demonstrating their cultivation technologies at the farmers' fields under the supervision of scientists working in the operational area. Keeping the importance of frontline demonstrations, the KVK, Faridabad conducted demonstrations on improved agricultural technologies of pulse crops in scientific manner at farmers' fields during the year 2003-04, 2004-05 and 2005-06 and achieved the expected yields.

Choudhary (2013) estimated the technological and extension yield gaps affecting yield of pulse crops under rainfed farming for three years from *kharif* 2008 to *rabi* 2010-11 under frontline demonstrations programme in Mandi district of Himachal Pradesh. He revealed that there was a wide yield variation between potential and demonstration yields of pulses mainly due to technology and extension gaps. Improved technology package has also improved the profitability of pulses in terms of gross and net returns besides enhanced incremental benefit-cost ratio (IBCR) ranging from 1.46 to 4.96. Overall, it was inferred that improved farm technology has great potential in enhancing the pulse productivity, profitability and water use efficiency through frontline demonstration programme in the study area and collateral farming situations in NW Himalayas as well.

Biswas et al. (2014) studied ex-trainees of KVK in technology transfer and adoption of improved farming practices in Dakshi, Dinajpur district of West Bengal. The

study was conducted in all 8 blocks of Dinajpur district of West Bengal where the KVK is situated. The study revealed that KVK primarily acted as Lab to land technology delivery mechanism and worked through imparting training to rural stakeholders on improved farming practices. The study finally revealed that majority of ex-trainees belonged to the category of small farmers group, young in the age of 20-30 years, belong to low income group, scheduled caste category, 'high school education' as literacy status, having land up to one hectare which reflected their real socio-economic status under the study. Cultivation was the main occupation of majority of stakeholders to maintain their livelihood security. The study also showed that awareness generation through vocational training by the KVK on various improved farming practices was efficiently done, but all the imparted technologies were not adopted by the stakeholders.

Choudhary and Suri (2014) analysed impact of the frontline demonstrations technology-transfer program (FLD-TTP) in pulses in Himachal Pradesh. Extension yield gaps varied by 485-550, 210-460, 470-640, 290-320, 494-600, and 277-512 kg ha<sup>-1</sup> in blackgram (*Vigna mungo*), kidneybean (*Phaseolus vulgaris*), pigeonpea (*Cajanus cajan*), cowpea (*Vigna sinensis*), chickpea (*Cicer arietinum*), and lentil (*Lens culinaris*), respectively, in the current study. Greater technology gaps were registered in cowpea and chickpea and the least in kidneybean. It was inferred that by adopting improved pulse production technology, pulse productivity can be raised by 97-128, 39-82, 112-129, 59-65, 130-141, and 67-126 per cent in blackgram, kidneybean, pigeonpea, cowpea, chickpea, and lentil, respectively. Overall, FLD-TTP has great potential to scale up pulse productivity and farmers' livelihoods in Himachal Pradesh and collateral farming situations in the developing world to enhance agricultural production.

Kumar et al. (2014) reported that substantial progress has been made in evolving techniques to obtain high yields of pulses, however, their production per hectare has remained the same for the last few decades. The acreage and productivity of pulse crop was found to be declining in Himachal Pradesh in general and Hamirpur district in particular. To boost the production and productivity of pulse crops Krishi Vigyan Kendras were conducting frontline demonstrations on pulse crops.

Kumar et al. (2014) analyzed the yield gap and economics of chickpea (*Cicer arietinum L.*) cultivation in low hills of Himachal Pradesh. The popularity of pulse crops remains quite low due to technological gaps in adoption of pulse technologies along with other factors also. To demonstrate pulse production technology, 96 frontline

demonstrations (FLDs) were organized by KVK Bilaspur, Himachal Pradesh on chickpea for four consecutive years from 2006-07 to 2009-10 on the farmers fields with prevailing farmers practice as control. The yield performance, yield gap, technology gap, extension gap and technology index were analyzed for demonstration and control plots. Higher yield of 21.8 to 61.4 per cent were recorded in demonstration plots over control. Average technology gap of 2.79 q/ha, average extension gap of 2.94 q/ha with the technology index of 23.21 per cent were recorded. By conducting FLDs of proven technologies, yield potential and net income from the chick pea cultivation was enhanced to a great extent with increase in farmer's income.

Sharma and Parkash (2015) conducted demonstrations on improved agricultural technologies of pulse crops at farmers' fields during the year 2009–10 and 2010–11 in Poonch district of Jammu & Kashmir. The economic parameters in terms of economic returns from pulses were calculated and compared with the corresponding traditional plots. All three pulse crops namely moong, mash and lentil recorded higher B:C ratios (4.88, 7.06 and 5.87, respectively) in demonstrated plots as compared to the plots where farmers were using traditional practices (4.09, 5.34 and 5.34, respectively).

Tandel et al. (2015) studied the extent of awareness about knowledge resource centre established by KVK, Navsari, Gujarat. Ten each adopted and non-adopted villages of Krishi Vigyan Kendra, Navsari were selected for the study purpose under KVK jurisdiction. The results revealed that there was significant association between education and extent of awareness about knowledge resource centre established by KVK in adopted villages whereas in non-adopted villages significant association between education, social participation, extension participation and extent of awareness about knowledge resource centre established by Krishi Vigyan Kendra.

Khedkar et al. (2017) studied the cluster frontline demonstration on chickpea was conducted by krishi vigyan Kendra Malegaon in two villages namely Vadel and Ajang of Malegaon tehsil during the rabi season. The results revealed that recorded average highest yield of 21.16 q/ha followed by 16.25 q/ha in control plot. Benefit cost ratio for demonstration and control was 2.56 and 1.78 , respectively. It was concluded that the pulses production could be enhanced by encouraging the farmers through adoption of recommended technologies which were followed by cluster frontline demonstrations.

Mandal et al. (2017) laid down frontline demonstrations (FLDs) on lentil using improved varieties WBL-58 and WBL-77 in the adopted villages of Rathindra KVK,

PSB, Visva-Bharati, Sriniketan, Birbhum in West Bengal to show the higher production potentiality. The demonstrations were carried out in 32 farmers' fields of 5 ha area and 79 farmers' fields of 20 ha area during the year 2013-14 and 2015-16 respectively in irrigated medium land situation. The technology of improved variety *viz.* WBL-58 and WBL-77 increased the average productivity by 26.5 per cent and 40.88 per cent and increased the net return by Rs 7,900 with an improved B:C ratio of 2.71 instead of 2.27 and Rs 15,240 with an improved B:C ratio of 3.74 instead of 2.95 than those of local check variety Asha during the both the years, respectively. Thus, the technology of improved variety of lentil may be accepted economically for better utilization of the residual soil moisture after short duration rainy paddy.

Singh et al. (2017) carried out a study on impact analysis of frontline demonstration on pulses in Punjab. The study was conducted to assess the impact of frontline demonstrations on summer moong and gram crops conducted in Moga district of Punjab and revealed that improved cultivation practices comprised under FLDs *viz.* recommended varieties, seed rate, timely sowing and plant protection technology resulted in average increase in yield of 15.7 per cent in summer moong and 13.5 per cent in gram crop over the check plots. Technology gaps, extension gaps and technology indices were calculated to analyse the performance of these frontline demonstrations at farmers' fields. Lower average technology index of 7.81 per cent indicated the feasibility of summer moong crop in existing farming situation in the district. The improved production technology of these pulses gave higher gross return and net return with higher benefit-cost ratio in FLD plots as compared to check plots.

Meena et al. (2018) reported that frontline demonstration (FLD) was one of the most important and powerful tools for transfer of technology. Keeping in view of an effective extension approach of FLDs for dissemination of technology FLDs on blackgram were conducted by KVK, Anta-baran, Rajasthan were assessed. They observed that there was 35.71 to 48.00 per cent increase in grain yield over local check and the average benefit cost ratio was higher under demonstration as compared to control plots during all the years of study. The average technology gap was 175 kg/ha and average extension gap was 245 kg/ha during all years of study. The findings also revealed that they had increase in adoption level ranging from 13.34 per cent of storage and marketing to 56.19 per cent of improved and quality seed after conducting the FLD programmes. The majority of the respondents farmers expressed medium (51.43%) to the high (33.33%) level of satisfaction for extension services and performance of technology under

demonstrations. It was concluded that the FLD played one of the important role in motivating the farmers for adoption of production technology resulting in increasing their yield and profit.

Singh et al. (2018) studied the impact of Frontline demonstration on Chickpea to Meet the deficit pulse availability in malwa plateau and central plateau region of India. The study was conducted to assess the impact of frontline demonstrations on Bengal gram crops conducted in the central plateau region of Maharashtra and the Malwa plateau of Madhya Pradesh. The study revealed that improved cultivation practices comprised under FLDs *viz.* recommended varieties, seed rate, timely sowing and plant protection technology resulted in increase in yield in gram crop over the check plots. The technology gaps, extension gaps and technology indices were calculated to analyse the performance of these front line demonstrations at farmers' fields which indicate the role of extension functionaries to act in a mission mode to fill the gaps and make the region self-sufficient in pulses.

Kumar et al. (2019) studied technological extension yield gaps in pulses crops for 3 years during 2009-10 to 2013-2014 under an FLD programme in the Poonch District of Jammu Kashmir. They revealed that there was a wide yield gap between potential demonstration yields due to technology extension yield gaps. Extension yield gap varied to the extent of 0.78 to 6.00 q/ha in chickpea. In case of lentil, demonstrations gave 12.77 per cent higher yield over the local check. Extension yield gap varied from 0.25-12.52 q/ha in lentil. In case of moong, FLDs gave 71 per cent higher yield than the local check extension yield gap varied from 1.27 to 1.46 q/ha. In case of mash, demonstration gave 35.5 per cent higher yield than farmers average plot yield whereas in case of rajmash on the basis of five year mean data, demonstration gave 28.73 per cent higher yield. Overall, it was inferred that improved farm technology has great potential in enhancing the pulse productivity and profitability through frontline demonstration programme in Poonch district of Jammu Kashmir collateral farming situations in NW - Himalayas as well.

### **2.3 Economics of pulse production**

Pawar and Pawar (2007) studied the economics of blackgram and greengram production on rainfed farms in Latur district of Maharashtra. The data were collected from 48 black gram and 48 green gram growers. The results of the study revealed that

main product of black gram was 9.54 q/ha while that of green gram was 9.08 q/ha. In production process, cost C was found to be Rs 10,801/ ha and Rs 11,232/ha in case of black gram and green gram production, respectively. The net profit was Rs 2,766/ha from black gram while it was Rs 3,701/ha from green gram. The output-input ratio was 1.25 and 1.33 in case of black gram and green gram production, respectively. The cost of production of black gram was Rs 1089/q while that of green gram was Rs 1,192/q.

Badal et al. (2008) examined on technical efficiency in production of moong bean in summer as well as *kharif* seasons in Faridkot (Punjab), Sikar (Rajasthan), Ghaziabad (Uttar Pradesh) and Muzaffarpur (Bihar) districts of India. The results of the study showed that the mean technical efficiency in moong bean production was 56 per cent. This indicated that even with the existing level of production technology, yield could be increased substantially by removing inefficiencies. The policy implication stemming from this was that it might be more cost-effective to achieve short-run increases in farm output, and thus income, by concentrating on improved efficiency rather than sole dependence on introducing new technology.

Shashikant and Dubey (2013) conducted a study on economic analysis of red gram cultivation in Gulbarga district of Karnataka. The study was mainly based on the primary data which were collected through survey method from selected sample respondents (36 small, 15 medium and 9 large) during 2008-09. The results indicated that production of red gram was profitable as reflected through its net returns. It was found that per hectare productivity of red gram was marginally higher on small farms (12.88 q) compared to medium (12.72 q) and large farms (12.52 q), due to better care and management of crop on account of a small area under it.

Sinha et al. (2014) conducted the economic analysis of production of chickpea in Bemetara district of Chhattisgarh. The study revealed that the average cost of cultivation and average net income per hectare of chickpea showed increasing trend with increase in farm sizes. The input- output ratio was observed 1:3.73. The production performance of chickpea was observed positive and significant growth in production was mainly due to positive and significant growth in area.

Chatterjee et al. (2015) studied on the economics of lentil cultivation in Nadia district of West Bengal to examine the inputs and materials used, cost of cultivation, gross returns, net returns and benefit-cost ratio. The crop performance was studied through composite index score. The results of the study revealed that average cost of production

was Rs 22,479/ha and average gross and net returns were to the tune of Rs 42,640/ha and Rs 20,161/ha and benefit-cost ratio was 2.00.

Verma et al. (2015) carried out a study on the yield and economics of pigeonpea to find out the yield and net income at different size of holdings in randomly selected advisory village of Ghazipur district of Uttar Pradesh during 2010-2011. The results of the study revealed that the total cost of cultivation and net income showed increasing trends from smaller to larger size of holdings along with no specific trends in benefit-cost ratio.

Bhat and Umesh (2016) studied the unique ability of pulses to fix atmospheric nitrogen which enhances soil fertility and reduces the need to use synthetic nitrogenous fertilizers. This study quantified the positive externalities of nitrogen fixation by pulses and its positive impact on farmers' expenses, government subsidies on fertilizers and environment because of reduced production and use of synthetic urea. They suggested that the international agencies concerned with environment and climate change should encourage pulse farming as a sustainable way of reducing the emission of global warming gases without affecting farm productivity. Since, pulses were majorly grown by small and marginal farmers under rainfed conditions, any support given to pulses would fulfill the equity dimensions of social welfare.

Mohaptra et al. (2016) studied the economics of tur cultivation in Vijayapur and Bagalakote districts of north Karnataka, India. They revealed that the yield per hectare of tur was 15.08 quintals and the average price received by the sample farmers per quintal of tur was Rs 5,825.50, respectively. The total cost of cultivation was Rs 60,260.37 and the net return per hectare of tur cultivation were found to be Rs 27,588.17, leading to profitability ratio of 1.45. In spite of more yield and higher price of output, the net returns for tur growers were less due to their higher investment in labour for carrying out various farm operations.

Kaur and Gupta (2018) studied the empirical analysis of economics of pulse cultivation in Bathinda and Fazilka districts of Punjab. On the basis of gross return which is the best indicator of profitability, the results of the study shows that although pulse cultivation has been observed to be somewhat profitable in district but it lacks assured returns due to lack of government procurement as well as low and unstable productivity unlike cereal crops which are enjoying assured returns.

The comprehensive review of literature in the forgoing chapter indicated that most of the research work related to the impact of frontline demonstration on production and economics of pulse production has been done in various parts of the country. However, scanty research work conducted in the state in this regard in the recent years. Therefore, this study is step to bridge the information gap which would be helpful in tailoring the policies relating to production and economics of pulse crop in Himachal Pradesh.

## 3. MATERIALS AND METHODS

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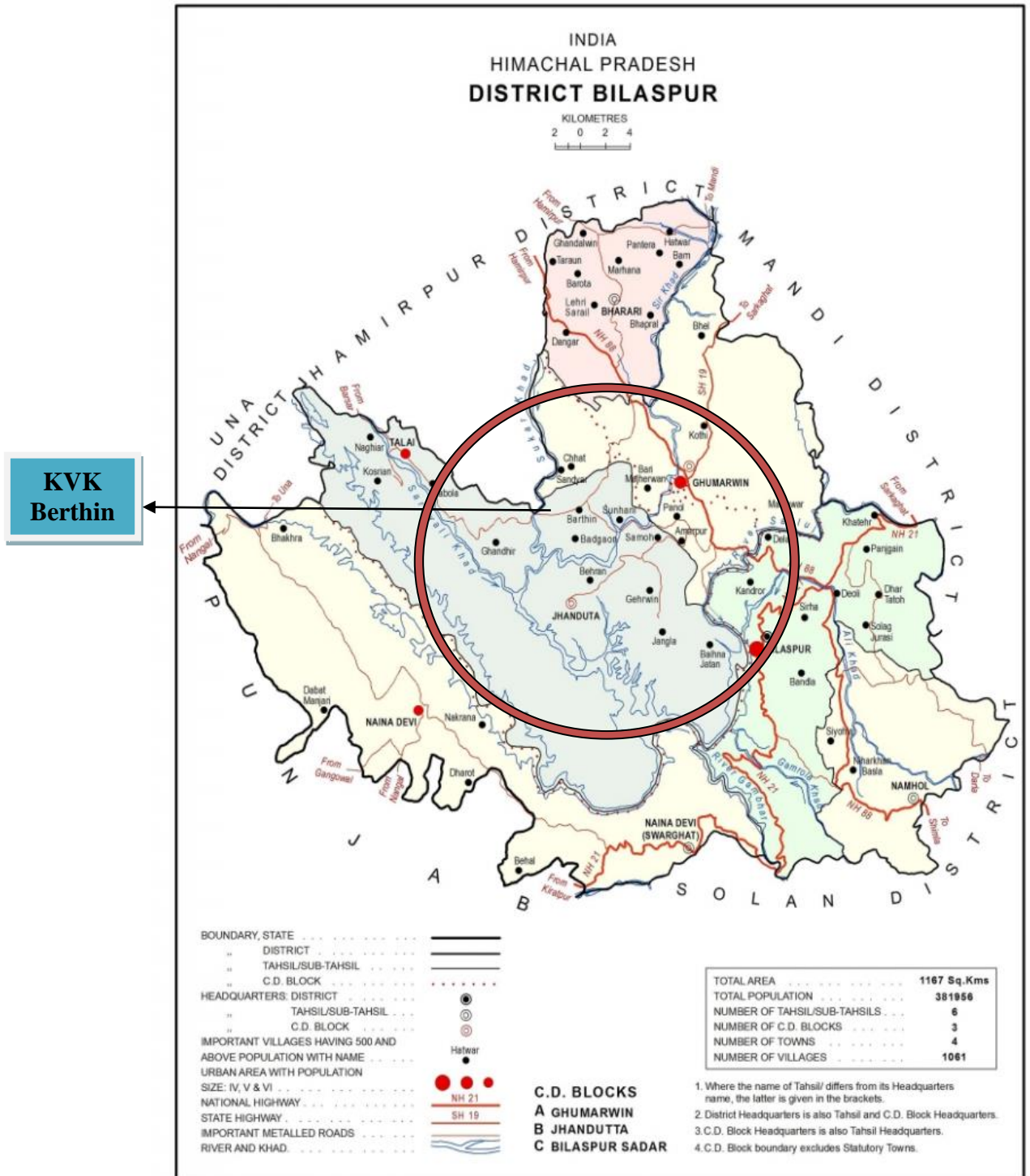
A sound and systematic methodology is a pre-requisite for any scientific enquiry. The selection and application of appropriate methodology bears more relevance in socio-economic studies based on sample surveys. The selection of representative sample at the first instance and thereafter derivation of the plausible estimates invariably depends upon the methodology adopted. Also, an elaborate view of the material and methods employed in the study will be helpful to the future researchers in determining the data requirements for the study in the same or related fields of this kind. The present chapter therefore, describes in detail the methodological procedure followed to accomplish the stated objectives of the study. The different aspects of the methodology in the present study are described under the following five sections:

- 3.1 Selection of the study area
  - 3.2 Sampling design
  - 3.3 Data collection
  - 3.4 Analytical tools and models
  - 3.5 Limitations of the study
- 3.1 Selection of the study area**

The present study was conducted in Bilaspur district of Himachal Pradesh. This district was purposively selected for the study as it is endowed with congenial agroclimatic conditions for growing of pulses. The research sub-station, Berthin as well as Krishi Vigyan Kendra of district Bilaspur at Berthin function as change agent to bring about desirable improvement in pulses production have been playing a crucial role in popularising the pulse production in the district.

### **3.2 Sampling design**

Simple random sampling technique was employed for the selection of farmers covered under FLDs. A list of farmers having FLDs on pulses was obtained from the Krishi Vigyan Kendra, Bilaspur at Berthin. From the list so acquired a random sample of 50 farmers was drawn. To assess the impact of FLDs on pulses production, a sample of 25 Non- FLD farmers was also drawn from the same villages covered under sample FLDs farmers.



**Fig 3.1** Map showing the location of KVK and study area in Bilaspur district of Himachal Pradesh

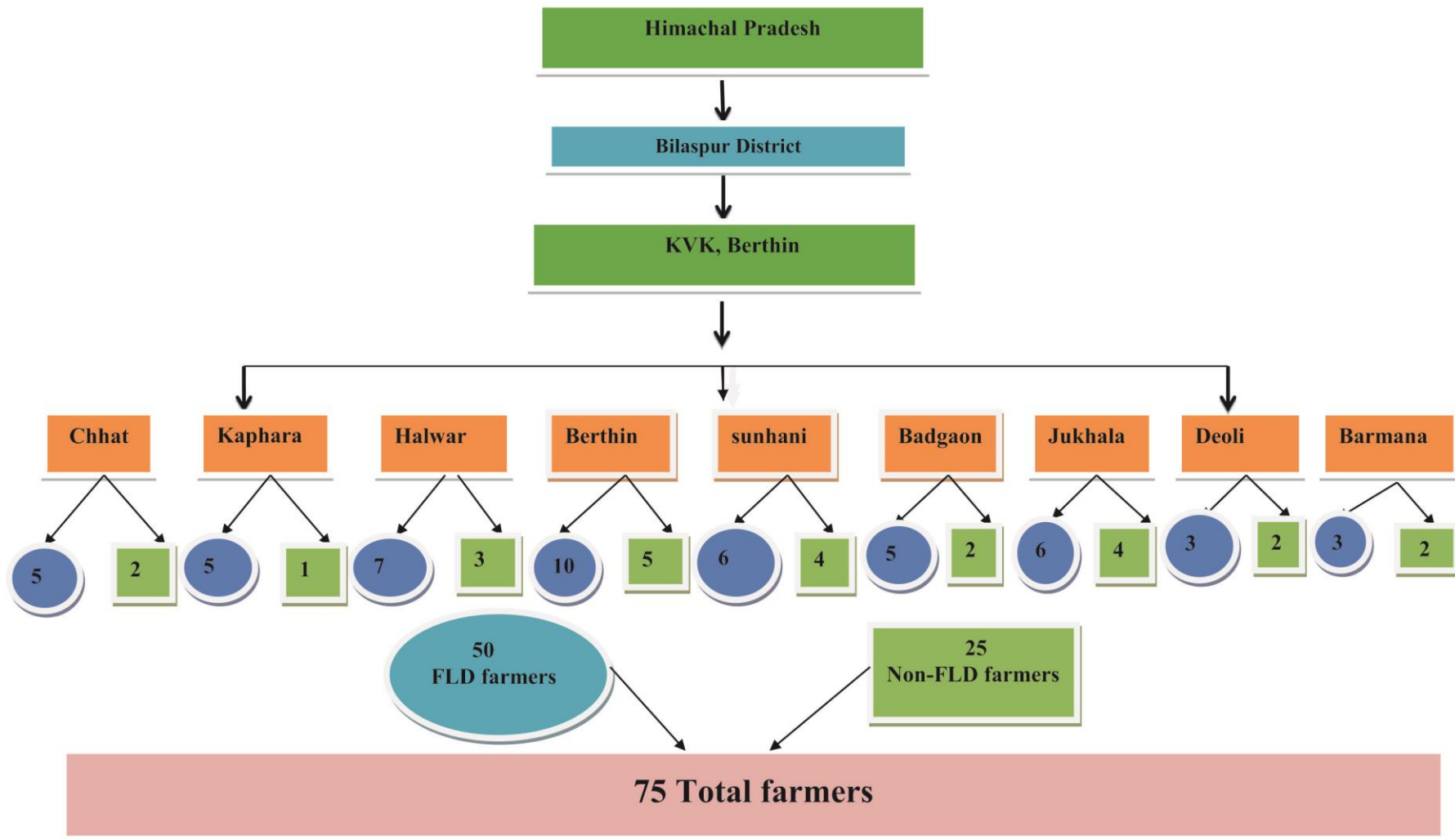


Fig 3.2 Sampling plan of study area

**Table 3.1** Distribution of sample farmers

(No.)

Sr. No.	Village	FLD	Non-FLD	Total
1	Chhat	5	2	7
2	Kaphara	5	1	6
3	Halwar	7	3	10
4	Berthin	10	5	15
5	Sunhani	6	4	10
6	Badgaon	5	2	7
7	Jukhala	6	4	10
8	Deoli	3	2	5
9	Barmana	3	2	5
	Total	50	25	75

**Plate 3.1** Data collection from farmer

### **3.3 Data collection**

The present study was based on both primary as well as secondary data. The primary data were collected through well designed and pre-tested schedule by personal interview method. The primary data were collected by survey method from sample farmers. The secondary data were collected from different reports of KVK, Berthin, reports of the Department of Agriculture and Directorate of Economics and Statistics.

#### **3.3.1 Survey schedule**

Keeping in view the objectives of the study, a comprehensive survey schedule was prepared to extract detailed information from the farmers of the study area. The survey schedule was pre-tested in the nearby areas to examine the relevance of structured questions on different aspects of pulses production. The schedule was then modified accordingly and finalized for the field survey of the study area (Appendix-I).

#### **3.3.2 Primary data**

The primary data on following aspects were collected:

- (i) Demographic parameters such as age, family size, education, sex-ratio, occupation, etc. of sample farmers.
- (ii) Farm physical inventories like size of land holding and its utilization, inventory of buildings, farm machinery and implements and livestock inventory, etc.
- (iii) Resource utilization pattern including cropping pattern, input use pattern, human labour, manures and fertilizers and use of chemicals etc.
- (iv) Production and output from pulses.
- (v) Prevailing prices of various inputs and outputs.
- (vi) Problems/constraints faced by the farmers with respect to pulses.

#### **3.3.3 Secondary data**

The secondary data required for the present study were collected on the following aspects:

- (i) Descriptive features of the study area.
- (ii) Population and literacy statistics of the study area.
- (iii) Land utilization pattern of the study area.
- (iv) Area and production of pulses in Himachal Pradesh .

These data were collected from various sources like India stat, Himachal Pradesh statistics, Statistical Yearbook of Himachal Pradesh, various publications of the state government and records from different Department of Agriculture and the Directorate of Economics & Statistics and Land Records, etc.

### 3.3.4 Study period

The data pertained to the agricultural year, 2017-2018.

## 3.4 Analytical tools and models

To meet out the objectives of the study, different analytical tools were employed for the analysis and interpretation of data. Tabular analysis using averages, ratios, percentages, etc. were used to study the demographic features, land use and cropping pattern, input use, costs and returns from different crops. To study the factors affecting the production of pulses regression analysis was carried out.

### 3.4.1 Demographic and crop indices

The following types of indices were worked out:

$$1. \text{ Sex-ratio} = \frac{\text{Total population of females}}{\text{Total population of males}} \times 1000$$

$$2. \text{ Literacy rate (\%)} = \frac{\text{Total number of literate persons}}{\text{Total population excluding non-school going below 5 years age}} \times 100$$

$$3. \text{ Cropping intensity (\%)} = \frac{\text{Total cropped area}}{\text{Net sown area}} \times 100$$

### 3.4.2 Costs and returns analysis

The cost concepts as suggested by commission for Agricultural Costs and Prices (CACP), Govt. of India, 2004 were used to work out the costs and returns of pulse crops produced by both FLD and Non-FLD farmers on their farms.

1. Cost A<sub>1</sub>: included all actual expenses in cash and kind incurred in production by the farmer;
  - i. Value of hired labour
  - ii. Value of seed
  - iii. Value of farm yard manure

- iv. Value of fertilizers
- v. Value of plant protection chemicals
- vi. Depreciation on implements and farm buildings
- vii. Interest on working capital
- 2. Cost A<sub>2</sub>: Cost A<sub>1</sub> + Rent paid for leased-in land
- 3. Cost B<sub>1</sub>: Cost A<sub>1</sub> + Interest on value of owned capital assets excluding land
- 4. Cost B<sub>2</sub>: Cost B<sub>1</sub> + Rental value of owned land (less land revenue) + rent paid for leased-in land
- 5. Cost C<sub>1</sub>: Cost B<sub>1</sub> + Imputed value of family labour
- 6. Cost C<sub>2</sub>: Cost B<sub>2</sub> + Imputed value of family labour
- 7. Cost C<sub>3</sub>: Cost C<sub>2</sub> + 10 per cent of Cost C<sub>2</sub> on account of managerial functions performed by farmer

### 3.4.3 Farm efficiency measures

To evaluate the farm income and profits, the following measures of farm income and profit efficiency were employed.

#### 1. Gross farm income (GFI)

It is defined as gross value of output including by-product priced at farm harvest rates.

#### 2. Net farm income (NFI)

This represents the remuneration for the farmers' management and has been calculated by deducting farm expenses from the gross farm income.

$$\text{NFI} = \text{GFI} - \text{Cost C}_2$$

#### 3. Farm family labour income (FLI)

This represents returns to family labour and has been calculated by deducting Cost B<sub>2</sub> from the gross farm income.

$$\text{FLI} = \text{GFI} - \text{Cost B}_2$$

#### 4. Farm business income (FBI)

It is defined as the returns to labour, owned land, owned fixed capital and management and is calculated by deducting Cost A<sub>2</sub> from the gross farm income.

$$\text{FBI} = \text{GFI} - \text{Cost A}_2$$

### 5. Farm investment income

It is defined as the sum total of net farm income, interest on owned fixed capital and rental value of land.

### 6. Output-input ratio

$$\text{Output-input ratio} = \frac{\text{Gross returns}}{\text{Total cost or Cost } C_3}$$

#### 3.4.4 Break-even analysis

Break-even analysis indicates costs-volume-profit relationship in short run. Break-even point is a point at which producer neither loses money nor makes profit. This analysis helps to understand relationships of costs, price and volume within a farm's range of operations.

$$\text{BEP} = \frac{\text{TFC}}{P_y - \text{AVC}}$$

where,

BEP = Break-even point in terms of physical units of production

TFC = Total fixed costs (Rs)

$P_y$  = Price of the output

AVC = Average variable cost (Rs) = TVC/TO

where,

TO = Total output

TVC = Total variable cost (Rs)

#### 3.4.5 Technological gap

The technological gap was computed on the basis of difference between the management practices and input usage on progressive/frontier farm and actual management practices and input usage on an average farm. This was computed by using following algorithm:

$$T_g = \frac{(Y_f - Y_a)}{Y_f} \times 100$$

where,

$T_g$  = Technological gap (%) in input usage

$Y_f$  = Input usage by frontier farmer

$Y_a$  = Actual input usage by average farmer

### 3.4.6 Regression analysis

To examine the factors affecting the production of pulses in the study area, production functions were estimated using input-output data from individual sample farmers. Both linear and log linear functions were fitted. Depending upon the value of  $R^2$  (best fit) and the statistical significance of regression coefficients, the linear form of multiple regression model was employed for analysis and discussion.

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + U$$

where,

$Y$  = Production of pulses (q/ha)

$X_1$  = Experience of farmers in pulses production (Years)

$X_2$  = Area under crop in *bigha* (12.5 *bigha* = 1 hectare)

$X_3$  = Educational status of the head of the family, ranked as

Illiterate = 0

Primary = 1

Middle = 2

Matriculate = 3

Sr. Secondary = 4

Graduate = 5

Diploma = 6

Post-graduate = 7

$X_4$  = Total human labour (Mandays/ha)

$b_0$  = Intercept

$b_1, b_2, \dots, b_4$  = Regression coefficients

$U$  = Random term

The presence of multicollinearity between various independent variables included in the regression analysis was also tested by zero order correlation matrix. The significance of estimates was tested using 't' test.

### 3.4.7 Problems and constraints

The multiple response of the farmers reporting various production, storage, social and institutional problems was taken in order to test whether there is significance difference among FLD and Non-FLD categories of farmers for the problem faced by them. To find out the difference in the severity of these problems across both types of farms, Chi-square ( $\chi^2$ ) test (Test of Homogeneity) was employed using the following algorithm:

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i}$$

where,

$O_i$  = Observed frequency of problems confronted by  $i^{\text{th}}$  farmer

$E_i$  = Expected frequency of problems of  $i^{\text{th}}$  farmer

### 3.5 Limitations of the study

The present investigation has been carried out systematically using scientific methodology. The due care was taken to select the representative sample. The accuracy of the data was ensured through cross-checks in the survey schedules. However, few limitations as expected in every socio-economic survey may not be over ruled. Though, these limitations would hardly limit the relevance and validity of results derived. Some of the limitations of the study were as under:

1. This study is based upon the sample observation collected from only 75 farmers of the selected villages. This is done keeping in view the limited time and resource constraint at the disposal of the researcher. However, random selection was done to get respective sample for the study.
2. As the farm records were not maintained by the farmers, the data were, therefore, collected by survey method based on the memory of sample farmers and their past experience. Though, due care was taken by cross checking the information, the possibility of a few slips in memory of the respondents could not, however, be ruled out.
3. The study is more applicable to Bilaspur district of Himachal Pradesh, however, the findings can be generalized for the other districts/area having similar agro-climatic conditions.

## 4. RESULTS AND DISCUSSION

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A systematic presentation of results is the most important part of any research investigation that enables the researcher to either confirm or reject the proposed hypotheses. This chapter is of utmost importance and focuses attention on the results obtained on the basis of research conducted in the study area. In the present chapter, the results are presented on different aspects such as role and impact of KVK in promoting programmes for pulses, various socio economic conditions of sampled farmers, investment pattern, economics of pulse crops, input use, crop productivity and technological gaps in production technology. The results in this chapter have been supported by data presented in the form of tables given under different sections as follows:

- 4.1 Description of the study area
- 4.2 Role and impact of KVK in promotion programmes of pulses
- 4.3 Socio-economic and structural characteristics of farmers
- 4.4 Input use, costs and returns
- 4.5 Problems in pulse production technology

### **4.1 Description of the study area**

Bilaspur district is one of district of Himachal Pradesh state with its administrative headquarters located at Bilaspur town. Earlier, the present day's Bilaspur district was a part of a princely state of British India called Kahlur. During different periods of time the place was ruled by different rulers among whom the Chandela Rajput's dynasty was the significant one. The town of Bilaspur was established in the year 1663. On the other hand Guru Tegh Bahadur came to the place of Bilaspur on 13th May 1665 in order to attend the mourning for Raja Dip Chand of this region. At that time the land consisted of the villages of Lodhipur, Mianpur and Sahota. The ground was divided on 19th June, 1665, by Baba Gurditta Randhawa. And the new village was named after the Guru's mother, Nanaki. After sometime Chakk Nanaki became well known as Anandpur Sahib. In 1932 state came under the newly formed States Agency of Punjab. After India got its independence in the year 1947, the ruler of the place of that time named HH Raja Sir Anand Chand handed over it to the Government of India on 12th October, 1948 and then

Bilaspur became an Indian state under a chief commissioner. Finally, the state of Bilaspur was merged with Himachal Pradesh and emerged as a district on the map of Himachal Pradesh state on 1st July 1954. On the other hand, Bilaspur, the historic town was submerged in 1954 when the Sutlej River was dammed to create the Govind Sagar and in this way a new town was constructed up slope of the old one.

Geographically, the district lies at 31°35'N latitude and 76°76'E longitude. The altitude of the district is 673 m. In the year 2017, there was a total 32.13% forest area of total geographical area. The district encompasses a geographical area of 1,167 sq kms and it is bounded by Hamirpur district on the North, Una district on the North West, Punjab on the South West, Solan district on the South East, Mandi district on the East and Una district on the West. Since it is located in the valley at lower altitude hence its natives experience extreme hot in the summer. Whereas due to the surrounding mountains top its climate remain pleasant and fairly cold in the winter. Most of its rainfall occurs in the monsoon season. The actual rainfall in the district was 1198.7 mm in the year of 2017-18. Administration wise, the district is divided into 2 sub-divisions namely Sadar and Ghumarwin. Moreover it comprises 4 towns and 1,061 villages. The administrative language in the district is Hindi.

**Table: 4.1 Descriptive features of Bilaspur district *vis-a-vis* Himachal Pradesh**

Sr. No.	Particulars	Units	Bilaspur	Himachal Pradesh
1.	Geographical area	Sq. kms	1167	55673
2.	Blocks	Number	4	78
3.	Tehsils	Number	4	102
4.	Sub-Tehsils	Number	3	56
5.	Sub-Divisions	Number	4	69
6.	Panchayats	Number	151	3226
7.	Villages	Number	1061	17882

Source: Statistical Yearbook of Himachal Pradesh, 2017-18

#### 4.1.1 Demographic features of study area

According to 2011 census the district has a population of 3,81,956 out of which 1,92,764 are males and 1,89,192 are females. The district has a sex ratio of 981 (females for every 1000 males). As per 2011 census the major religion in the district is Hindu with 97.39 per cent of the total population. The population density in the district is 327 (persons per sq km). Rural population was higher in number than urban population. Literacy rate of Bilaspur district was 84.59 per cent. Total workers in Bilaspur district was 205871 in number.

**Table 4.2 Demographic features of Bilaspur district *vis-a-vis* Himachal Pradesh**

Sr. No.	Particulars	Units	Bilaspur	Himachal Pradesh
1.	Total population	Number	381956	6865000
	i) Male population	Number	192764	3482000
	ii) Female population	Number	189192	3383000
2.	Rural population	Number	356827	6176000
3.	Urban population	Number	25129	689000
4.	Scheduled caste population	Number	98989	1729000
5.	Scheduled tribe population	Number	10693	392000
6.	Sex- ratio	Ratio	981	972
7.	Density of population	Person/Sq. kms	327	123
8.	Literacy rate	Per cent	84.59	82.80
9.	Total workers	Persons	205871	892988

Source: Himachal Pradesh District Bilaspur Factbook (2019)

#### 4.1.2 Area and land utilization

The land-use statistics for Bilaspur district *vis-a-vis* Himachal Pradesh are presented in Table 4.3. The table reveals that according to revenue papers, the district has a geographical area of 111.78 thousand hectares which constitute 2.44 per cent of total

geographical area of the state. About 13.17 per cent of the total geographical area of the district is under forests. Area not available for cultivation constitutes about 18.14 per cent of the reporting area and about 35.41 per cent of the total area is under pasture/grazing lands. Out of the total geographical area only 26.67 per cent is net sown area which is comparatively higher than the state (12.02%). The cropping intensity in Bilaspur district is 185 per cent which is higher than that at the state level (169%).

**Table 4.3 Land utilization pattern of Bilaspur district and Himachal Pradesh**

		(per cent)	
Sr. No.	Particulars	Bilaspur	Himachal Pradesh
1	Total geographical area according to revenue papers	111776	4575.57
2	Forests	13.17	24.61
3	Area not available for cultivation	18.14	27.30
i	Barren and uncuturable land	3.97	16.99
ii	Land put to non- agricultural uses	14.17	7.65
4	Culturable wasteland	4.87	2.66
5	Area under pasture/grazing land	35.41	33.01
6	Land under miscellaneous tree crops, etc.	0.14	1.39
7	Fallow land	2.23	1.67
8	Net sown area	26.67	12.02
9	Total cropped area	46.33	20.37
10	Cropping intensity (%)	185	169

Source: Himachal Pradesh District Bilaspur Factbook (2019)

#### **4.1.3 Profile of pulses cultivation in Himachal Pradesh**

Pulses are important component of Indian agricultural economy next to foodgrains and oilseeds in terms of acreage, production and economic value (Choudhary 2009). India is largest producer and consumer of pulses in the world, accounting for about 25 per cent of global production, 27 per cent of consumption and 34 per cent of food use (FAO). India is also the top importer with 11 per cent share of global imports during 1995-2001 (Gregory et al. 2003). Thus, there is a great challenge for policy makers, farm scientists, extension functionaries and farming community to enhance pulse productivity and diversify their cropping systems to meet out the national and local pulse requirements.

Pulses are the basic ingredient in the diets of a majority of peoples, as they provide a perfect mix of vegetarian protein component of high biological value when supplemented with the cereals. However, with the best efforts, pulse acreage and productivity has remained stagnant in Himachal Pradesh (Kumar and Prasher, 2012). Besides this lack of technical knowledge, unavailability of quality seed and non adoption of plant protection measures further aggravate the problem of poor productivity in the district (Choudhary et al 2009a; Paul et al. 2011). In Himachal Pradesh, pulses are grown on an area of 32.42 thousands hectare with an annual production of 34.59 thousand MT (Anonymous, 2011). The productivity of pulses in Himachal Pradesh continues to be quite low over the years because of their cultivation under rainfed conditions on less productive lands with no or little inputs compared to those used for cereals. The Table 4.4 reveals that the area and production of blackgram and chickpea was found to be maximum in Kangra district, whereas, maximum area and production in lentil was reported in Sirmaur district. On the other hand, area of total pulses was maximum in Shimla and maximum production of total pulses was recorded in Lahaul and Spiti. The blackgram, chickpea and lentil contributed 72, 7 and 4 per cent of the total area under pulses in the state, respectively.

#### **4.2 Role of KVK in promotion programme of pulses**

The concept of Krishi Vigyan Kendra was framed by Professor Swaminathan. Professor M S Swaminathan convinced Government of India that there is absolute necessity to develop Krishi Vigyan Kendra in each district of India with an objective to cater Mandate and Activities for the farming community of the district. The training programmes organised by Krishi Vigyan Kendra (KVK) are very effective tool in any extension methodology being used for dissemination of latest agricultural technologies to the farmers. Besides this, the formulated course content of training programmes specifically strives to address the location-bound all types of agricultural production constraints in particular and consequently other socio-economic constraints being faced by the farmers. There is a growing demand to organize specialized training programmes amidst the farming community as farmer is at receiving end and direly requires knowledge about improved production technologies. Moreover, farmers' quest to understand the dynamics of agricultural production system and selection of technologies to make the most of the synergy existing between these technologies is perhaps the driving force for formulation of training programmes in KVKs.

**Table 4.4: Area and production of pulses in Himachal Pradesh (2010-2011)**

Sr.No.	District-wise	Blackgram		Chickpea		Lentil		Total pulses	
		Area (hectares)	Production(MT)	Area (hectares)	Production (MT)	Area (hectares)	Production MT	Area (hectares)	Production (MT)
1	Bilaspur	34 (0.35)	22 (0.54)	83 (15.43)	88 (18.14)	-	-	154 (0.45)	128 (0.37)
2	Chamba	1884 (19.22)	827 (20.36)	-	-	38 (6.23)	13 (4.38)	3872 (11.29)	1968 (5.68)
3	Hamirpur	9 (0.09)	4 (0.09)	3 (0.56)	1 (0.22)	1 (0.16)	-	14 (0.03)	5 (0.01)
4	Kangra	2207 (22.52)	861 (21.20)	212 (39.40)	167 (34.43)	26 (4.26)	9 (3.18)	3079 (8.98)	1271 (3.67)
5	Kinnaur	3 (0.03)	5 (0.12)	-	-	-	-	1685 (4.92)	684 (1.97)
6	Kullu	1007 (10.27)	211 (5.20)	77 (14.31)	52 (10.72)	101 (16.56)	35 (12.37)	3440 (10.04)	1661 (4.79)
7	Lahaul & Spiti	-	-	-	-	-	-	1808 (5.28)	9845 (28.39)
8	Mandi	1133 (11.56)	872 (21.47)	9 (1.67)	7 (1.44)	142 (23.28)	37 (13.07)	6507 (18.99)	6024 (17.37)
9	Shimla	1325 (13.52)	533 (13.12)	5 (0.93)	6 (1.24)	45 (7.38)	24 (8.48)	7169 (20.92)	6230 (17.97)
10	Sirmaur	1105 (11.28)	457 (11.25)	141 (26.21)	154 (31.75)	238 (39.02)	143 (50.53)	4008 (11.70)	5099 (14.71)
11	Solan	894 (9.13)	193 (4.75)	8 (1.49)	10 (2.06)	19 (3.11)	22 (7.77)	2283 (6.66)	1663 (4.80)
12	Una	199 (2.03)	77 (1.90)	-	-	-	-	252 (0.74)	93 (0.27)
Total H.P		9800 (100.00)	4061 (100.00)	538 (100.00)	485 (100.00)	610 (100.00)	283 (100.00)	34271 (100.00)	34671 (100.00)

Note: Annual season and crop report 2010-11

#### **4.2.1 Activities at KVK on pulses**

- i. Producing quality seed of different pulses throughout the year
- ii. Demonstrations of vermi composting technology at farmers fields with the purpose to promote organic farming.
- iii. SMS advisory to farmers under Kisan Portal on different aspects and production technologies of pulses on their mobile phones.
- iv. Quality pulse seed production and “Quality seed growers” 200 hours training under *Pradham Mantri Kaushal Vikas Yojna* has increased acreage under pulse cultivation in the district.
- v. Organizing frontline demonstrations (FLDs) on various pulse crops to generate production data and feedback information.

#### **4.2.2 Extension activities carried out by KVK Berthin**

The extension scientists of the directorate of extension education and Krishi Vigyan Kendra conducted different activities and training programmes during the year 2016-2017 to meet the needs of farmers, farm women, field functionaries, unemployed youths and school dropouts in order to increase farm production and supplement the income in the field of agriculture, animal wealth and family welfare.

##### **4.2.2.1 One day training programmes**

The scientists of Krishi Vigyan Kendras also conducted one day training programmes to meet the needs of farmers, farm women, unemployed youths and school dropouts in order to improve agriculture, animal husbandary, value addition. The extension activities of KVK, Berthin on pulses production promotion programmes were presented out in different villages with various subject particulars discussed in Table 4.5. In total 59 one day training programmes were organized at different villages spread over entire district which included crop production (13), plant protection (06) and in others training programmes on livestock, home science (40). In all these one day training programmes 1547 farmers actively participated and was dominated by females with 1100 in numbers. In crop production total 13

programmes was held with 532 people actively participating, and so on with Plant Protection 6 programmes with 252 people and females dominated in participating in plant protection.

**Table 4.5 One day training programmes at different villages (2016-2017)**

Sr.No.	Particulars	No. of programmes	No. of participants		
			Male	Female	Total
1.	Crop production	13	314	218	532
2.	Plant protection	6	106	146	252
3.	Others trainings	40	809	1100	1547
	Total	59	1229	1464	2331

#### **4.2.2.2 On and Off-campus trainings**

The Krishi Vigyan Kendra organised various on campus and off-campus training programmes to meet the needs of farmers, farm women, field functionaries, unemployed youth and school dropouts Table 4.6. The main purpose of organizing these training programme is to increase the farm production and supplement the income in the field of agriculture, animal wealth and family welfare where there is dissemination of knowledge of the newer technologies and break throughs. A number of off campus trainings on different aspects of pulses production were conducted in a total 330 farmers were trained (195 males, 135 females). In all these on campus training programmes 177 farmers participated, out of which 70 were females and 107 were males. The maximum number of farmers participated in integrated training on all aspects of agriculture (30), followed by farmer-scientist-interaction on problems pertaining to agro techniques for rabi season cereals and pulse crops (29) and training programmes of INM on various crops (28). A total of seven on campus training programmes on scientific cultivation, integrated nutrients management and farmer-scientist interaction on problems pertaining to agro technologies for pulse crops were conducted by KVK.

**Table 4.6 On-campus and off-campus training programmes (2016-2017)**

Sr.No.	Subject/Topic	No. of participants		
		Male	Female	Total
A	Off-campus training programmes	195	135	330
B	On-campus training programmes	107	70	177
1.	Production technology of Kharif season crops and diversification through other enterprises	8	17	25
2.	Scientific cultivation of rabi crops	25	-	25
3.	Integrated training on all aspects of agriculture	17	13	30
4.	Farmer-Scientist-Interaction on problems pertaining to agro techniques for rabi season cereals, vegetables, oil seed and pulse crops	16	13	29
5.	Scientific cultivation of kharif crops	10	8	18
6.	Scientific cultivation of pulses and vegetables	12	10	22
7.	Training programme on INM in cereals, vegetables and oil seed	19	9	28

#### 4.2.2.3 Frontline demonstration on pulses

The frontline demonstration programme (FLDs) in pulses is a unique programme by Ministry of Agriculture, Govt. of India, conducted under close supervision of farm scientists. Main objective of FLDs in pulses is to demonstrate and popularize the improved agro-technology on farmers fields under varied farming situations for effective transfer of generated technology and fill the gap between improved technology and adopted/indigenous technology to enhance pulse productivity and farms gains for sustaining the production systems especially under rainfed farming (Choudhary et al. 2009b).

The number of frontline demonstration laid down in different villages from year 2014-2017 have been given in Table 4.7. In demonstration fields pulses was grown according to the package of practices. It can be seen from the table that during the year 2014-15 a total of 100 FLDs were laid down on farmers field. The number of FLDs increased to 168 in 2015-16 and in the year 2016-17 the number of FLDs conducted were 98 only. In 2015-16 and 2016-17 the maximum yield of 9.20 q/ha and 11.90 q/ha, respectively, was recorded in

chickpea (GPF-2) whereas in 2014-15 stagnant yield of 6.10 q/ha was recorded under all varieties of pulses (blackgram and chickpea).

Before providing the critical input a training programme was arranged for farmers to educate about recommended technologies to be demonstration. In demonstration quality seeds of improved seeds of improved variety, seed treatment, recommended dose of fertilizers, *rhizobium* biofertilizers, weed management and plant protection management techniques were demonstrated on the farmers' fields. The conventional practices were maintained in case of local checks. All the important farm operations were performed under the supervision of KVK scientists by regular field visits. At front line demonstration site off campus trainings were organized to extend the technology to other farmers of the area. Opinion of the farmers about the technologies used under demonstration was collected for further improvement in research and extension activities. The data were collected from front line demonstrations field as well as from farmers from check field (farmer practices).

Table 4.8 reveals that transfer of improved farm technology under frontline demonstrations (FLDs) in pulses resulted in invariably higher grain yield of pulses under demonstration plots than farmers plot yield, which may be attributed to the adoption of recommended agro-technologies in FLDs during study period. Sagar and Chandra (2004), and Choudhary et al. (2009b) has also reported yield enhancement by the use of recommended agro-technologies in FLDs. The table further reveals that the maximum per cent increase in yield over check was recorded to be 51.10 and 49.20 per cent under chickpea (HPG-17) in 2014-15 and 2015-16, respectively. On the other hand, in 2016-17 the maximum per cent increase in yield over check (48.10%) was recorded in Himachal Chana-2. It also reveals that lowest per cent increase over check in yield was reported in chickpea (GPF-2) in 2014-15, in 2015-16 and 2016-17 lowest per cent increase was reported in blackgram (Him Mash-1).

**Table 4.7 Frontline demonstrations on pulses**

Sr No.	Crop	Variety	No.of demonstration			Yield (q/ha)					
						2014-15		2015-16		2016-17	
			2014-15	2015-16	2016-17	Demonstration	Check	Demonstration	Check	Demonstration	Check
1	Blackgram	Him Mash-1	50	60	50	6.10	4.70	6.40	5.30	10.10	9.20
2	Chickpea	HPG-17	39	50	3	6.10	5.30	8.80	5.90	10.60	8.50
		Himachal	4	25	38	6.10	5.10	7.90	5.70	11.20	7.56
		Chana-2									
		GPF-2	7	33	7	6.10	5.40	9.20	6.50	11.90	8.60
	Total		100	168	98						

**Table 4.8 Per cent increase in yield over check**

Sr.No.	Crop	Variety	Per cent increase in yield over check		
			2014-15	2015-16	2016-17
1	Blackgram	Him Mash-1	29.80	20.80	9.80
2	Chickpea	HPG-17	51.10	49.20	24.70
		Himachal Chana-2	19.60	38.60	48.10
		GPF-2	13.00	41.50	38.40

#### 4.2.2.4 Extension yield gaps

The successful development, dissemination and adoption of improved technologies for small-holders depend on more than careful planning of research and the use of appropriate methodologies in extension (Cramb 2003; Biggs and Smith 1998). Extension gaps are the indicators of lack of awareness for the adoption of improved farm technologies by the farmers (Kadian et al. 1997; Vedna et al. 2007; Choudhary et al. 2009b). The extension gaps in yield of pulses are given in Table 4.9. Maximum extension gap of 1.40 q/ha was observed in blackgram (Him Mash-1) during 2015-16, 2.90 q/ha gap was observed in chickpea (HPG-17) during 2016-17 and 3.64 q/ha in chickpea (Himachal chana-1) during 2016-17. Maximum extension gap of 1.40 q/ha was observed in blackgram (Him Mash-1) during 2015-16, 2.90 q/ha gap was observed in chickpea (HPG-17) during 2016-17 and 3.64 q/ha in chickpea (Himachal Chana-1) during 2016-17. The extension functionaries in study area have strictly focused on dissemination of proven farm technologies in pulse production systems to enhance the pulse productivity over existing levels. However, higher extension yield gaps given indicate that there is still a strong need to aware and motivate the farmers for adoption of improved farm technologies in pulses over existing local practices. Refinement in the local farmers practices for higher adoption of location specific generated farm technology for sustaining crop productivity is another option open for the research scientists (Choudhary et al. 2010b).

**Table 4.9 Extension gaps in yield of pulses**

Sr.No.	Crops	Variety	Extension gap (q/ha)		
			2014-15	2015-16	2016-17
1	Blackgram	Him Mash-1	1.40	1.10	0.90
2	Chickpea	HPG-17	0.80	2.90	2.10
		Himachal Chana-2	1.00	2.20	3.64
		GPF-2	0.70	2.70	3.30

#### 4.2.2.5 Pulses production technological gaps

The gap between the recommended practices in frontline demonstrations and farmers' practices of black gram and chickpea in study area are presented in Table 4.10 and 4.11, respectively. The perusal of the tables revealed that farmers generally did not use recommended and improved technologies. There was a wide gap in use of improved varieties seed in both the crops due to its non availability. In farmers' practice broadcast method of sowing black gram and chickpea against the recommended line sowing was followed and higher seed rate was used. Farmers did not practice seed treatment with *rhizobium* culture, an important component in increasing the yield and yield attributes of pulse crops. Similar observations in seed treatment gap were also reported by Kumar and Elamathi 2007. Partial gap in time of sowing of black gram was also observed. Farmers had sown the black gram in between June 15th to June 30th, compared to recommended time of sowing i.e. June end to July beginning. However, no gap in sowing of chickpea crop was observed. These tables further revealed that farmers did not apply any recommended fertilizer, if applied only urea was given to the crop at the time of sowing. Partial or full gap in adoption of weed control and plant protection measures was observed in farmers' practice over recommended practice in frontline demonstrations. Similar observations for gap in improved technologies and farmers practices were also observed by Burman et al. (2010) in different crops.

**Table 4.10 Comparison between demonstration package of practices and existing farmer's practices of blackgram**

Sr.No.	Crop operations	Recommended practices demonstrated	Farmers' practice	Gap
1	Variety	UG-218 and Him mash-1	Local	Full
2	Land preparation	Two ploughing	One or two ploughings	Nil
3	Seed rate	20 kg/ha	22-25 kg/ha	Higher
4	Seed treatment	Rhizobium culture	Nil	Full
5	Method of sowing	Line sowing at 30cm row spacing	Broadcasting	Full
6	Time of sowing	June end to July beginning	June 15 <sup>th</sup> to June 30 <sup>th</sup>	Partial
7	Fertilizer dose	20:40:20 kg NPK per ha	No fertilizer or urea only	Full
8	Method of fertilizer application	Kera	Broadcast at the time of sowing	Full
9	Weed management	Pendimethalin application @ 1.5 l ai/ha	No or one hand weeding	Full
10	Plant protection	Need based pesticide and fungicide application	No pesticide and fungicide application	Full
11	Irrigation	Rain fed	Rain fed	Nil

#### 4.2.3 Adoption of pulse growing practices

To evaluate the sample farmers for the extent of knowledge gained and adoption of pulse production technologies as a result of the training programmes and frontline demonstrations (FLD) conducted twelve recommended practices were selected as a criterion. It was assumed that the knowledge of a farmer to a larger degree depends upon the extent of exposure given to him about the technology. The gain in knowledge by the respondents about the improved package of practices of pulse crops was measured in terms of percentage. The data towards gain in knowledge about improved production technologies for pulse crop were recorded under two heads i.e. knowledge before training and knowledge after training.

**Table 4.11 Comparison between demonstration package of practices and existing farmer's practices of chickpea**

Sr.No.	Crop operations	Recommended practices demonstrated	Farmers' practice	Gap
1	Variety	HPG-17, Himachal channa-2 and GPF-2	Local	Full
2	Land preparation	Two ploughing	One or two ploughings	Nil
3	Seed rate	40 kg/ha	50-52 kg/ha	Higher
4	Seed treatment	Rhizobium culture	Nil	Full
5	Method of sowing	Line sowing at 30 cm row spacing	Broadcasting	Full
6	Time of sowing	Mid October	Mid October	Nil
7	Fertilizer dose	30:60:30 kg NPK per ha	No fertilizer or urea only	Full
8	Method of fertilizer application	Kera	Broadcast at the time of sowing	Full
9	Weed management	Pendimethalin application @ 1.5 l ai/ha	No or one hand weeding	Full
10	Plant protection	Need based pesticide and fungicide application	No pesticide and fungicide application	Full
11	Irrigation	Rain fed	Rain fed	Nil

Table 4.12 reveals that the beneficiary farmers of the training programmes on improved production technologies for pulse crop gained highest knowledge about variety (96 %) followed by seed treatment (76 %), seed rate (72 %), time of sowing (64 %), land preparation (64%), method of sowing (60 %), time of sowing (48 %), weed management (48 %), nutrient management (38 %) time and method of harvesting (34 %) storage and marketing (26 %) and irrigation (22 %). The findings of the study also revealed that the respondents had gained knowledge ranging from 22 per cent in case of irrigation to 96 per cent in case of varieties after attending training programmes. These findings were in concomitance with Joseph (2008). This might be due to the fact that the trainees got sensitized and were convinced, and learned the skills, gained knowledge, through training programmes about improved production technologies for pulse crop. The contents and

conduct of these training programmes were designed and perceived in a manner which could easily be understood by the trainees and ultimately resulted into a substantial gain in knowledge through work experience.

**Table 4.12 Impact of training programmes on gain in knowledge of respondents**

Sr.No.	Recommended practices	Respondents having knowledge		(Number)
				Gain in knowledge
		Before training	After training	
1	Land preparation	14(28.00)	46(92.00)	32(64.00)
2	Seed treatment	-	38(76.00)	38(76.00)
3	Variety	-	48(96.00)	50(96.00)
4	Seed rate	12 (24.00)	48 (96.00)	36 (72.00)
5	Time of sowing	15 (30.00)	39 (78.00)	24 (48.00)
6	Method of sowing	7 (14.00)	37 (74.00)	30 (60.00)
7	Irrigation	23 (46.00)	34 (68.00)	11 (22.00)
8	Nutrient management	12 (24.00)	31 (62.00)	19 (38.00)
9	Weed management	21(42.00)	43 (86.00)	22 (44.00)
10	Plant protection measures	19(38.00)	39 (78.00)	20 (40.00)
11	Time and method of harvesting	17(34.00)	34 (68.00)	17 (34.00)
12	Storage and marketing	16(32.00)	29 (58.00)	13 (26.00)

Note: Figures in parentheses indicate percentage to total

#### 4.2.4 Extent of adoption

The extent of adoption of recommended/improved practices of pulses production is presented in Table 4.13. The table reveals that only few farmers were following the improved practices *viz.*, growing high yielding varieties, soil testing and time and method of harvesting before acquiring training whereas, after attending training programmes 100 per cent trained farmers adopted soil testing and 86 per cent adopted recommended weed management practices. In case of other technologies, only 18 per cent farmers were practicing land preparation with improved practices before attending training programmes, however, 96 per cent of respondents started land preparation with recommended practices after acquiring training programmes. Regarding time of sowing, only 16 per cent farmers were sowing at appropriate time. However, after attending training programmes, 94 per cent of the trainees started sowing at appropriate time. Before attending training programmes the farmers were practicing other improved practices like seed rate (18 %), time of sowing (16 %), method of sowing (46 %),

irrigation (42 %), nutrient management (14 %), weed management (0 %), plant protection measures (24 %) and storage (42 %). Infact, after acquiring training, more number of farmers started practicing improved practices like seed rate (90 %), time of sowing (94 %), method of sowing (74 %), irrigation (70 %), nutrient management (88 %), weed management (86 %) and plant protection measures (78 %). These findings were in accordance with the findings of Patel et al. (2003). Nearly 68 per cent of the farmers started safe storage of pulse crops after acquiring training, however, before acquiring training due to the lack of storage space available with the farmers, they were compelled to sell their surplus produce immediately after threshing and cleaning at throw away prices in most of times.

After attending training programmes, the farmers started adopting the production technologies ranging from 26 per cent for storage to 100 per cent for soil testing. This might be due to the fact that gain in knowledge, skills and confidence level of farmers through training programmes on different production technologies, seed treatment, soil testing and time and method of harvesting, seed rate, time of transplanting, method of transplanting, irrigation scheduling, nutrient management, weed management, plant protection measures and storage etc. has helped in improving the productivity and consequently its speedy adoption among the farmers.

**Table 4.13 Change in adoption level of the respondents regarding pulse production technologies** (Number)

Sr.No.	Recommended practices	Respondents having knowledge		Change in adoption level
		Before training	After training	
1	Land preparation	9 (18.00)	48(96.00)	39 (78.00)
2	Seed treatment	-	41(82.00)	41(82.00)
3	Variety	10 (20.00)	39 (96.00)	29(58.00)
4	Seed rate	9 (18.00)	45 (90.00)	36(72.00)
5	Time of sowing	8 (16.00)	47 (94.00)	39(78.00)
6	Method of sowing	23 (46.00)	37 (74.00)	14(28.00)
7	Irrigation	21 (42.00)	35 (70.00)	14(28.00)
8	Nutrient management	7 (14.00)	44 (88.00)	37(74.00)
9	Weed management	-	43 (86.00)	43(86.00)
10	Plant protection measures	12 (24.00)	39 (78.00)	27(54.00)
11	Time and method of harvesting	14(28.00)	45 (90.00)	31(62.00)
12	Storage	21 (42.00)	34 (68.00)	13(26.00)
13	Soil testing	-	50 (100.00)	50(100.00)

Note: Figures in parentheses indicate percentage to total

### 4.3 Socio economic profile of the sampled households

The socio-economic features of the farmers affect the organization and management of farm enterprises with respect to scale of farming, input use pattern, production and marketing, etc. to a greater extent. In general, the farmers having high socio-economic status in the society especially with respect to land, associated infra-structural facilities and financial resources, are courageous enough for the adoption of new technologies and alternate more remunerative crops. Therefore, the study of vital characteristics like, family structure, education level, possession of land area under crops and farm inventories, etc. are of vital importance. With this background, the important socio-economic features of sample households have been analysed and discussed in the following sections:

**Table 4.14 Family size and structure of sampled farmers**

No./household

Sr.No.	Particulars	FLD farmers	Non- FLD farmers
1	Male		
	(A)Adult	2.22 (46.25)	1.72 (37.72)
	(B) Children	0.24 (5.00)	0.44 (9.65)
2	Female		
	(A)Adult	2.06 (42.92)	2.16 (47.37)
	(B)Children	0.28 (5.83)	0.24 (5.26)
3	Total		
	(A)Adult	4.28 (89.17)	3.88 (85.09)
	(B)Children	0.52 (10.83)	0.68 (14.91)
	Average family size	4.80 (100.00)	4.56 (100.00)
	Family structure		
	Joint family	28 (56.00)	9 (36.00)
	Nuclear family	22 (44.00)	16 (64.00)
	Total	50 (100.00)	25 (100.00)

Note: Figures in parentheses show percentages to total

#### **4.3.1 Family structure and size**

The structure of family and its size are the most important indicators that determine the social and economic well being of the family. The size of the family of farmers also plays a pivotal role in making strategic farm management decisions for successful running of the farm business. The detailed study of the family size and structure of sample farmers has been done and the results have been shown in Table 4.14. The average family size was 4.80 persons in case of FLD farmers. In case Non-FLD farmers the average family size was found out to be 4.56 persons. The prevalence of joint family system was noticed in both type of farms, more than 50 per cent of sample FLD farmers were having the system of joint family as against of 36 per cent in case of Non-FLD farmers.

#### **4.3.2 Age of head and family members**

Agriculture being a biological enterprise is also influenced by large number of factors, where decisions need to be taken quickly in a time bound manner. The decision making skills among the family members develops with experience over time. The farm decisions with respect to investment on infra-structure or adoption of crop enterprises are taken jointly by head of the family and other family members. The age of an individual is an important factor for performing various farm tasks and participation in decision making on the farm. The young persons are capable of taking risky farm management decisions than aged persons. Keeping these things in mind, the age-wise distribution of the head of the family and other family members of sampled farms was analysed and is given in table 4.15 and table 4.16. It can be seen from the Table 4.15 that majority of the heads of the families in FLD (48%) and Non-FLD farms (64%) were in the age group of 40-60 years followed by the age group above 60 years (28 to 38%). The heads of the family in the young age group of 25-40 years also accounted for 8 per cent in case of Non-FLD farms to 14 per cent in case of FLD farms. None of the head of family belonged to female gender in both the type of farms.

**Table: 4.15 Age- wise distribution of the head of the family**

(Per cent)

Sr.No.	Age group (years)	FLD farmers		Non-FLD farmers	
		Male	Female	Male	Female
1	25-40	14.00	-	8.00	-
2	40-60	48.00	-	64.00	-
3	Above 60	38.00	-	28.00	-
	Total	50	-	25	-

In both type of sample farms none of the head of family was below the age of 25 years. As the majority of heads were above the age of 40 years which indicates that heads were quite experienced and capable of handling matter related to organization of their farms. Since farming is a labour intensive activity, therefore, number as well as age, composition of family members available for farming determines the farm efficiency. The family members in the age group of 16-60 years are considered as active work-force and the members below the age of 16 and above 60 are considered as dependents on other family members. The age-wise distribution of family members on FLD and Non-FLD farmers has been presented in table 4.16. It indicates that about 1.67 and 3.51 per cent of the population was in the age group of 0-5 years in FLD farmers and Non-FLD farmers, respectively.

The proportion of population in the age group of 6-15 years was about 9 per cent in FLD farmers and about 11 per cent in Non-FLD farmers. The working population (16-60 years) constituted about 67 per cent of the total population. The proportion of females was higher than males in the working population. It ranged between 67.52 per cent in FLD farmers to 70 per cent in Non-FLD farmers. The population of the dependents was about 33 per cent in both types of farmers. This indicates that population of active workers in the family was higher as compared to dependent population. The sex-ratio was higher in Non-FLD farmers (1111) than the FLD farmers (951).

**Table 4.16: Age-wise distribution of family members**

		(Per cent)					
Sr.No.	Age group (years)	FLD farmers			Non- FLD farmers		
		Male	Female	Total	Male	Female	Total
1	Upto 5	2.44	0.85	1.67	5.56	1.67	3.51
2	6 to 15	7.32	11.11	9.17	14.81	8.33	11.40
3	16 to 25	16.26	13.68	15.00	9.26	15.00	12.28
4	26 to 40	21.95	27.35	24.58	18.52	26.67	22.81
5	41 to 60	28.46	26.50	27.50	35.18	28.33	31.58
6	Above 60	23.58	20.51	22.08	16.67	20.00	18.42
	Total	123 (100.00)	117 (100.00)	240 (100.00)	54 (100.00)	60 (100.00)	114 (100.00)
	Active workforce (16 to 60)	66.67	67.52	67.08	62.96	70.00	66.67
	Dependent population	33.33	32.48	32.92	37.04	30.00	33.33
	Sex –ratio*		951.22			1111.11	

Note: Figures in parentheses indicate percentage

\*Number of females per thousand of males

### 4.3.3 Education of head and family members

The educational level of farmers and his family members is an important determinant of the ability of the farming communities to make judicious decisions to cope up with the various challenges in agriculture. In the present time the information of different agricultural development, schemes, market information, information of inputs etc. are available in print and electronic to which illiterate people has little/no access. The well educated persons are more competent to adopt innovative means of production, farm technologies and various measures to tackle the threats in present day agriculture. The educational status of the sample population has been analyzed and is presented in Table 4.17 and 4.18.

The heads of the farm families perform multi-farm functions ranging from farm workers to manager. The decisions regarding the cropping pattern, adoption of farm enterprises and marketing of farm produce to a greater extent are mostly influenced by head of the families. The Table 4.17 portrays that the literacy rate of the head of the families was quite high ranging from 92 (FLD farmers) to 96 per cent (Non-FLD farmers). Majority of heads of the families in both type of farms were educated up to high school (34% to 36%) followed by senior secondary (24% and 32%). The percentage of heads of the families having education to the graduation level and above turned out to be 8 and 12 per cent, respectively for FLD and Non-FLD farmers. Thus, it can be concluded that the educational status of the heads of the sample farmers was quite good. This indicates that on an average they were competent to take wise decisions on their farms.

The investment on farm assets and selection of farm enterprises is a collective decision of the whole family in most of the times. Hence, the education of family members is also equally important in farming business. It can be observed from the table 4.18. that about 13 and 19 per cent of the total family members of FLD and Non-FLD farmers were illiterate. The proportion of family members for both FLD and Non-FLD farms having education up to primary level was turned out to be about 15 per cent and 3 per cent, respectively. Nearly half of the total family members were having education upto secondary level. The family members having education upto graduate level and above that accounted for 25 per cent and 36 per cent of total family members. The table 4.18 further highlights that percentage of females family members having education above senior secondary level was observed to half than that of males family members. This implies that education of females especially at the level of graduation and above, has not received much attention by their wards. The overall literacy rate of males was significantly higher than that of females in both type of farms. The overall literacy rate of farms was quite good and stood at about 81 per cent in Non-FLD farmers to 88 per cent in FLD farmers. However, in case of male literacy rate no significant difference was observed in both the categories of farms. Similar results were also reported by Quadri et al. (2013).

**Table 4.17: Educational status of the head of the family**

(Per cent)

Sr.No.	Particulars	FLD farmers		Non FLD farmers	
1	Illiterate	8.00		4.00	
2	Primary	10.00		-	
3	Middle	16.00		16.00	
4	Matric/high school	34.00		36.00	
5	Senior secondary	24.00		32.00	
6	Graduation and above	8.00		12.00	
	Total	50		25	
		(100.00)		(100.00)	
	Literacy rate (%)	92.00		96.00	

**Table 4.18: Education status of family members**

(Per cent)

Sr.No.	Particulars	FLD farmers			Non- FLD farmers		
		Male	Female	Total	Male	Female	Total
1	Illiterate	4.59	20.56	12.50	4.88	30.61	18.89
2	Primary	7.34	22.43	14.81	-	6.12	3.33
3	Middle	10.09	14.02	12.04	12.20	8.16	10.00
4	Matriculate	16.51	10.28	13.43	17.07	10.20	13.33
5	Senior secondary	27.52	16.82	22.22	21.95	16.33	18.89
6	Graduate and above	33.94	15.89	25.00	43.90	28.57	35.56
	Total	100.00	100.00	100.00	100.00	100.00	100.00
	Literacy rate (%)	95.41	79.44	87.50	95.12	69.39	81.11

#### 4.3.4 Occupational pattern

The income of households directly depends upon the type of occupation of head of the family and other family members. The occupational pattern of the heads of the families and members has been analysed and is presented in Table 4.19 and Table 4.20.

The table 4.19 shows that majority of heads of FLD (42%) and Non-FLD (56%) families had government service as their main occupation followed by agriculture sector in which 34 per cent heads of FLD farms and 24 per cent of Non-FLD farms were engaged. The private jobs were found to be the other major occupation for about 10 and 16 per cent heads of the FLD and Non-FLD farms, respectively. However 10 and 4 per cent heads of the families in FLD farms and Non-FLD were mainly engaged in business and trade activities. In case of FLD farms 4 per cent heads were having their main occupation as labourer/wage earner.

**Table 4.19: Occupational pattern of the heads of sample farmers**

(Per cent)

Sr.No.	Particulars	FLD farmers		Non FLD farmers	
		Main	Subsidiary	Main	Subsidiary
1	Agriculture	34.00	42.85	24.00	50.00
2	Government service/Pensioners	42.00	33.33	56.00	40.00
3	Private job	10.00	9.52	16.00	10.00
4	Business/Trade/Shop	10.00	14.29	4.00	-
5	Labourer	4.00	-	-	-
	Total	50 (100.00)	21 (100.00)	25 (100.00)	10 (100.00)

As far as subsidiary occupation was concerned, agriculture was found to be the subsidiary occupation for about 43 and 50 per cent of the heads in FLD and Non-FLD farmers. Next to agriculture, government service and private jobs were other subsidiary occupation for about 33 and 10 per cent of heads under and 40 and 10 per cent of the total heads under FLD and Non-FLD farmers, respectively. The distribution of total working population according to their main and subsidiary occupation depicted in table 4.20 shows that about 45 per cent of the members of FLD farmers had agriculture as their main occupation whereas in case of Non-FLD farmers about 44 per cent had government service as their main occupation. Next to agriculture, government service and private jobs were the other major occupations for about 30 and 11 per cent of the family members of FLD farmers and for Non-FLD farmers, agriculture and private jobs were next to

government job as found to be their other major occupation which accounted for about 28 and 14 per cent of the family members, respectively. However, about 7 and 6 per cent for the family members in FLD farmers and 10 and 3 per cent in Non-FLD families were engaged in business and labour activities. As far as the subsidiary occupations were concerned, agriculture was found to be the subsidiary occupation for about 49 and 33 per cent of the FLD and Non-FLD farmers.

**Table 4.20: Occupational pattern of the family members**

(Per cent)

Sr.No.	Particulars	FLD Farmers		Non-FLD Farmers	
		Main	Subsidiary	Main	Subsidiary
1	Agriculture	45.33	48.84	27.84	32.67
2	Government service/pensioners	30.37	33.72	44.33	27.73
3	Private job	11.21	12.79	14.43	28.71
4	Business/trade/shop	7.01	4.65	10.31	-
5	Labourer	6.07	-	3.09	10.89
	Total	214	86	97	101
		(100.00)	(100.00)	(100.00)	(100.00)

#### 4.3.5 Investment on farm buildings

Investment on residential and farm buildings is among the first priorities of the farm families, which largely depends upon the level of household income. It is also considered as a symbol of status of individual in the society. Keeping this in view, the investment on buildings and farm structures by sample farmers has been analysed and is presented in the Table 4.21. It is evident from the table that the average number of buildings on FLD and Non-FLD farms was turned out to be 2.8 which consisted of kuchcha, pucca and mixed types. The both types of farmers were found maintaining and improving their ancestors building alongwith construction of pucca house depending upon their requirement and income. Among the residential houses the number of pucca house was higher as compared to kucca and mixed type. The sample farmers had given more priority to

**Table 4.21: Investment on residential and farm buildings**

Sr.No	Particulars	FLD farmers			Non –FLD farmers		
		Number	Present value(Rs)	Annual repairs(Rs)	Number	Present value(Rs)	Annual repairs(Rs)
<b>A</b>	<b>Residential house</b>						
1	<i>Kuchcha</i>	-	-	-	0.02	6000 (0.55)	100 (0.64)
2	<i>Pucca</i>	0.84	1108000 (82.42)	760 (5.74)	0.84	928000 (84.58)	8010 (51.54)
3	Mixed	0.16	144000 (10.71)	6900 (52.11)	0.14	80000 (7.29)	780 (5.02)
	Sub-Total	1.00	1252000 (93.13)	7660 (57.85)	1.00	1014000 (92.42)	8890 (57.21)
<b>B</b>	<b>Cattle shed</b>						
1	<i>Kuchcha</i>	0.24	10000 (0.74)	1000 (7.55)	0.42	14000 (1.28)	1480 (9.52)
2	<i>Pucca</i>	0.56	36200 (2.69)	1860 (14.05)	0.50	28600 (2.61)	1850 (11.9)
3	Mixed	0.16	6800 (0.51)	520 (3.93)	0.08	3600 (0.33)	330 (2.12)
	Sub-Total	0.96	53000 (3.94)	3380 (25.53)	1.00	46200 (4.21)	3660 (23.55)
<b>C</b>	<b>Store house</b>						
1	<i>Kuchcha</i>	0.20	7600 (0.57)	800 (6.04)	0.16	5300 (0.48)	530 (3.41)
2	<i>Pucca</i>	0.52	27200 (2.02)	1000 (7.55)	0.46	24600 (2.24)	1790 (11.52)
3	Mixed	0.12	4600 (0.34)	400 (3.02)	0.18	7100 (0.65)	670 (4.31)
	Sub-Total	0.84	39400 (2.93)	2200 (16.62)	0.80	37000 (3.37)	2990 (19.24)
	Total	2.80 (100.00)	1344400 (100.00)	13240 (100.00)	2.80 (100.00)	1097200 (100.00)	15540 (100.00)

Note: Figures in parentheses indicate percentage to total

investment on residential houses as compared to the other type of farm buildings. As on an average, the investment on residential houses by both the FLD families and Non-FLD families accounted for nearly 92 to 93 per cent of total investment in both types of farms. Across both types of families no significant difference was observed in the pattern of investment on farm buildings. The annual expenditure on repair and maintenance on residential and farm buildings, at Rs 13240 in FLD farmers to Rs 15540 in Non-FLD farmers.

#### **4.3.6 Livestock inventory and investment**

Livestock play a crucial role in hill agriculture as livestock and crop components have symbiotic relationship with each others. The by-products of crop component are used as fodder for livestock and livestock in turn supply valuable critical inputs in the form of farm yard manure (FYM) for crop production. In the study area livestock were being reared to produce milk, wool, meat, FYM and workforce. The size of unit depends on many factors like, availability of fodder, household and market requirement for milk, meat, requirement of FYM on farm, family labour etc. This is the only component of farming that provides round the year income and employment to farm families. The livestock inventory on sample farms has been analysed and is given in Table 4.22. It can be seen from the table that average size of livestock unit was 2.28 units in FLD farmers as against 1.60 units in Non-FLD farmers, respectively. Among the different livestock, the population of improved milking cows was found maximum in both FLD and Non-FLD followed by buffaloes in milking stage, respectively. This indicates that in the study area both cows as well as buffaloes were reared for milk purpose but cows were preferred over buffalo, mainly because of its low maintenance cost. The population of bullocks was quite low in both types of farms i.e. 0.12 and 0.06 units, which accounted for about 3 and 8 per cent of total livestock population in FLD farmers and Non-FLD farmers, respectively. It was mainly due to the, ploughing and threshing operations of various crop by using the services of tractor and thresher respectively, and as such little need was felt to maintain bullocks throughout the year. The total average value of livestock unit for FLD and Non-FLD was estimated at Rs 45650/farm and Rs 27080/farm, respectively in which the major share was of buffalo (41 % to 45 %) followed by improved cows. The table further shows that in the study area not even a single farmer in both types of farms reputed rearing of sheep and goats. The livestock composition was consisted of cattle and buffaloes and no other types of livestock appeared in the composition of livestock.

**Table 4.22: Investment on farm animals**

		(Per farm)							
Sr.No	Particulars	FLD farmers				Non-FLD farmers			
		Inventory		Value		Inventory		Value	
		Number	Percent	Rupees	Percent	Number	Percent	Rupees	Percent
A	Cow	0.84	36.84	19830	43.44	0.64	40.00	9480	35.01
	improved								
1	Milking	0.76	33.33	19240	42.15	0.52	32.50	7240	26.74
2	Dry	0.08	3.51	590	1.29	0.12	7.50	2240	8.27
B	Local cow	0.14	6.14	1600	3.50	0.08	5.00	2800	10.34
1	Milking	0.14	6.14	1600	3.50	0.08	5.00	2800	10.34
2	Dry	-	-	-	-	-	-	-	-
C	Buffalo	0.64	28.07	20500	44.91	0.28	17.50	11000	40.62
1	Milking	0.48	21.05	17300	37.90	0.20	12.50	9000	33.23
2	Dry	0.16	7.02	3200	7.01	0.08	5.00	2000	7.39
D	Bullocks	0.06	2.63	340	0.74	0.12	7.50	720	2.66
E	Heifers	0.42	18.42	2560	5.61	0.12	7.50	1080	3.99
1	Cow	0.36	15.79	1820	3.99	0.08	5.00	480	1.77
2	Buffalo	0.06	2.63	740	1.62	0.04	2.50	600	2.22
F	Young	0.18	7.89	820	1.80	0.36	22.50	2000	7.39
	stock								
1	Cow	0.08	3.51	230	0.50	0.24	15.00	1200	4.43
2	Buffalo	0.01	4.39	590	1.29	0.12	7.50	800	2.95
	Total	2.28	100.00	45650	100.00	1.60	100.00	27080	100.00

#### 4.3.7 Investment on farm tools, equipments and machinery

Farm tools, equipments and machinery are amongst the basic requirements and means for performing timely farm operations, reducing the cost of operations, maximising the efficiency of various inputs used and improving the productivity of labour and land too accomplishing different crop production operations. The pattern of inventory and investment on farm implements and machinery on FLD and Non-FLD farmers is depicted in Table 4.23.

On an average there were three units of major farm equipments and machinery on both types of farms whereas the number of minor implements recorded to be 15 and 17 on FLD and Non-FLD farms. This indicates that in absolute numbers, the number of minor farm tools and implements were quite high as compared to major farm implements (power operated). The number of power operated farm machinery such as tractors, power tillers and threshers, etc. were quite low on account of their high initial cost and seasonal use in the crop production operations. Nearly 17 to 14 per cent of sample farmers in FLD and Non-FLD farms had possession of these types of major farm machinery. This indicate that respondents opted to hire the services of these machines rather than purchasing for own farm use. Thus, the farmers had the tendency to purchase those farm implements, tools and machinery which were of frequent use on the farm and required relatively low

**Table 4.23: Investment on farm machinery, tools and equipments**

(Per farm)					
Sr.No.	Particulars	FLD farmers		Non-FLD farmers	
		Number	Value (Rs)	Number	Value (Rs)
<b>A</b>	<b>Major farm machinery</b>				
i	Tractor	0.08 (0.44)	48000 (67.95)	0.04 (0.20)	14000 (43.37)
ii	Power tiller	0.04 (0.22)	2800 (3.96)	0.02 (0.10)	900 (2.79)
iii	Chaff cutter	0.92 (5.11)	4356 (6.17)	0.92 (4.66)	4148 (12.89)
iv	Thresher	0.08 (0.44)	5800 (8.21)	0.06 (0.30)	4500 (13.94)
v	Sprayer/Duster	0.76 (4.22)	2264 (3.21)	0.94 (4.76)	2723 (8.44)
vi	Water lifting pump	1.20 (6.67)	4304 (6.09)	0.88 (4.45)	3100 (9.60)
	Sub-total	3.08 (17.11)	67524 (95.59)	2.86 (14.47)	29371 (90.99)
<b>B</b>	<b>Minor implements</b>				
i	Plough	0.20 (1.11)	908 (1.29)	0.10 (0.51)	296 (0.92)
A	Wooden	0.12 (0.67)	108 (0.15)	0.08 (0.40)	96 (0.30)
B	Iron	0.08 (0.44)	800 (1.13)	0.02 (0.10)	200 (0.62)
ii	Spade	1.04 (5.78)	212.80 (0.30)	1.62 (8.20)	334.10 (1.04)
iii	Hoe	3.24 (18.00)	598 (0.85)	3.68 (18.62)	691 (2.14)
iv	Rake	0.84 (4.67)	149.40 (0.21)	1.48 (7.49)	266 (0.82)
v	Sickle	5.60 (31.11)	629.20 (0.89)	5.80 (29.45)	688.30 (2.13)
vi	Axe	0.96 (5.33)	347.60 (0.49)	0.96 (4.86)	347.60 (1.08)
vii	Kudali	3.04 (16.89)	267 (0.38)	3.26 (16.50)	285.60 (0.88)
	Sub total	14.92 (82.89)	3112 (4.41)	16.90 (85.53)	2908.60 (9.01)
	<b>Total</b>	18.00 (100.00)	70636 (100.00)	19.76 (100.00)	32279.60 (100.00)

Note: Figures in parentheses indicate percentages to total

initial investment and maintenance cost, other-wise tendency of farmers was to hire services from off-farm sources at prevailing rates in the locality. The table further indicates that the average total investment on implements/machinery on the sample farms was estimated Rs 70636 on FLD farms and Rs 32279 on Non-FLD farms, respectively.

The share of total investment on major farm implements/machinery was more than 95 per cent in case of FLD farmers as against about 91 per cent in Non-FLD farmers. About 4 to 9 per cent of the total investment was made on minor farm implements and tools from FLD to Non-FLD farmers.

**Table 4.24: Land utilization pattern on sample farms**

(ha/farm)

Sr.No.	Particulars	FLD farmers			Non- FLD farmers		
		Irrigated	Un-Irrigated	Total	Irrigated	Un-Irrigated	Total
1	Cultivated land	0.9664 (98.53)	0.0912 (21.11)	1.0576 (74.87)	0.4384 (95.14)	0.0665 (13.24)	0.5049 (52.42)
2	Orchards	0.0144 (1.47)	-	0.0144 (1.02)	0.0224 (4.86)	0.0032 (0.64)	0.0256 (2.66)
3	Fallow land (current)	-	0.0416 (9.63)	0.0416 (2.94)	-	0.2183 (43.45)	0.2183 (22.66)
4	Land under misc.(trees/ grasses/forest)	-	0.0656 (15.19)	0.0656 (4.64)	-	0.1632 (32.48)	0.1632 (16.94)
5	Any other (grassland)	-	0.2336 (54.07)	0.2336 (16.53)	-	0.0512 (10.19)	0.0512 (5.32)
	Total holding	0.9808 (100.00)	0.4320 (100.00)	1.4128 (100.00)	0.4608 (100.00)	0.5024 (100.00)	0.9632 (100.00)
	Per cent irrigated area			91.37			86.82

Note: Figures in parentheses indicate percentage to total

#### 4.3.8 Land inventory and utilization

Land is the basic resource for the adoption of different farm and non-farm activities, their scale of operations and technology to be adopted. The size of land holding also is an indicator of the economic security and the welfare of the farm family. The farmers with large holdings have more opportunities to adopt more number of farm enterprises as compared to their counterparts with small holdings. Land inventory and its utilization pattern of the sample farmers has been analyzed and is depicted in Table 4.24. The table reveals that the average size of holdings of the FLD and Non-FLD farms was recorded to be 1.4128 and 0.9632 ha, respectively out of the total land area. The owned land composed of the area allocated for cultivation of crops, area under forests and plantation crops (orchards), and land put to non agricultural use and area covered under pastures and grazing land. Among these land uses, the proportion of area put under cultivation of crops by FLD and Non-FLD farmers was found to be about 75 and 53 per cent of total land holding. The area under orchards (fruits plants) accounted for about 1 and 3 per cent,

respectively. The maximum portion of irrigated land was allocated for cultivation of crops. It was recorded to be about 98 and 95 per cent of total irrigated area. The table also depicts that about 3 per cent of total land was kept fallow by FLD farmers and in case of Non-FLD farmers 22 per cent of total land was kept fallow.

#### 4.3.9 Cropping pattern

The cropping pattern indicates the percentage of land put under different crops during an agricultural year. The analysis of cropping pattern indicates the relative importance of crops in the farm plan during the period. This aspects also helps in ascertaining the extent of identification of crops on the farms. The cropping pattern and intensity on sample farms in the study area has been analysed and is given in table 4.25 from the table it is quite evident that in case of FLD farmers in *kharif* season pulses were the most important crops and occupied the maximum proportion (19.32%) of the total cropped area followed by maize (17.00%) and vegetables crops (4.64%). Under pulses blackgram was the only pulse crop grown by the sample farmers. Whereas, in case of Non-FLD farmers maize was the most important crops that occupied the maximum proportion (19.10%) followed by vegetables (13.19%) and pulses (12.85%).

**Table 4.25: Cropping pattern and intensity on sample farms**

		(per cent)	
Sr.No	Season/Crop	FLD farmers	Non-FLD farmers
I	<i>Kharif</i>		
1	Maize	17.00	19.10
2	Pulses	19.32	12.85
i	Blackgram	19.32	12.85
3	Fodder	2.01	3.13
4	Vegetables	4.64	13.19
	Sub total	42.97	48.26
II	<i>Rabi</i>		
1	Wheat	15.53	16.32
2	Pulses	36.32	24.65
i	Chickpea	18.55	14.93
ii	Lentil	17.77	9.72
3	Fodder	2.16	2.78
4	Vegetables	3.01	7.99
	Sub total	57.03	51.74
	Total cropped area (ha)	2.0704	0.9216
		(100.00)	(100.00)
	Net cultivated area (ha)	1.0576	0.5049
	Cropping intensity (%)	195.76	182.53

In *rabi* season, also the pulses emerged out the leading crops, occupying more than 36 per cent of total cropped area on FLD farm. Among pulses, chickpea and lentil were the only crops grown by farmers. The wheat crop also accounted for about 16 per cent of the total cropped area. In case of Non-FLD farms, the most important crop was wheat covering about 16 per cent of gross cropped area followed by pulses (chickpea and lentil). The cropping intensity, which signifies the extent of crop intensification on the farm, came out to be 195.76 per cent on FLD farms and 182.53 per cent in case of Non-FLD farms.

#### 4.3.10 Crop production and productivity

The quantum of various types of crops raised on the farm highlights the economic prosperity and soundness of the farming as occupation. Therefore, the production of major crops on per farm basis has been worked out and displayed in Table 4.26. It was noticed from the table that among FLD farmers maize gave the maximum production of 7.12 quintal per farm on an average farm followed by wheat (6.48 q/farm) and vegetables (2.61 q/farm). The per farm production of pulses was recorded to be quite low. The table further reveals that in case of Non-FLD farms production of maize was 2.92 q/farm and that wheat(2.52 q/farm). Among pulse crops in case of FLD farmers the per farm production was highest in case of chickpea (1.99 q) followed by blackgram (1.69 q), lentil (1.54 q), respectively. Whereas, in case of Non-FLD farmers per farm production was maximum in case of blackgram (0.30 q) followed by chickpea (0.27 q), lentil (0.20 q), respectively.

**Table 4.26: Production and productivity of major crops**

Sr.No.	Crops	FLD farmers		Non-FLD farmers	
		Production (q/farm)	Productivity (q/ha)	Production (q/farm)	Productivity (q/ha)
1	Maize	7.12	29.32	2.92	17.00
2	Wheat	6.48	21.92	2.52	18.75
3	Fodder	2.09	20.34	1.10	13.88
4	Vegetables	2.61	28.63	2.40	21.92
5	Pulses				
I	Blackgram	1.69	4.22	0.30	2.44
Ii	Chickpea	1.99	5.24	0.27	2.54
Iii	Lentil	1.54	4.49	0.20	2.35

The output per unit of area of a crop is represented through yield rate which generally speaks of the economic importance of that crop. For this, the average yields of

different crops in the study area have been worked out and are shown in Table 4.26. On an average FLD farm productivity was found to be 29.32 q/ha for maize, 28.63 q/ha for vegetables 21.92 q/ha for wheat crop respectively. The productivity of pulses on FLD farms was recorded to be 4.22 q/ha, 5.24 q/ha and 4.49 q/ha for blackgram, chickpea and lentil respectively. The per cent difference on both farms was found to be 42, 14, 32 and 23 for maize, wheat, fodder and vegetables. Whereas in case of pulses per cent difference on both farms was 42, 52 and 48 for blackgram, chickpea and lentil, respectively. The productivity of all the crops in case of Non-FLD farmers was found to be less than the productivity of these crops on FLD farms. The productivity of pulses recorded to be in the range of 2 to 3 q/ha.

#### **4.3.12 Farm, off-farm and non-farm income**

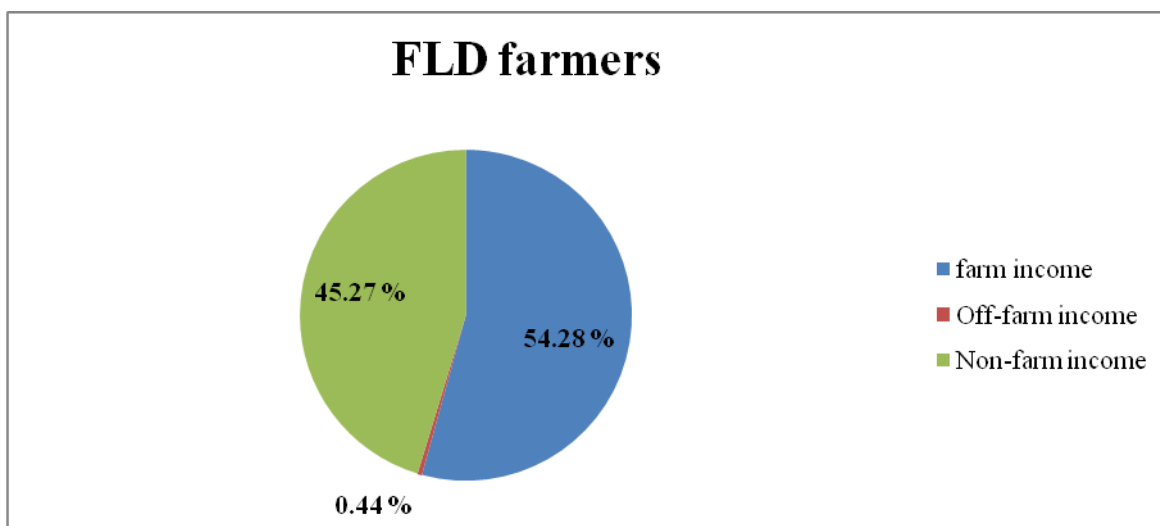
The farm and non-farm activities are the main source of income and off farm income constitutes small proportion of total income of the farms. The farm income was estimated as value of main product and by products net of the cost on account of seed, fertilisers, pesticides, payment to hired labour and draft power. The income generated by family members as labourer on other farmer's fields was taken as off farm income. The income generated from non-agricultural activities such as services, business/trade/shop, non-agricultural labour activities etc. were considered as non-farm income. The different components of farm, off-farm and non-farm income are presented in Table 4.27 and Fig 4.1. and Fig 4.2. The table reveals that in FLD farms about 30 per cent of the total farmer's income was generated through production of crops of which more than about 20 per cent was from the production of pulses. About 16 per cent of farmer's income was accrued from the production of livestock alongwith agriculture. In case of Non-FLD farmers, the corresponding figures for the income from production of crops was recorded to be 13 per cent of which the share of the pulses was 5 per cent only. The comparison across both FLD and Non-FLD farms reveals that crops contributed more towards the total income of the FLD farms than to the income of Non-FLD farms. The share of farm income in the total income of farmers was found to be higher in FLD farms (45.27%) as compared to Non-FLD farms (29.86%). In non-farm income, the component of services both government as well as private was the major one that contributed more than 38 per

cent to the total income in FLD farms. The contribution of this sector was found to be comparatively higher in case of Non-FLD farms (56.68%). The contributing off-farm income towards total income was almost negligible in both type of farms. The business/trade/shop also contributed about 12 to 15 per cent to total income. The non-agricultural labourer components contribution was recorded to be very low ranging from 0.75 to 1.21 per cent from FLD to Non-FLD farmers. The contribution of non-farm income in the total income was found to be ranged between about 54 per cent in FLD farms to 70 per cent in Non-FLD farms.

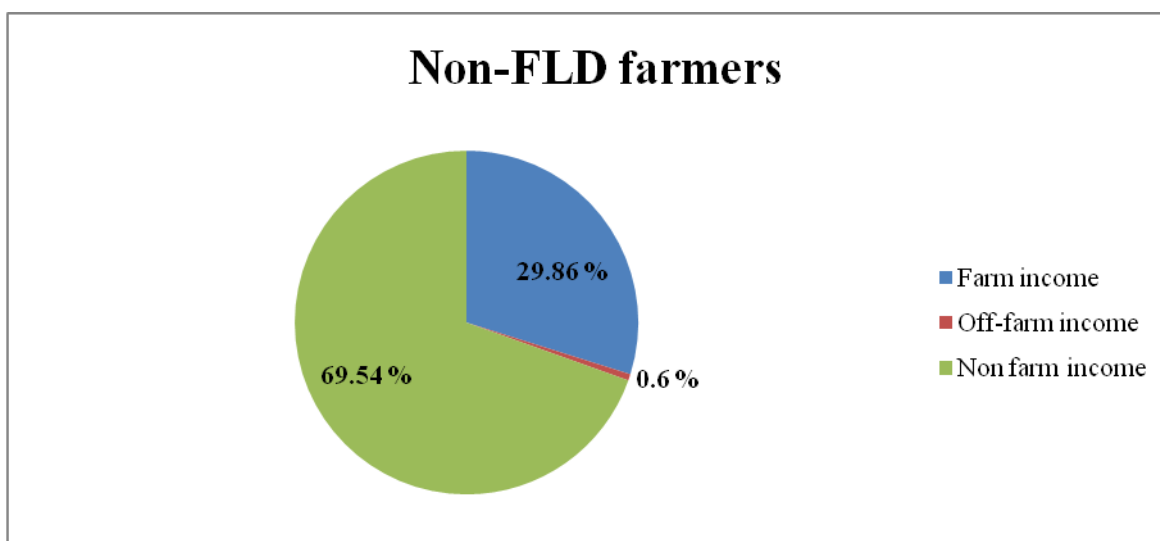
**Table 4.27: Composition of farm, off-farm and non- farm income of sample farms**  
(Rs./farm)

Sr.No.	Particulars	FLD farmers	Non-FLD farmers
I	Farm income		
1	Crops	29.23	13.30
I	Pulses	20.11	5.26
ii	Other crops	9.12	8.04
2	Livestock	16.04	16.56
	Sub-total	45.27	29.86
II	Off-farm income (Agricultural labourer)	0.44	0.60
III	Non-farm income		
1	Trade/shop	15.34	11.65
2	Government service	22.15	34.57
3	Private service	16.04	22.11
4	Non-agricultural labourer	0.75	1.21
	Sub-total	54.28	69.54
	Total	284748 (100.00)	163488 (100.00)

Note: Figures in the parentheses indicate percentages to the total



**Fig.4.1 Composition of farm, off-farm and non-farm income of FLD farmers**



**Fig.4.2 Composition of farm, off-farm and non-farm income of Non-FLD farmers**

#### **4.4 Input use pattern, costs and returns**

An analysis of resource use costs and returns is of vital importance as the input use pattern establish the type of technology on the farms and the extent as well as magnitude by which the various technological factors of production are used in the production process. The costs and returns analysis of a particular enterprise also provide useful information of practical value in improving the farm efficiency. In this section, therefore, an attempt has been made to present the resource use pattern, costs and returns from pulses and the various farm efficiency measures under both types of farms.

#### 4.4.1 Pattern of human labour use

The employment of human labour plays a major role regarding profitability of the farms. Since ages, pulses have been well integrated into farming system of our country as the farmers could produce them by using their own seeds and family labour without depending much on external inputs. In the study area pulses are still cultivated on the marginal and sub-marginal land, predominantly under unirrigated conditions. The several operations like seed treatment, field preparation, inter-culture, harvesting and threshing etc. require labour. The use of labour in different farm operations in production of pulses was converted into human labour mandays to estimate the labour requirement. Eight hours of working were considered equivalent to one human labour manday.

Table 4.28 provides information on average labour required in production of pulses in the study area. It can be seen from the Table 4.28 that the total labour required for performing various farm operation for pulses in case of FLD farmers were found to be about 122, 97 and 86 man days per ha for blackgram, chickpea and lentil and in Non-FLD farmers the number of man days per ha were recorded to be 79, 66 and 70. The table further shows that in case of FLD farmers maximum human labour man days were employed in accomplishing weeding/hoeing followed by harvesting, threshing and storage. These field operations together accounted for about 53, 56 and 51 per cent of the total labour requirement on an average farm, respectively. In case of Non-FLD farmers maximum human labour man days were employed in harvesting, threshing and storage followed by FYM application and hoeing/weeding operations. These together accounted for about 41, 32 and 38 per cent total human labour man day per ha in blackgram, chickpea and lentil, respectively. So it can be concluded from the table that in the study area FLD farmers used about 11 per cent more human labour in comparison to Non-FLD farmers.

**Table 4.28: Pattern of labour use in pulses production**

Sr.No.	Particulars	(No. of mandays)											
		FLD farmers						Non-FLD farmers					
		Blackgram		Chickpea		Lentil		Blackgram		Chickpea		Lentil	
	Per farm	Per ha	Per farm	Per ha	Per farm	Per ha	Per farm	Per ha	Per farm	Per ha	Per farm	Per ha	
1	Seed treatment	1.30	3.40 (2.79)	1.20	3.20 (3.29)	1.25	3.40 (3.95)	0.40	3.28 (4.17)	0.44	3.14 (4.77)	0.51	5.10 (7.25)
2	Fields preparation												
	Ploughing	1.30	3.40 (2.79)	1.60	4.20 (4.31)	1.40	3.80 (4.41)	0.40	3.28 (4.17)	1.67	11.90 (18.09)	0.70	7.00 (9.96)
	FYM application	4.00	10.00 (8.30)	2.80	7.40 (7.60)	3.20	8.70 (10.10)	1.39	11.69 (14.86)	1.73	12.35 (18.77)	0.70	7.00 (9.96)
3	Sowing	8.20	20.50 (16.84)	3.80	9.90 (10.16)	3.80	10.60 (12.30)	0.64	5.33 (6.77)	1.12	8.04 (12.22)	0.70	7.00 (9.96)
4	Fertilizers application	4.20	10.40 (8.55)	3.50	9.30 (9.55)	3.30	8.80 (10.22)	0.64	5.33 (6.77)	0.44	3.14 (4.77)	0.70	7.00 (9.96)
5	Hoeing/weeding	14.00	35.10 (28.84)	12.90	34.10 (35.01)	9.00	24.50 (28.44)	1.39	11.69 (14.86)	1.20	8.57 (13.03)	0.72	7.20 (10.25)
6	Plant protection												
	Fungicides	2.00	4.90 (4.03)	1.70	4.50 (4.62)	1.15	3.10 (3.60)	1.34	11.21 (14.25)	0.44	3.14 (4.77)	0.70	7.00 (9.96)
	Insecticides	2.10	5.30 (4.35)	1.40	3.60 (3.70)	1.15	3.10 (3.60)	0.75	6.21 (7.89)	0.44	3.14 (4.77)	0.70	7.00 (9.96)
7	Harvesting, threshing and storage	11.50	28.70 (23.58)	8.00	21.20 (21.77)	7.40	20.12 (23.36)	2.48	20.66 (26.26)	1.73	12.35 (18.77)	1.60	16.00 (22.76)
8	Total man days	48.60	121.70 (100.00)	36.90	97.40 (100.00)	31.65	86.12 (100.00)	9.43	78.68 (100.00)	9.21	65.77 (100.00)	7.03	70.30 (100.00)
i	Family labour	33.60	84.00 (69.02)	25.70	67.64 (69.45)	21.40	56.32 (65.40)	7.00	58.38 (74.20)	7.32	52.27 (74.66)	5.10	51.00 (82.33)
ii	Hired labour	15.00	37.70 (30.98)	11.20	29.76 (30.55)	10.25	29.80 (34.60)	2.43	20.30 (25.80)	1.89	13.50 (25.01)	1.93	19.30 (17.67)

Note: Figures in the parentheses indicate percentages to total

#### 4.4.2 Input use pattern

The Pattern of use of various inputs exhibits the extent of level of modern technology used on different farms. The quality and quantity of these inputs used in cultivation of crops are the chief determinants of the production and yield. The input use pattern in pulses cultivation under FLD and Non-FLD farms has been presented in Table 4.29. It can be seen from this table that the seed was the most vital and crucial input and was the major component of cost as its rate was estimated to be 20, 42 and 32 kg/ha for blackgram, chickpea and lentil, respectively on an average FLD farms. In case of Non-FLD farms about 18, 24 and 26 kg/ha seed rate of blackgram, chickpea and lentil was used which was recorded to be about 10 to 43 per cent less as compared to FLDs farmers.

Both the FLD and Non-FLD farms in the study area were found to be using different variety of seeds per hectare. FLD farms were found to be using recommended quantity of seed rate whereas Non-FLD farms were found to be using less than the recommended dose of seed rate. The use of FYM was found to be at the rate of about 33, 26 and 27 q/ha for blackgram, chickpea and lentil in FLD farms and in Non-FLD farms the use of FYM was recorded to be about 21 to 22 q/ha, respectively, which was found to be far below the recommended quantity. During the survey, it was observed that among chemical fertilizers mainly IFFCO mixture was applied by farmers in pulses. It was found that about 99, 105 and 101 kg/ha of IFFCO mixture was used by FLD farms in blackgram, chickpea and lentil, respectively. Whereas for Non-FLD farms 89, 95 and 95 kg/ha of IFFCO was applied. It was also noticed from the table that on per hectare basis FLD farms used 6 to 11 per cent more IFFCO mixture as compared to Non-FLD farms.

The table further highlights that usage of pesticides measures/chemicals on FLD farms for blackgram, chickpea and lentil was worked out to the extent of Rs. 1715, Rs. 1575 and Rs. 1355 per ha respectively. Whereas in case of Non-FLD farms Rs. 1504, Rs. 1196 and Rs. 1233 per ha of pesticides were used for blackgram, chickpea and lentil, respectively, and was substantial owing to the infestation of diseases and insects causing damage to the pulse crops. The tractor services were used for ploughing and preparation of land for cultivation. The tractor hours used were recorded to be to the extent of 7, 10 and 11 tractor hours per ha, respectively for blackgram, chickpea and lentil, respectively for FLD farms. The same number of tractor hours per ha were also used in case of Non-FLD farms also. The human labour required per ha was to the extent of about 86 to 122 man days from lentil to blackgram in FLD farms and in Non-FLD farms it ranged from 62 to 79 man days from lentil to blackgram, respectively.

**Table 4.29: Input use pattern for production of pulses**

Sr.No	Particulars	Units	FLD farmers						Non-FLD farmers					
			Blackgram		Chickpea		Lentil		Blackgram		Chickpea		Lentil	
			Per farm	Per ha	Per farm	Per ha	Per farm	Per ha	Per farm	Per ha	Per farm	Per ha	Per farm	Per ha
1	Human labour	MD	48.60	121.70 (100.00)	36.90	97.40 (100.00)	31.65	86.12 (100.00)	9.43	78.68 (100.00)	9.21	65.77 (100.00)	7.03	70.30 (100.00)
i	Family labour		33.60	84.00 (69.02)	25.70	67.64 (69.45)	21.40	56.32 (65.40)	7.00	58.38 (74.20)	7.32	52.27 (74.66)	5.10	51.00 (82.33)
ii	Hired labour		15.00	37.70 (30.98)	11.20	29.76 (30.55)	10.25	29.80 (34.60)	2.43	20.30 (25.80)	1.89	13.50 (25.01)	1.93	19.30 (17.67)
2	Tractor services	hr	3.00	7.50	4.00	10.50	4.00	10.80	1.00	8.30	1.00	7.10	1.0	11.10
3	Seed	kg	8.00	20.00	16.00	42.10	12.00	32.43	2.12	17.66	3.32	23.72	2.62	26.22
4	FYM	q	13.20	33.00	9.80	25.79	10.10	27.30	2.50	20.83	3.08	22.00	2.17	21.77
5	Fertilizer	kg												
i	Urea		-	-	-	-	-	-	-	-	-	-	-	-
ii	IFFCO mixture		39.70	99.25	39.80	104.74	37.50	101.35	10.62	88.54	13.25	94.58	9.52	95.24
6	Plant protection chemicals	Rs.	686	1715	598.69	1575.49	501.36	1355.04	180.55	1504.63	167.52	1196.43	123.30	1233.33

#### 4.4.3 Technological gap in production of pulses

Technological gap with respect to management practices in the process of production and existing practices of a particular crop indicates the per cent difference in the recommended and existing practices. The technological gap in respect of utilization of various inputs and performing of various cultural practices in the cultivation of pulses has been worked out and is given in Table 4.30 and Table 4.31. An overview of the table reveals that on FLD farms the highest technological gap was observed with respect to method of sowing on FLD farms and on Non-FLD farms technological gap was observed to be highest with respect to seed rate. The seed treatment was another practice where significantly high gap was observed on Non-FLD farms. No gap was observed in FLD farms with respect to the use of improved varieties they used seeds of hybrid varieties whereas the gap was recorded to be high (76%) in opting for hybrid seed varieties in Non-FLD farms. Around 24 per cent of gap was observed in case of seed treatment on FLD farms as against of 72 per cent in Non-FLD farms, respectively. Lack of knowledge and ignorance among farmers may be the major reason for this gap. A significantly high gap to the extent was observed for seed rate, land preparation method of fertilizers application, fertilizers doses on Non-FLD farms. It can, therefore, be concluded from the table that the technological gaps with respect to all the cultural practices were lower on Non-FLD farms, as the FLD farmers were having the deep practical knowledge regarding latest cultural and management practices of pulses production and were found to be comparatively more cautious regarding the raising crops in their farms.

**Table 4.30: Technological gap in management practices of pulses**

Sr.No.	Recommended practices	Percent of farmers following recommended practices		Technological gap (%)	
		FLD	Non-FLD	FLD	Non-FLD
1	Improved variety	100	24	Nil	76
2	Land preparation	70	40	30	60
3	Seed rate	84	20	16	80
4	Seed treatment	76	28	24	72
5	Method of sowing	62	36	38	64
6	Time of sowing	90	60	10	40
7	Fertilizer dose	64	40	36	60
8	Method of fertilizer application	86	32	14	68
9	Weed management	78	52	22	48
10	Plant protection	94	60	6	40

Technological gap can be defined as the per cent difference in the recommended and existing practices in the process of crop production. Here an attempt has been made to study the technological gap with respect to different agronomic practices viz., seed rate, farm yard manure, fertilizer application, plant protection measures and irrigation. The technological gaps in pulses cultivation on FLD and Non-FLD farms were computed to know the extent of adoption of technology and deviation from the recommended level.

The technological gap in respect of use of inputs such as seeds, farm yard manure, fertilizers doses and application of plant protection measures for FLD and Non-FLD farms is given in Table 4.31. It is observed that the technological gap in use of seeds was highest in Non-FLD farms and in FLD farms it was less than the Non-FLD farms. This infers that the FLD farmers were comparatively closer to the recommended practice with respect to seed rate. Again the technological gaps were positive in both the cases which show that both the farm groups were using lesser seed as compared to the recommended. Similarly, a positive and very high technological gap was observed in case of FYM use on both the farms. The farmers used FYM in different crops on the basis of availability of FYM and the quantity of FYM used in the previous crop. They did not keep the recommendations in mind. In case of the fertilizers, higher technological gaps were recorded in FLD farmers than Non-FLD farmers. So far as the plant protection measures were concerned very less technological gaps were observed with respect to the number of sprays of insecticides and fungicides on FLD farmers under study however significantly high gaps were found on Non-FLD farmers. It can be concluded from the table that all the inputs were below their recommended levels more on Non-FLD farmers which indicated that there lies sufficient scope to enhance yields by increasing the use of these inputs.

**Table 4.31: Technological gap in input use under FLD and Non-FLD farmers**

Sr.No.	Particulars	Units	FLD farmers								
			Recommended			Existing use/application			Technological gaps (%)		
			Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil
1	Seed	kg/ha	25	50	40	20.00	42.10	32.43	20.00	16.00	20.00
2	FYM	q/ha	50	50	50	33.00	25.79	27.30	34.00	48.00	46.00
3	Fertilizers	kg/ha	140	140	140	99.25	104.74	101.35	29.10	25.00	27.85
4	Fungicides	No.	2	2	2	1.46	1.72	1.32	27.00	14.00	34.00
5	Insecticides	No.	2	2	2	1.41	1.68	1.23	29.50	16.00	38.50
Non-FLD farmers											
Sr.No.	Particulars	Units	Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil
1	Seed	kg/ha	25	50	40	17.66	23.72	26.22	32.00	52.00	35.00
2	FYM	q/ha	50	50	50	20.83	22.00	21.77	58.00	56.00	56.46
3	Fertilizers	kg/ha	140	140	140	88.54	94.58	95.24	38.57	32.44	31.97
4	Fungicides	No.	2	2	2	1.12	1.02	1.21	44.00	49.00	39.50
5	Insecticides	No.	2	2	2	1.23	1.41	1.36	38.50	29.50	32.00

#### 4.4.4 Cost of cultivation

The computation of cost of cultivation is necessary to determine the relative profitability of various crops. The cost of cultivation of different crops was computed on the basis of standard cost concepts for sampled FLD and Non-FLD farms and the results have been presented in Table 4.32.

It can be seen from the table that in case of FLD farmers, the total cost of cultivation that includes material cost, labour cost and other indirect costs was estimated to be Rs. 56458 per ha for blackgram, Rs. 51578 for chickpea and Rs. 47933 for lentil. In case of Non-FLD farmers, the total cost of cultivation was estimated to be Rs. 39404, Rs. 34967 and Rs. 34363 per ha for blackgram, chickpea and lentil, respectively. The comparison of cost of cultivation of pulses across FLD and Non-FLD farms revealed that it was higher to the extent of about 43 per cent in blackgram, 47 per cent in chickpea and 39 per cent in lentil in FLD farms. The major component of the cost of cultivation was turned out to be human labour which contributed more than 50 per cent to total cost in blackgram and about 47 and 45 per cent in chickpea and lentil crop in case of FLD farms. In Non-FLD farms the contribution of human labour toward, total cost of cultivation ranged between 45 to 49 per cent from lentil to blackgram. Next to human labour expenditure on farm yard manure in FLD farm was the major component of cost which accounted for about six to eight per cent of total cost in blackgram. The next major component of cost in Non-FLD farms after human labour. The share of the other indirect nominal expenses in the total cost was worked out to be about 22, 24 and 26 per cent in blackgram, chickpea and lentil, respectively, on FLD farmers. In case of Non-FLD farms it was recorded to be about 26, 29 and 30 per cent in blackgram, chickpea and lentil, respectively. So it is evident from this table that the contribution of other nominal costs in total cost of cultivation, however, did differ significantly across FLD and Non-FLD farms, but the per cent that share of material cost in total cost was slightly on higher side in case of FLD farms.

**Table 4.32: Cost of inputs in pulses production**

													(Rs.)
Sr.No.	Particulars	FLD farmers						Non-FLD farmers					
		Blackgram		Chickpea		Lentil		Blackgram		Chickpea		Lentil	
		Per ha	Per cent	Per ha	Per cent	Per ha	Per cent	Per ha	Per cent	Per ha	Per cent	Per ha	Per cent
1	Material cost												
i	Seed	2600	4.60	4210	8.16	3243	6.67	2296	5.83	2372	6.78	2622	7.63
ii	Manure	4500	7.97	3250	6.30	3590	7.49	2249	5.70	1600	4.57	1531	4.45
iii	Fertilizers	1830	3.24	1710	3.31	1528	3.18	1348	3.42	1081	3.09	1095	3.19
iv	Pesticides/chemicals	1715	3.04	1575	3.05	1355	2.84	1505	3.82	1196	3.43	1233	3.59
v	Sub-total	10645	18.85	10745	20.82	9716	20.27	7398	18.77	6249	17.87	6481	18.86
2	Human labour	30425	53.89	24350	47.22	21500	44.85	19500	49.49	16250	46.47	15500	45.11
3	Tractor charges	3000	5.32	4200	8.15	4300	8.98	2000	5.08	2000	5.72	2000	5.82
4	Other nominal costs												
i	Interest on working capital	1398	2.48	1231	2.39	1391	2.90	1171	2.97	1002	2.87	1245	3.63
ii	Interest on fixed capital	1342	2.38	1342	2.60	1271	2.66	420	1.06	484	1.38	323	0.94
iii	Depreciation	1148	2.03	1210	2.34	1255	2.62	415	1.05	482	1.37	314	0.91
iv	Rental value of owned land	8500	15.05	8500	16.48	8500	17.72	8500	21.58	8500	24.32	8500	24.73
	Sub-total	12388	21.94	12283	23.81	12417	25.90	10506	26.66	10468	29.94	10382	30.21
5	Total cost of cultivation	56458	100.00	51578	100.00	47933	100.00	39404	100.00	34967	100.00	34363	100.00

#### 4.4.5 Costs and returns

The analysis of costs and returns is of vital importance both from the point of view of evolving sound production plans and for the formulation of price policy. The study of crop/enterprise costs and returns also provide very useful information for improving the farm efficiency. The costs and returns for pulse crops grown by the FLD farmers and Non-FLD farmers were estimated and are presented in Table 4.33. It can be seen from the table that on FLD farms, the total operational cost per ha (Cost A<sub>2</sub>) was estimated to be Rs. 35966, Rs. 31911 and Rs. 30362 for blackgram, chickpea and lentil, respectively. In Non-FLD farms the total operational cost per ha (Cost A<sub>2</sub>) was estimated at Rs. 19983 for chickpea to Rs. 21984 for blackgram. The comparison across FLD and Non-FLD types of farms revealed that the total operational cost per ha for all pulses was higher by 46 per cent (lentil) to 64 per cent (blackgram) under FLD farms as compared to Non-FLD farms.

The Cost B<sub>2</sub> per ha on FLD farms ranged between Rs. 40133 (lentil) to Rs. 45808 (blackgram). In case of Non-FLD farms the Cost B<sub>2</sub> ranged between Rs. 28967 (chickpea) to Rs. 30904 (blackgram) and were much higher (36% to 48%) for all pulses in FLD farms than Non-FLD farms. The total cost (Cost C<sub>3</sub>) per ha was amounted to Rs. 55504, Rs. 52116 and Rs. 47996 for blackgram, chickpea and lentil crop, respectively. The corresponding amounts for the same crops, under Non-FLD farms were recorded to be Rs. 41144, Rs. 36264 and Rs. 35599 for blackgram, chickpea and lentil, respectively. The similar type of difference as that of Cost A<sub>2</sub> and Cost B<sub>2</sub> was noticed in Cost C of all pulses across FLD and Non-FLD types of farms. The gross returns per ha were estimated to be Rs. 44900, Rs. 52400 and Rs. 54860 for lentil, chickpea and blackgram in FLD farms and found to be higher (about 73 to 106%) than Non-FLD farms. In case of Non-FLD farms the gross returns were recorded to be Rs. 23500 from lentil to Rs. 31720 for blackgram. The table further portrays that the net returns per ha over operational cost (Cost A<sub>2</sub>) were recorded to be ranging between Rs. 14538 in case of lentil to Rs. 20489 (chickpea) in case of FLD farmers as against Rs. 2710 (lentil) to Rs. 9736 (blackgram) in Non-FLD farmers. This shows that net returns over operational cost (Cost A<sub>2</sub>) for all pulses were higher by about 2 to 5 per cent in FLD farms than Non-FLD farms.

The table also indicates that net returns per ha over Cost B<sub>2</sub> also were recorded to be positive for all pulses in case of FLD farms, however, in case of Non-FLD farms, these were turned out to be positive for blackgram only. The negative net returns per ha of Rs. (-) 3567 and Rs. (-) 6113 were observed for chickpea and lentil, respectively. The net returns per ha over Cost C<sub>1</sub> and Cost C<sub>2</sub> were also turned out to be positive for all pulses under FLD farmers. However, over Cost C<sub>3</sub> the net returns per ha was turned out to be negative for blackgram Rs. (-) 644 and lentil Rs. (-) 3096 and were positive for chickpea (Rs. 284) only. In case of Non-FLD farms, the net return per ha over Cost C<sub>2</sub> and Cost C<sub>3</sub> were turned out to be negative for all the pulses.

**Table 4.33: Costs and returns from pulses**

(Rs./ha)

Sr.No.	Particulars	FLD farmers			Non-FLD farmers		
		Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil
1	Cost A <sub>1</sub>	35966	31911	30362	21984	19983	20790
2	Cost A <sub>2</sub>	35966	31911	30362	21984	19983	20790
3	Cost B <sub>1</sub>	37308	33253	31633	22404	20467	21113
4	Cost B <sub>2</sub>	45808	41753	40133	30904	28967	29613
5	Cost C <sub>1</sub>	44958	38878	35133	28904	24467	23863
6	Cost C <sub>2</sub>	50458	47378	43633	37404	32967	32363
7	Cost C <sub>3</sub>	55504	52116	47996	41144	36264	35599
8	Gross returns	54860	52400	44900	31720	25400	23500
	Net returns over						
i	Cost A <sub>1</sub>	18894	20489	14538	9736	5417	2710
ii	Cost A <sub>2</sub>	18894	20489	14538	9736	5417	2710
iii	Cost B <sub>1</sub>	17552	19147	13267	9316	4933	2387
iv	Cost B <sub>2</sub>	9052	10647	4767	816	-3567	-6113
v	Cost C <sub>1</sub>	9902	13522	9767	2816	933	-363
vi	Cost C <sub>2</sub>	4402	5022	1267	-5684	-7567	-8863
vii	Cost C <sub>3</sub>	-644	284	-3096	-9424	-10864	-12099
	Output-input ratio over						
i	Cost A <sub>2</sub>	1.52	1.64	1.47	1.44	1.27	1.13
ii	Cost B <sub>2</sub>	1.19	1.25	1.11	1.02	0.87	0.79
iii	Cost C <sub>2</sub>	1.08	1.10	1.02	0.85	0.77	0.73
iv	Cost C <sub>3</sub>	0.98	1.01	0.93	0.77	0.70	0.66

#### 4.4.6 Farm efficiency measures

In order to analyse the efficiency of pulses production under both types of farms the various farm efficiency measures such as gross farm income, net farm income, farm family labour income, farm business income and farm investment income have been worked out and are presented in Table 4.34. This table indicates that the gross farm income per hectare was found to be Rs. 54860, Rs. 52400 and Rs. 44900 for blackgram, chickpea and lentil on FLD farms and Rs. 31720, Rs. 25400 and Rs. 23500 on Non-FLD farms. The net farm income per hectare was found to be positive for all pulses and recorded to be Rs. 4402, Rs. 5022 and Rs. 1267 for blackgram, chickpea and lentil, respectively. On FLD farms, however, on Non-FLD farm it was turned out to be negative and estimated to be for Rs. (-) 5684, Rs. (-) 7567 and Rs. (-) 8863 for blackgram, chickpea and lentil, respectively. Farm family labour income on per ha basis was found to be positive and slightly high in case of FLD farms as compared to the Non-FLD farms where except blackgram, it was on the negative side for chickpea and lentil. This shows that more availability and utilisation of family labour by the FLD farmers than these of Non-FLD farmers. The other income measures such as farm business income and farm investment income was turned out to be positive and higher for all pulse crops in FLD farms as compared to Non-FLD farms.

**Table 4.34: Measures of farm business returns from pulses**

		(Rs./ha)					
Sr.No.	Particulars	FLD farmers			Non-FLD farmers		
		Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil
1	Gross farm income	54860	52400	44900	31720	25400	23500
2	Net farm income	4402	5022	1267	-5684	-7567	-8863
3	Farm family labour income	9052	10647	4767	816	-3567	-6113
4	Farm business income	18894	20489	14538	9736	5417	2710
5	Farm investment income	14244	14864	11038	3236	1417	-40

The farm business income per ha ranged between Rs. 14538 from lentil to Rs. 20489 per ha for chickpea. It was found to be higher by more than 2 to 5 times for all pulses in FLD farmers than Non-FLD farmers. The farm investment income also revealed similar trends across FLD farmers and Non-FLD farmers but it showed negative returns in lentil on Non-FLD farms. Therefore, it can be concluded that a wide disparity was observed in various business returns on per hectare basis as the various farm income measures were found to be fairly high in case of FLD farms.

#### **4.4.7 Break-even analysis**

Break even output is the level of output where a farmer neither faces loss nor profit. The break-even levels for pulses under both FLD and Non-FLD types of farms both in physical as well as monetary terms have been presented in Table 4.35. It can be seen from the table that total fixed cost per ha was estimated to be Rs. 10990, Rs. 11052 and Rs. 11026 for FLD farms in blackgram, chickpea and lentil and for Non-FLD farms it was recorded to be Rs. 9335, Rs. 9466 and Rs. 9137, respectively. The total variable cost per ha for blackgram, chickpea and lentil on FLD farms was found to be Rs. 45418, Rs. 40526 and Rs. 36907 and in Non-FLD farms it was Rs. 30069 for blackgram, Rs. 23849 for chickpea and Rs. 22606 for lentil. The price received per quintal for pulses were recorded to be ranging between Rs. 10000 to Rs. 13000. The output realized per ha for FLD farms was 4.22 q, 5.24 q and 4.49 q for blackgram, chickpea and lentil and for Non-FLD farms it is 2.44 q, 2.54 q and 2.35 q. The break-even analysis shows in physical terms revealed that farms would be at no profit no loss situation if they produce at least 4.91 q of blackgram, 4.88 q of chickpea and 6.18 q of lentil on FLD farms, and 13.78 q, 15.49 q and 10.02 q of blackgram, chickpea and lentil in Non-FLD farms, respectively.

**Table 4.35: Break-even output of pulses on sample farms**

Sr.No.	Particulars	Units	FLD farmers			Non-FLD farmers		
			Blackgram	Chickpea	Lentil	Blackgram	Chickpea	Lentil
1	Total fixed cost	Rs./ha	10990	11052	11026	9335	9466	9137
2	Total variable cost	Rs./ha	45418	40526	36907	30069	23849	22606
3	Average variable cost	Rs./q	10763	7734	8220	12323	9389	9089
4	Price realization	Rs./q	13000	10000	10000	13000	10000	10000
5	Output realized	q/ha	4.22	5.24	4.49	2.44	2.54	2.35
6	Break-even output	q/ha	4.91	4.88	6.19	13.78	15.49	10.02

#### 4.4.8 Factors affecting production of pulses

To examine the factors affecting the production of pulses, regression analysis was carried out for both FLD and Non-FLD types of farms with the help of linear and log linear functions. However, statistically linear form was found to be the best fit and appropriately on the basis of economic and statistically criterion and was used to study the effect of explanatory variables such as farmers experience in pulses production, area under crop, education of the respondents and total human labour employed in production of different pulses production of blackgram, chickpea and lentil in the study area. The details of regression analysis for FLD and Non-FLD farmers are presented in Table 4.36 and Table 4.37. It can be seen from the table that experience of farmers ( $X_1$ ), area under crop ( $X_2$ ) and human labour ( $X_4$ ) had positive significant effect on production of blackgram, the coefficient education ( $X_3$ ) also turned out to be significant but had negative effect on production of blackgram. This indicates that there was scope for increasing the production as well as profit from blackgram with the increased use of human labour, area under crop and gaining more experience in the pulses production. In case of chickpea crop also the experience ( $X_1$ ), education ( $X_3$ ) and human labour ( $X_4$ ) exhibited positive significant effect on its production. The area under crop ( $X_2$ ) was turned out to be non-significant in chickpea. The table further

shows that in case of lentil, the area under crop ( $X_2$ ) and education ( $X_3$ ) had positive significant effect on its production, however human labour ( $X_4$ ) employed exhibited negative significant effect on production of lentil, this shows that there was over utilization of human labour in the crop, therefore, it can be concluded that the production of lentil could be increased by putting more area under this crop and employment of surplus labour in other pulse crops. The factors included in the analysis were found to most important as they explained as high as 80 to 83 per cent variation in production of pulses in FLD farmers.

**Table 4.36: Estimated regression coefficients of factors influencing pulses production FLD farms**

Sr.No.	Particulars	Regression coefficients	Blackgram	Chickpea	Lentil
1	Intercept	$b_0$	0.6463	0.4218	0.2209
2	Experience ( $X_1$ )	$b_1$	0.0042*	0.0147**	0.056
			(0.0020)	(0.0073)	(0.0317)
3	Area ( $X_2$ )	$b_2$	0.0010*	0.0012	0.0071*
			(0.0005)	(0.0064)	(0.0034)
4	Education ( $X_3$ )	$b_3$	-0.0041**	0.0035**	0.0567*
			(0.0020)	(0.0015)	(0.0259)
5	Human labour ( $X_4$ )	$b_4$	0.1690*	0.0186*	-0.0130**
			(0.0836)	(0.0089)	(0.006)
	Coefficient of multiple determination	$R^2$	0.8114	0.8330	0.8030
	F value		12.1056	13.1012	9.5421

Note: Figures in parentheses indicate standard errors

\*Significant at 5% level of significance

\*\*Significant at 1% level of significance

In case of Non-FLD farmers, the production function explained about 57 to 79 per cent of variation in production of pulses (Table 4.37). On an average Non-FLD farm, the area under crop ( $X_2$ ) and the use of human labour ( $X_4$ ) significantly affected the production of blackgram and chickpea whereas in case of lentil only the factor human labour ( $X_4$ ) was turned out to be significantly affecting production. The area under crop

exhibited significant positive effect on production of blackgram but it exhibited negative significant effect on the production of chickpea. Similarly, the application of human labour in the production of blackgram was observed to over employment as it exhibited negative significant effect on production of blackgram whereas, in case of chickpea it extended positive significant effect. This indicates that production of chickpea could be increased with the more use of human labour. The table further shows that human labour exhibited negative significant effect on production of lentil. This indicates that there was over utilization of human labour ( $X_4$ ) by Non-FLD farmers in the production of lentil and its use must be diverted to other competing crops. So it can be concluded that there is scope to increase the production and profit from pulses by rationalizing the use of human labour and area under pulse crop.

**Table 4.37: Estimated regression coefficient of factors influencing pulses production Non-FLD farms**

Sr.No.	Particulars	Regression coefficients	Blackgram	Chickpea	Lentil
1	Intercept	$b_0$	0.5885	-0.0078	2.3678
2	Experience ( $X_1$ )	$b_1$	0.0008	0.0034	-0.0087
			(0.0061)	(0.0030)	(0.0091)
3	Area ( $X_2$ )	$b_2$	0.0183**	-0.0010*	0.0041
			(0.0091)	(0.0004)	(0.0049)
4	Education ( $X_3$ )	$b_3$	-0.0002	-0.0003	0.0004
			(0.0007)	(0.0014)	(0.0012)
5	Human labour ( $X_4$ )	$b_4$	-0.0723**	0.1172**	-0.4845**
			(0.0342)	(0.0535)	(0.2373)
	Coefficient of multiple determination	$R^2$	0.7919	0.6290	0.5718
	F value		9.3567	11.0178	10.0456

Note: Figures in parentheses indicate standard errors

\*Significant at 5% level of significance

\*\*Significant at 1% level of significance

#### 4.5 Problems in production of pulses

The farmers of the study area faced a number of problems in production of pulses. During survey of study area, both FLD and Non-FLD farmers reported various types of problems in the production, storage and other related aspects of production of pulses and the same have been presented in Table 4.38. The table highlights that among the production problems, the major problem reported by FLD farmers relates to the adverse effect of unfavourable/ changing climate on the production and productivity of these crops. This problem was opined by 66 per cent of FLD farmers. The other serious problems in production as reported by FLD farmers of the study area was that of the severe problem of disease (Blight) and insect pest (Pod borer) which were faced by 70 per cent of farmers. In case of Non-FLD farmers, the major production problems opined by majority of farmers were adverse effect of changing climate (76%), incidence of disease (Blight) and insect pest attack (Pod borer) (77%), lack of knowledge about their control measures (60%) and unavailability of seeds of improved varieties (54%). The FLD farmers also faced the problem such as lack of knowledge about the fertilizer usage (22%), disease and insect pest attack and lack of knowledge about their control measures (30%).

In storage problems, the main problem was that of the lack of technology and training to create local storage structures and lack of modern storage facilities. The other main problems opined by both types of farmers were the institutional and social problems such as inadequate training facilitates in the field of production aspects of pulses and the losing interest of the members of family in farming with the changing of time. Similar results were found by Arneja et al. (2009), Deka et al. (2013) and Jadav et al. (2011). The table further shows that the proportion of farmers facing the problems was comparatively higher on Non-FLD farms as compared to FLD farms.

In order to test whether there was any significance difference among both types of farms, with respect to facing and reporting of the problems in production of pulses  $\chi^2$  test was applied. The  $\chi^2$  value of the applied  $\chi^2$  test turned out to be 18.67 which was more than the tabulated  $\chi^2$  value (4.07) at one per cent level of probability. Therefore, it was concluded that the FLD and Non-FLD farms differed significantly among themselves in facing and reporting

of problems on production, storage and other related aspects of pulse crops. The problems faced by both types of farms were of different nature.

**Table 4.38: Problems faced by the pulse growers**

(Per cent multiple response)

Sr.No.	Particulars	FLD farmers	Non-FLD farmers
1	<b>Production problems</b>		
i	Unavailability of improved varieties	8	54
ii	Effect of unfavourable climatic conditions on the crop production	66	76
iii	Disease and insect problems	70	77
iv	Lack of knowledge of pest and diseases control	30	60
v	Lack of knowledge about recommended doses of pesticides and fertilizers	22	24
2	<b>Storage problems</b>		
i	Lack of storage facilities	20	32
ii	Lack of technology and training to create local storage structures	14	46
3	<b>Social and institutional problems</b>		
i	Inadequate training of farmers	16	72
ii	Lack of knowledge in package of practices	22	48
iii	Lack of interest of family members in farming	44	60
iv	Lack of knowledge about improved agricultural technologies time to time	22	48
v	Lack of coordination between farmers	14	26
4	<b>Other problems</b>		
i	Non remunerative price	20	84
ii	Expensive price of chemicals, fertilizers, pesticides and weedicides in market	14	72
iii	Lack of finance to purchase inputs	16	84

Calculated value of chi square is 18.67, tabulated value of chi square at 14 d.f at 1% level of probability is 4.07



**Plate 4.1 Demonstration of chickpea variety (HPG-17)**

## 5. SUMMARY AND CONCLUSIONS

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### 5.1 Introduction

Pulses are important crops that provide high quality protein complementing cereal proteins for predominantly vegetarian population of the country. Pulses are the most important part of our diet, richest and cheap source of proteins, vitamins, minerals and amino acids besides high nutritional value. These are unique leguminous crops in respect of maintaining and restoring soil fertility through biological nitrogen fixation. Therefore, inclusion of pulses in the cropping system improves the performance of inter-crop or crop grown in succession. Hence, the economic value of these crops is very high. Pulses can be produced with a minimum use of resources and are mostly cultivated under rainfed conditions (and do not require intensive irrigation). In Himachal Pradesh, pulses are grown on an area of 31.38 thousands hectare with an annual production of thousand 63.34 MT (Anonymous 2016-17). The important pulses grown in the state include gram, moong, urd, lentil, rajmash, moth, pea, cowpea, horsegram and lathyrus. These crops have not received much attention by researchers and policy makers in the past. However, the farmers in the state are getting high income from pulse production by following modern techniques and recommended package of practices. The Krishi Vigyan Kendra of CSK HPKV, located at Berthin in Bilaspur district has a mandate of promoting pulses. As a result, the farmers' efforts to produce different pulse crops are increasing leading to higher production and income. There has been no systematic study on economics of pulses production so far and thus, keeping in view the above mentioned facts, the present study was undertaken in Bilaspur district of Himachal Pradesh with the following specific objectives:

1. To study the role of KVK, Bilaspur at Berthin on promotion programme of pulses in the study area
2. To examine the impact of Frontline Demonstrations on production and work out economics of pulses in the study area.

## 5.2 Methodology

The present study was conducted in Bilaspur district of Himachal Pradesh. This district was purposively selected for the study as it is among the pulse growing districts of the state and endowed with congenial agroclimatic conditions for pulses production. Simple random sampling technique was employed for the selection of farmers covered under FLDs. A list of farmers having FLDs on pulse was obtained from the Krishi Vigyan Kendra, Bilaspur at Berthin. From the list so acquired a random sample of 50 farmers was drawn. To assess the impact of FLDs on pulses production, a sample of 25 Non- FLD farmers was also drawn from the same villages covered under sample under FLDs farmers, thus making a total sample of 75 farmers. The sample farmers thus fall into two categories namely, FLD and Non-FLD farmers. Both primary and secondary data were used to meet out the objectives of the study. The primary data were collected through survey method from sample farmers while the secondary data pertaining to the area, production and productivity of pulses were gathered from Statistical Year Book of Himachal Pradesh, 2018-19. The data pertained to the agricultural year 2018-19. Both tabular and statistical analysis was done for the study. Regression analysis was used to find out the factors affecting production of pulses on FLD and Non-FLD farmers.

## 5.3 Major findings

1. The transfer of improved farm technology under frontline demonstrations (FLDs) in pulses resulted in invariably higher grain yield of pulses under demonstration plots than farmers plot yield, which may be attributed to the adoption of recommended agro-technologies in FLDs.
2. Frontline demonstration on pulses was conducted in different villages of district Bilaspur. In 2015-16 and 2016-17 the maximum yield of 9.20 q/ha and 11.90 q/ha, was recorded in chickpea (GPF-2) whereas in 2014-15 stagnant yield of 6.10 q/ha was recorded under all varieties of pulses (blackgram and chickpea).
3. The maximum per cent increase in yield over check was recorded to be 51.10 and 49.20 per cent under Chickpea (HPG-17) in 2014-15 and 2015-16, respectively. On the other hand, in 2016-17 the maximum per cent increase of 48.10 per cent in yield over check was recorded in Himachal Chana-2.

4. The gap between the recommended practices in frontline demonstration and farmers' practices of blackgram and chickpea revealed that farmers generally did not use recommended technologies. There was a wide gap in use of improved varieties seed in both the crops due to its non availability. Farmers did not practice seed treatment with *rhizobium* culture, an important component in increasing the yield and yield attributes of pulse crops.
5. The study revealed that beneficiaries of KVK training programmes on pulses gained latest and more knowledge about improved package of practices, and it showed a higher level of adoption at speedy rate.
6. The average family size was 4.80 persons in case of FLD farmers. In case Non-FLD farmers the average family size was found out to be 4.56 persons. The prevalence of joint family system was noticed more in FLD farmers than in Non-FLD farmers.
7. The majority of the heads of the families in FLD (48%) and Non-FLD farms (64%) were in the age group of 40-60 years followed by the age group of above 60 years (28 to 38%). The heads of the family in the young age group of 25-40 years only accounted for 8 to 14 per cent in Non-FLD to FLD farms. None of the head of family belonged to female gender in both types of farms.
8. The working population (16-60 years) constituted about 67 per cent of the total population. The proportion of females was higher than males in the working population. It ranged between 68 per cent in FLD farmers to 70 per cent in Non-FLD farmers. The sex-ratio was higher in Non-FLD farmers (1111) than the FLD farmers (951).
9. The literacy rate of the head of the families was quite high ranging from 92 (FLD farmers) to 96 per cent (Non-FLD farmers). Majority of heads of the families in both type of farms were educated up to high school (34% to 36%) followed by senior secondary (24% and 32%).
10. The percentage of females family members having education above senior secondary level was observed to half than that of males family members. The overall literacy rate of males was significantly higher than that of females in both type of farms. The overall literacy rate of sample farms was quite good and stood at about 81 per cent in Non-FLD farmers to 88 per cent in FLD farmers.

11. The majority of heads of FLD (42%) and Non-FLD (56%) families had government service as their main occupation followed by agriculture sector in which 34 and 24 per cent of heads of FLD families and Non-FLD families were engaged. Agriculture was found to be the subsidiary occupation for 43 and 50 per cent of the heads in FLD and Non-FLD families.
12. The investment on residential houses by both the FLD families and Non-FLD families accounted for nearly 92 to 93 per cent of total investment of residential and farm buildings. The annual expenditure on repair and maintenance for residential and farm buildings was estimated at Rs. 13240 in FLD and to Rs. 15540 in Non-FLD families.
13. The average size of livestock unit was 2.28 units in FLD farmers as against 1.60 units in Non-FLD farmers. The total average value of livestock unit per farm for FLD and Non-FLD farmer was estimated at Rs. 45650 and Rs. 27080 in which the major share was of buffalo (41 % and 45 %) followed by improved cows.
14. On an average there were three units of major farm equipments and machinery on both types of farms whereas the number of minor implements recorded to be 15 and 17 on FLD and Non-FLD farms. The average total investment on implements/machinery was estimated to be Rs. 70636 on FLD farms and Rs. 32279 on Non-FLD farms, respectively, and it was more than 2 times higher on FLD farms.
15. The average size of holdings of the FLD and Non-FLD farms was recorded to be 1.4128 and 0.9632 ha, respectively out of the total land area. The proportion of area put under cultivation of crops by FLD and Non-FLD farmers was found to be about 75 and 53 per cent of total land holding.
16. In *kharif* season pulses were the most important crops and occupied the maximum proportion (19.32%) of the total cropped area followed by maize (17.00%) and vegetables crops (4.64%). Under pulses blackgram was the only pulse crop grown by the sample farmers. Whereas, in case of Non-FLD farmers maize was the most important crops that occupied the maximum proportion (19.10%) followed by vegetables (13.19%) and pulses (12.85%). In *rabi* season, also the pulses emerged out the leading crops, occupying more than 36 per cent of total cropped area on FLD farms.

17. The cropping intensity, which signifies the extent of crop intensification on the farm, came out to be 195.76 per cent on FLD farms and 182.53 per cent in case of Non-FLD farms.
18. The contribution of farm income was comparatively low (45 %) than the Non-farm income (54 %) on sample FLD farms whereas, in case of Non-FLD farms, farm income and on-farm income contributed about 30 and 70 per cent to total income. The pulse crops contributed 20 per cent to total income of FLD farmers as against only 5 per cent in Non-FLD farmers than Non-farm income (70 %).
19. The productivity of pulses on FLD farms was recorded to be 4.22 q/ha, 5.24 q/ha and 4.49 q/ha for blackgram, chickpea and lentil, respectively. The productivity of all the crops in case of Non-FLD farmers was found to be lower than the productivity of these crops on FLD farms and it was recorded to be in the range of 2 to 3 q/ha.
20. The total human labour required for performing various farm operations for pulses in case of FLD farmers were found to be about 122, 97 and 86 mandays/ha for blackgram, chickpea and lentil. In Non-FLD farmers the number of mandays/ ha were recorded to be 79, 66 and 70.
21. The highest labour usage was found to be on weeding and intercultural operations followed by harvesting and field preparation among blackgram, chickpea and lentil. Whereas in case of Non-FLD farms maximum human labour mandays were employed in harvesting followed by weeding and intercultural operations and field preparation.
22. The technological gaps with respect to all the cultural practices were lower on FLD farms, as the FLD farmers were having the deep practical knowledge regarding latest cultural and management practices of pulses production and were found to be comparatively more cautious regarding the raising crops in their farms.
23. The total cost of cultivation of blackgram, chickpea and lentil was estimated to be Rs. 56458, Rs. 51578 and Rs. 47933 per ha, respectively, on FLD farmers and it varied from Rs. 34363 to Rs. 39404 per ha for all pulses in Non-FLD farmers.

24. In case of FLD farmers, the maximum net farm income of Rs. 5022 was recorded in Chickpea whereas minimum (Rs 1267) in blackgram. Whereas, in case of Non-FLD farmers negative net farm income was recorded in all pulses.
25. The break down analysis revealed that FLD farmers would be at no profit no loss situation if they produce at least 4.91 q of blackgram, 4.88 q of chickpea and 6.18 q of lentil on their farms, whereas in case of Non-FLD farmers 13.78 q, 15.49 q and 10.02 q of blackgram, chickpea and lentil, respectively, were their break even points.
26. The influence of experience, area, education and human labour on production was found to be significant for FLD farmers whereas, in case of Non-FLD farmers only influence of area and human labour was found to be significant.
27. The factors included in the analysis were found to most important as they explained as high as 80 to 83 per cent variation in production of pulses in FLD farmers and in case of Non-FLD farmers they explained 57 to 79 per cent of variation in blackgram, chickpea and lentil, respectively.
28. The pertinent problems faced by the farmers in the study area were the adverse effect of unfavourable climatic conditions on the crop production, incidence of disease and insect pests, etc. on the crops. More number of problems were faced by Non-FLD farmers as compared to FLD farmers as revealed by the  $\chi^2$  test.

#### **5.4 Suggestions**

1. The findings of the study reveals that pulses contributed significantly more than 20 per cent towards the income of the farmer covered under FLD programme. Therefore, it is required that more number of FLDs on pulses must be laid down in the areas having potential of pulse production.
2. There is an urgent need of narrowing down the technological gaps in pulses production in seed rate, method of sowing and plant protection measures in pulse production by bringing more number of farmers under the ambient trainings under required pulse production technologies.
3. More area under production of pulse must be brought by providing incentives to the farmers such as improved seeds and other extension advisory services on weed/pest control and nutrient management.

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## APPENDICES

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### Appendix I

#### SAMPLE HOUSEHOLD SURVEY SCHEDULE

#### I. General Information about Respondent

Name of Respondent		
Address		
Age (years)		
Education		
Village		
Block		
Contact No. (Mobile)		
Size of family (No.)	Male	
	Female	
Type of family (Joint/Nucleus)		
Occupation		
I. Main  II. Subsidiary		
Type of Holding (Marginal/Small/Large)		

Date of survey \_\_\_\_\_

Signature of student \_\_\_\_\_

Signature of advisor \_\_\_\_\_

**II. Family Features**

Sr. No	Relation with the head of the family	Age (years)	Sex (M/F)	Education I/P/M/H/S/D/G/PG
1				
2				
3				
4				
5				

Where, I- Illiterate, P-Primary, M- Middle, H- high, S- Senior secondary, D- Diploma, G- Graduation and PG- Post Graduation

**III. Occupational pattern of family members**

Sr. No	Occupation	Main			Subsidiary		
		No. of family members	Time devotion per annum (%)	Annual income (Rs.)	No. of family members	Time devotion per annum (%)	Annual income (Rs.)
1	Agriculture						
2	Business / trade						
3	Rural Artisan						
4	Govt. Service						
5	Labourer						
6	Other (Specify)						

**IV. Inventory and Land Utilization**

Sr. No.	Particulars	Area (Bigha/kanal)			Source of irrigation
		Irrigated	Unirrigated	Total	
1.	Owned land				
2.	Leased-in land				
3.	Leased-out land				
4.	Total holding (1+2+3)				
<b>Land Utilization</b>					
1.	Cultivated land				
2.	Orchard land				
3.	Fallow land				
4.	Cultivable wasteland				



**B) Farm implements machinery and other assets**

Major farm machinery	Number	Year of purchase	Present Value (Rs)	Annual Repairs (Rs)	Remarks
i. Tractor					
ii. Power tiller					
iii. Chaff-cutter					
iv. Thresher/harvester					
v. Sprayer/Duster					
vi. Water pump					
vii. Seed drill					
viii. Harrow					
ix. Diesel engine					
x. Electric pump					
xi. Any other					
<b>Minor Implements</b>					
i. Plough					
Wooden					
Iron					
ii. Spade					
iii. Hoe					
iv. Rake					
v. Sickle					
Small					
Large					



	SEASON								
1	Cereal crops								
	Maize								
	Paddy								
2	Pulses								
	Mash								
3	Fodder								
4	Vegetables								
	RABI SEASON								
1	Cereal crops								
	Wheat								
	Barley								
2	Pulses								
	Gram								
	Lentil								
4	Fodder								
5	Vegetables								

IR: Irrigated, UIR: Un-irrigated

#### IX. Other Enterprises on farm

Particulars	Scale/Size /Area	Production	Marketed Surplus			Remarks
			Quantity	Price	Value(Rs)	
Mushroom						
Bee keeping						
Sericulture						
Floriculture						
Any Other						

**X. Input use pattern**

S.N.	Season/Crop	Area (kanal)	Field preparation				Seed (kg)	Treatment of planting material	FYM (qtls)	VC (qt/kg)	Fertilizers				Sowing/Transplanting	
			Bullock (BPL)	Tractor	FL (M/F/C)	HL (M/F/C)					Urea (kg)	IFFCO Mixture (kg)	DAP (kg)	Any other	FL (M/F/C)	HL (M/F/C)

S.N.	Season/Crop	Irrigation Days/NO		Intercultural operations (Days)		Harvesting (Days)		Assembling and Transportation				Plant protection (qty)		
		HL(M/F/C)	FL (M/F/C)	HL(M/F/C)	FL (M/F/C)	HL(M/F/C)	FL (M/F/C)	HL(M/F/C)	FL (M/F/C)	HL(M/F/C)	Tr.H	Herbicides	fungicides	Insecticides

FL: Farm labour, HL: Hired labour, M: Male, F: Female, C: Children, Tr.h: Transportation hours, VC:Vermicompost

**XI. Problems faced by the pulse growers**

Sr.no	Constraints	Yes	No
	<b>Crop production problems</b>		
1	Unavailability of improved varieties		
2	Effect of unfavorable climatic conditions on the crop production		
3	Insufficient knowledge about fertilizer usage		
4	Insufficient knowledge of pest and diseases		
5	Improper knowledge about recommended doses of pesticides and fertilizers		
6	Disease and insect pests		
	<b>Other problems</b>		
1	Non remunerative price		
2	More expensive price of chemicals, fertilizers, pesticides and weedicides in market		
3	Lack of transportation facilities		
4	Wider distance of krishiupaj mandis and incorrect and lower prices of pulses		
5	Lack of finance to purchase inputs		
	<b>Storage problems</b>		
1	Lack of storage facilities		
2	Lack of technology and training to create local storage structures		
3	Lack of proper care of agricultural products in ware houses		
	<b>Social and psychological problems</b>		
1	Inadequate training of farmers		
2	Lack of motivation		
3	Lack of active local leaders		
4	Lack of knowledge about improved agricultural technologies time to time		
5	Lack of coordination between farmers		

**Appendix –II****Price list**

Sr. No.	Particulars	Average price (Rs.)
1	Average price of blackgram (Rs./q)	13000
2	Average price of chickpea (Rs./q)	10000
3	Average price of lentil (Rs./q)	10000
4	Price of FYM (Rs./q)	80
5	Price of IIFCO (Rs./kg)	21
6	Price of human labour on an average farm (Rs./man days)	250
7	Price of tractor charges (Rs./hr)	350

## Brief Bio-data of Student

Name : Shalvi Thakur  
 Mother's Name : Smt. Raksha Thakur  
 Father's Name : Sh. Pawan Kumar  
 Date of Birth : 21.06.1995  
 Permanent Address with Contact Number : H.No.149, Chamboh Block No.42, V.P.O Chamboh, Tehsil Bhoranj Distt Hamirpur-177601  
 Contact no.- 8894294529



Academic Qualification: (starting with 10<sup>th</sup> class)

Qualification	Year	School/Board/University	Marks (%)	Division	Major Subject
10 <sup>th</sup>	2011	CBSE	86.00	1 <sup>st</sup>	Maths, Science, English, Social Science, Hindi, I.T
10+2	2013	CBSE	79.00	1 <sup>st</sup>	Biology, Physics, Chemistry, English
B.Sc. (Agriculture)	2017	CSKHPKV, Palampur	74.60	1 <sup>st</sup>	All subjects of Agriculture
M.Sc. (Ag.) Economics	2019	CSKHPKV, Palampur	72.50	1 <sup>st</sup>	Agricultural Economics and Statistics
Fellowships/ Scholarships/ Gold Medals/ Awards/ any Other Distinction:		Financial assistance at the rate of Rs 750 per month for two years from CSKHPKV, Palampur, H.P., India			
Publications		Nil			
Research Paper		Nil			
Published abstract		Nil			
Others		Nil			