DIVERSIFICATION OF THE EXISTING FARMING SYSTEMS UNDER MARGINAL HOUSEHOLD CONDITIONS IN KANGRA DISTRICT OF HIMACHAL PRADESH

THESIS

By

MEENAKSHI
(A-2015-40-007)

Submitted to

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CERTIFICATE – I

This is to certify that the thesis entitled, **"Diversification of the existing farming systems under marginal household conditions in Kangra district of Himachal Pradesh"** submitted in partial fulfillment of the requirements for the award of the degree of **Doctor of Philosophy (Agriculture)** in the discipline of **Agronomy** of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur is a bonafide research work carried out by **Meenakshi** D/o Smt. Anjna Kumari and Shri Pradeep 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 : September, 2018

(Dr. Pawan Pathania)
Major Advisor

CERTIFICATE- II

This is to certify that the thesis entitled **"Diversification of the existing farming systems under marginal household conditions in Kangra district of Himachal Pradesh"** submitted by **Meenakshi (Admission No. A-2015-40-007)** D/o Shri Pradeep Kumar Saini to the CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur in partial fulfillment of the requirements for the degree of **Doctor of Philosophy (Agriculture)** in the discipline of **Agronomy** has been approved by the Advisory Committee after an oral examination of the student in collaboration with an External Examiner.

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Needless to mention, errors and omissions are mine.

Place: Palampur

Date: September, 2018 ***(Meenakshi)***

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LIST OF ABBREVIATIONS USED

Abbreviation	Meaning	Abbreviation	Meaning
%	Percent	SSP	Single super phosphate
&	And	*viz.*	Namely
*	Asterisk	N	Nitrogen
Fig.	Figure	P	Phosphorus
kg	Kilogram	K	Potassium
MT	Metric ton	q	Quintal
ha	Hectare	etc.	Et cetera
i.e.	id est (that is)	lt.	Liter
et al.	Et alii (and other)	MOP	Muriate of Potash
m	Metre	q/ha	Quintal per hectare
FYM	Farmyard manure	No.	Number
Kg/ha	Kilogram per hectare	BPD	Bullock Pair Days
t/ha	Tonnes per hectare	IFFCO	Indian Farmers Fertiliser Cooperative
RDF	Recommended dose of fertilizers	Sq. km	Square kilometre

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ABSTRACT

The farmer has to be assured of a regular income for a reasonable standard of living by including other enterprises and efficient management of on- and off-farm resources. Himachal Pradesh has limited scope of the extension of cultivated area, because of its topographic features; the only scope for the agriculture growth is increasing productivity of high cash crops and spread the pace of diversification with different agro climatic condition in the state. The present study was conducted in Kangra district of Himachal Pradesh to characterize and diversify the farming systems. For characterization of farming systems, data were collected from 120 farmers selected randomly from 12 villages of four blocks namely, Baijnath, Kangra, Nagrota Bagwan and Nurpur. On enterprises based characterization, four types of farms were identified. These were crops+ livestock, crops+livestock+vegetables, crops+vegetables+bee keeping and vegetables+livestock. The large portion of farmers (marginal farmers) followed crops+livestock+vegetables farming system (65.83%) followed by crops+livestock (28.33%). Crops+livestock+beekeeing and vegetables+livestock farming systems were also adopted by the negligible percentage (0.83%) of the farm households. On an average, farmers of different categories (Marginal, small, medium and large) generally used higher seed rates of maize (27.57 kg/ha), wheat (111.11 kg/ha) and paddy (38.18 kg/ha) than the recommended one i.e. 20, 100 and 25 kg/ha, respectively and the average use of NPK in the form of urea and IFFCO was much lower than the recommended dose for all the crops. Twenty four on-farm trials were undertaken to harness the fruits of diversification during 2014-15 and 2015-16. The households were identified based on the benchmark survey already undertaken during 2012-13 under the aegis of On-farm Farming System Research Programme of AICRP-IFS. The benchmark survey results revealed that a net income under field crops alone, Field crops+dairy and crops+dairy+goat/sheep was ₹ 9230, ₹ 22465 and ₹ 20147/household, respectively. After two years of intervention, the income/household increased to ₹ 18696, ₹ 27175 and ₹ 28964, respectively. The intervention cost on field crops (Complete package of practices and vegetable seedlings), field crops + dairy (Package of practices, vegetable seedlings, mineral mixture supplementation and grading sieve) and field crops + dairy + goat/sheep (Package of practices, vegetable seedlings, mineral mixture supplementation and grading sieve) during the first year of study was ₹ 3281, 3599 and 3605/household, respectively. During the second year the corresponding intervention cost was ₹ 3212, 3465 and 4153/household, respectively. The study results inferred that the interventions at each aspect of crop and animal diversification increased the income of all the households. The sustainable diversified farming systems were seen highly profitable and the appropriate diversification of components increased the production per unit area and overall income of the farm.

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1. INTRODUCTION

Farming system represents an appropriate combination of farm enterprises (cropping systems, horticulture, livestock, fishery, forestry, poultry etc.) and the means available to the farmer to raise them for profitability. It interacts adequately with environment without dislocating the ecological and socioeconomic balance on one hand and attempts to meet the national goals on the other (Jayanthi et al. 2002). The farming system specially refers to a crop combination or enterprise mix in which the products/by products of one enterprise serve as the input for the production of other enterprises (Maji 1991). Farming system provides increased productivity per unit land, better utilization of resources, recycling of farm wastes, sustainability, higher income and employment generation and reduction of risk. The farmer has to be assured of a regular income for a reasonable standard of living by including other enterprises and by efficient management of inputs available on the farm to increase the average income. A more diversified occupational structure can add value to labour, time and provide a stronger employment and income support. Simultaneously, it has a strategic role in promoting not only crop diversification but also local skill formation. Hence, it becomes imperative to evolve suitable farming system option for achieving sustainable income and employment generation on the small and marginal land holdings (Toor et al. 2009).

1.1 Importance of diversification

In relation to agricultural development, "diversification" is probably one of the most frequently used terms in the recent decade. Traditionally, diversification has been used more in the context of subsistence farming, wherein farmers grew different crops on their farm to sustain their livelihood. The household level food security and pertaining risk were important considerations in diversification. Farmers, especially marginal farmers used to opt for crop diversification under compulsion and not due to market dynamism. In the recent decade, diversification is increasingly being used to describe increase in area under high value crops (Jha, 2009). So, agricultural diversification is used as a strategy to reduce risks associated with traditional

agriculture and improve returns to investment in subsistence turned commercial agriculture. Diversification with intensive use of inputs has the potential to increase profit with greater market orientation of products. The technology (quality seeds, fertilizers, mechanics etc.), market information and higher level of farm management through intensive crop specific farmer training are some of the critical inputs to success of diversification interventions.

Diversification of agriculture is an innovative approach though widely advocated as a means for agricultural and rural development. Different scholars have interpreted diversification differently. To some it means shifting from subsistence farming to commercial farming while to others it means shifting from low-value food/non-food crops to high-value food/non-food crops or switching over from local to high-yield varieties, or shift from agriculture to animal husbandry, poultry, agro forestry, fisheries, horticulture etc. or vertical diversification i.e. shift to non-farm activities. In fact, diversification is traditionally viewed as a risk management strategy.

The diversification of agriculture both by introducing new crops and also of the income sources by introducing non-agricultural enterprises can be instrumental in improving upon the income, consumption and ultimately the living standard of the rural households (Mahajan, 2009). Diversification of agriculture can be adopted as a strategy for minimizing risk of crop failure where the immediate goal is not to make profits but stabilize income for survival.

Diversification and commercialization of agriculture have been largely considered as means to improve the rural economy by creating employment and to meet the food, fiber and timber needs of the expanding population. In order to formulate an appropriate policy for diversification of agriculture, knowledge of the extent and pattern of diversification along with factors affecting it such as farm size, resource use efficiency, marketed surpluses, etc., is necessary. Major factors that determine the extent of diversification are: agro-climatic conditions and land suitability; infrastructure including markets, institutional support, technology and policy environment and labour market structure. Finally, it is the profitability that decides diversification. Diversification achieves stability of income because even if

the return from one crop is low, the return from the other will be high and thus compensate the loss from the first. This is particularly important for marginal and small farmers who strive to make their farm viable.

1.2 Rationale of the study

Rice-wheat and maize-wheat are the important cropping systems of Himachal Pradesh. These systems have sustained for years and bring together conflicting and complementary practices but now the productivity of both the systems have stagnated and factor productivity is declining year after year. In Himachal Pradesh, these systems cover more than 80 and 230 thousand hectares, respectively. The farmers realize much of their food security from these cropping systems and the low production level needs immediate attention for the efforts to be geared in strengthening these cropping systems. The increased dependence on one or two major cereal crops (wheat, rice, etc.) witnessed after the green revolution makes the farming economy vulnerable to price fluctuation arising due to demand-supply or export-import equations especially after the WTO (World Trade Organization) began influencing markets (Rana et al. 2015).

The Himachal Pradesh has limited scope of the extension of cultivated area, because of their topographic feature; the only scope for the agriculture growth is increasing productivity of high cash crops and spread the pace of diversification with different agro climatic condition in the state (Krishan 2014). Crop diversification can better tolerate the ups and downs in the market value of farm products and may ensure economic stability for farming families. The adverse effects of aberrant weather, such as erratic and scanty rainfall and drought are very common in a vast area in agricultural production of the state. Under these aberrant weather situations, dependence on one or two major cereals (rice, wheat, etc.) is always risky (Hari Om et al. 2008). Besides food security, the low production levels jeopardize farmers' economic security to a considerable extent.

To strengthen the economic security, it is imperative to intensify and diversify the existing rice-wheat and maize-wheat cropping systems. In general, farmers in some pockets are growing pulses, oilseeds, vegetables and even fruit crops to sustain their income. However, rearing one or two livestock along with crops is a common

feature in farming. Mostly farmers follow subsistence farming. However farming system approach to gear up the economic conditions of farmers besides looking into the nutritional security is the need of the hour. Therefore, it is important to diversify the existing farming system with inclusion of profitable enterprises as well as value addition of the farm produce to have better returns to the farmers. With this background, the present study was undertaken to diversify the existing farming systems under marginal household conditions in Kangra district of Himachal Pradesh with the following objectives:

- To characterize the farming systems of Kangra district and
- to diversify the existing farming systems under marginal household conditions

1.3 Organization of the study

The entire study has been systematically presented and organized in five chapters. Chapter-1 (Introduction) elaborates the concept, rationale and objectives of the study. This is followed by chapter-2 which contemplates the critical review of work done in India and abroad related to the present topic of investigation. The systematic methodology adopted for the selection of the sample, collection and analysis of data has been described in chapter-3. The results of the study and elaborate discussions on various issues with logical conclusions and inferences based on results of the study have been documented in chapter-4. Finally, the summary and conclusions that emerged from the study have been presented in chapter-5. The illustrations, tables and figures have been extensively used to elucidate the results while additional information has been given in different appendices for more clarification and understanding of interested readers.

1.4 Limitations of study:

The present study is based on the primary data obtained from memory of the farmers. The analysis is limited to the available stock of data on the various aspects of the study. The validity of the results of study is, therefore, based on the degree of reliability of primary data obtained on the basis of memory. However, an attempt has been made to have an in depth analysis of the data by adopting suitable analytical techniques to arrive at meaningful conclusions.

2. REVIEW OF LITERATURE

Review of literature is a comprehensive and systematic review of the past relevant literature, which is a pre-requisite in carrying out any research in a scientific manner. It gives the guidelines from the past researches and provides foundation to the theoretical frame work for the present investigation. The review of past literature helps the researcher to formulate and specify the desired objectives, prepare a suitable questionnaire, get an insight into the methods and procedures to analyze the data, interpret the results, compare and make deduction, alteration and suggestion whenever necessary. Diversification of existing farming systems under marginal household conditions in Kangra district of Himachal Pradesh have been reviewed in this chapter under the following heads:

2.1 Personal socio-psychological characteristics of the farmers practicing different farming systems

2.2 Diversification of farming systems

2.3 Constraints and opportunities of different farming systems/enterprises

2.1 Personal socio-psychological characteristics of the farmers practicing different farming systems

2.1.1 Age

Malathesh (2004) conducted study on an analysis of selected farming systems in eastern dry zone in Karnataka district. The results revealed that in case of crop + dairy farming system, 30 per cent of respondents were under young age group, followed by 40 per cent under middle age and 30 per cent were under old age group.

Vani (2005) conducted a study on socio-psychological and economic dimensions of farming system approach in Chitradurga district. The results indicated that farmers who adopted agriculture + dairy + poultry farming system were belonging to middle (61.54%), young (23.08%) and old age (15.38%).

The research carried out by Mangala (2008) on impact of integrated farming system on socio-economic status of BAIF beneficiary farmers revealed that

majority of the respondents practicing IFS (51.43%) belonged to middle age group, while 27.14 per cent were of old age group and 21.43 per cent were of young age group.

Chitra (2010) conducted study on knowledge and adoption of improved practices in selected farming systems of Mandya district. The results indicated that little more than 56.70 per cent of the respondent belonged to middle age group followed by 23.3 per cent to old age group and 20 per cent to young age group who were practicing both paddy+ sugarcane +dairy and ragi +dairy.

2.1.2 Education

Malathesh (2004) conducted study on an analysis of selected farming system in eastern dry zone in Karnataka district. The results revealed that in case of crop + dairy farming systems 46.6 per cent of the respondents belonged to the low level of education, 30.07 per cent to middle and 23.33 per cent were under the high level of education group.

Vani (2005) conducted study on socio-psychological and economic dimensions of farming system approach in chitradurga district and revealed that the farmers adopted agriculture + dairy + poultry were belonged to middle education (46.15%) than low (30.77%) and high (23.08%) educated farmers.

Mangala (2008) reported in her study on impact of integrated farming system on socio-economic status of BAIF beneficiary farmers that 34.30% of the IFS beneficiaries were illiterates, followed by primary school (17.86%), can read only (15.7%), can read and write (11.43%), middle school (10.7%), high school (9.3%) and PUC (0.71%) level of education.

Pottappa (2008) in his study on knowledge and adoption of potato growers in Chikkaballapur district reported that majority (56.6%) of the respondents belonged to low education category followed by 18.33 per cent with higher education category whereas, 25.0 per cent were in the medium education category.

Chitra (2010) conducted study on knowledge and adoption of improved practices in selected farming systems of Mandya district. The results indicated that 30 per cent of the respondents were educated up to high school whereas, 26.6 per cent of

respondent were illiterates. Nearly one-forth (23.4%) and 20 per cent of respondents were educated up to primary to middle school and college level, respectively in Paddy + Sugarcane + Dairy farming system.

Ugwumba (2010) conducted a study on integrated farming system and its effect on farm cash income in Awka south agricultural zone of Anambra state. The results revealed that farmers who were educated, had more years of experience and could combine many viable enterprises tend to be more efficient in production and consequently realized more income.

2.1.3 Land holding

Malathesh (2004) revealed that in case of crop + dairy farming system of production, 26.66 per cent of the respondents were under small group of land holding, followed by 40.01 per cent who had medium size of land holding and 33.33 per cent with big land holding.

Vani (2005) indicated that farmers adopted agriculture+ poultry +dairy were belonged to medium (46.15%) and big (53.85%) farmers category.

Dolli (2006) in his study on sustainability of natural resources management in watershed development project revealed that majority of respondents had large landholding (7.85 acres).

Mangala (2008) highlighted that 50.72 per cent of the BAIF beneficiaries were small, followed by marginal (25.72%), medium (22.14%) and large (1.42%).

Chitra (2010) indicated that almost an equal per cent (43.4% and 40%) of the respondent were belonged to small and marginal size of land holding category, whereas, 16.60 per cent were having large size of land holdings in farming system of paddy +sugar cane +dairy.

2.1.4 Cropping intensity

Malathesh (2004) in eastern dry zone of Karnataka district revealed in case of crop and dairy nearly 40 per cent of respondents were under high level of cropping intensity, followed by 16.66 per cent with low cropping intensity and 43.33 per cent who had medium level of cropping intensity.

Saha (2008) carried out a study on sustainability of farming systems and livelihood security among rural households in Tripura and indicated that farming system practiced by small farmers had 43.33 per cent of high level of aspiration, followed by 31.66 percent of medium level of aspiration and 25 per cent of low level participation.

2.2 Diversification of farming systems

Singh and Saini (1988) concluded that integration of improved technology of crop and milk production has markedly higher potential for increasing income and employment on all categories of farms as compared to the existing technology of crop production in isolation. The lower category of the farms would be benefited more as compared to their large counterparts. The bias of improved crop production technology in favour of large category of farms with better resource endowment would change rather revert through integration of improved crop and milk production technology in favour of marginal and small farms. The increase in income and employment position particularly on lower category of farms would help to solve the problem of disparity and bring about a growth in rural sector with equity.

Oberai and Raina (1991) examined the growth rate in yields and diversification in foodgrains. There appeared to be an increasing trend towards wheat and maize rotation while the area under paddy and pulses was on the decline. They revealed that agricultural diversification through vegetable crops has high potential for income generation in Western-Himalayan region.

Chand (1996) studied the agricultural diversification through high value crops in Himachal Pradesh in order to examine the scope for raising income and employment in various size of land holdings by diversification through all season vegetables cultivation; to examine the scope for fruit cultivation in the study area; and to analyze the impact of infrastructural, institutional and socio-economic factors on crop diversification through vegetable crops. The sample size of 298 farm households was selected from four panchayats in Solan block of Solan district. Simple tabular analysis was used to study the changes in income and employment due to diversification in agriculture. This study concluded that diversification has changed the pattern of cropping and increased the level of income and employment of the farmers.

Saraswat (1996) studied diversification of cropping pattern and farming system in Kot Village of Hamirpur district in Himachal Pradesh. The data has been collected from a sample of 221 households. The results of this study indicated that the change in the cropping pattern in the village was marginal because of the lack of irrigation facilities. The diversification in agriculture took place due to increasing trend of agricultural productivity because of technical changes and use of high yielding variety seeds, fertilizers, pesticides and improved methods of cultivation in agriculture.

Saini et al. (1998) revealed that diversification of arable farming systems with milch animals, poultry and floriculture in Himachal Pradesh played a remarkable role in enhancing income and employment on farms, having low land base and surplus human labour. However, the diversification of existing farming systems, with capital intensive commercial enterprises was not possible due to meager resources available with the small farmers. They suggested that to help the small farmers in reaping the benefits of diversified plans, the financial institutions should provide adequate credit on easy terms enabling the small farmers to get themselves out of the vicious circle of poverty and chronic problem of unemployment/under-employment of family labour on these farms in the study area in particular and hilly areas, of the country at large.

Singh (1999) studied potential, constraints and requirements of productivity improvements towards diversification of high value crops. The study indicated that farmers were practicing diversification. The scope for diversification of foodgrains with vegetable, fruits and flowers was observed to be vast both in terms of farm profitability and employment of labour. It was observed that farmers were willing to shift towards fruits and vegetables irrespective of level of cost of production but growing of foodgrain is still predominant mainly due to their orientation towards food security. The strategies suggested to encourage diversification include: protection of small and marginal farmers from yield and price risk, initiation of crop insurance schemes for high value crops, linking of processing with production and marketing, emphasis on research not only to enhance production but also the quality of these perishable products. Location specific strategy of diversification towards high value crops was also stressed.

Sharma (2000) examined the impact of diversification on employment and poverty in Bhutan. The study highlighted the nature of diversification that has taken place in Bhutan and the rationale for diversification between agriculture and the non-farm sector as well as within agriculture. He further revealed that diversification has mainly depended on the development of market infrastructure, an institutional arrangements, the agro-economic condition in a given region and the technology available for various crops. He also analyzed that diversification accelerated to meet the objectives of higher income, higher employment, and stabilisation of income and conservation of natural resources.

Hazra (2001) examined the trend of diversification in Indian agriculture. According to him due to diverse agro-climatic conditions in the country, a large number of agricultural crops are produced which can be classified into two groups – food grain crops and commercial crops. The study concluded that due to wide divergence in agriculture condition, government policies and availability of basic infrastructure induced to the technique of crop diversification in Indian agriculture.

Kathar et al (2001) studied status of diversification, wage rates and employment in agriculture in Haryana. The data has been collected pertaining to pre-reform period 1976-77 and post reform period 1994-95 from two research bulletins of Department of Agricultural Economics, Cost of Cultivation Scheme Haryana Agriculture University, Hisar. It has been concluded in this study that diversification in terms of crop as well as occupation has increased in the post-reform period. The extent of crop diversification on the basis of different diversification measures was observed to be the highest on large farms mainly due to adequate availability of land and other resources. Similarly occupational diversification among small, medium, and large farmers has increased in the post-reform period. The wage rate of agricultural laborers increased manifold in post reform period over the pre-reform period.

Singh et al. (2001) revealed that agricultural diversification through horticulture crops, vegetables and commercial crops has a huge potential for employment and income generation on different farms in Farrukhabad of Uttar Pradesh. The vegetable cultivation due to its labour intensive nature was more beneficial for marginal and smallholdings where family labour availability per unit of land was higher as compared to large farm holdings.

Singh et al. (2001) revealed that various crops i.e. potato, sugarcane, cotton, wheat, rice, bajra and maize had higher level of employment while moderate level of employment existed in pulses and oilseed in Haryana.

Kumar et al. (2002) examined the profitability, risk and diversification in mountain agriculture in the state of Himachal Pradesh. The study suggested that the dairy and vegetables were the most appropriate choice for the farmers to increase their income as the pure vegetables farming found to be more risky, therefore, it could be decreased, if the farmers diversify their cropping pattern.

Ahmad and Isvilanonda (2003) examined the regional pattern of diversification at farm level in Thailand and also examined the impact of diversification on the farm income. Also they tried to find out the constraints faced by the farmers in different regions and production environment. The regional disparity in agricultural development has been observed due to the farmers' inability in certain regions to diversify relatively profitable crops.

Kalamkar (2003) conducted an empirical investigation during 1961-62 to 1997-98 in order to analyze agricultural growth and contribution of various components to the overall output growth of the Maharashtra State. In this study, the diversified crops such as cereals, pulses, and other commercial crops were selected. Herfmdahl and Antropy indices were applied for crop diversification. The study concluded that the growth in area of major crops in Maharashtra revealed a mixed trend. Except the traditional crops such as jowar, bazra and wheat, all other crops recorded growth during the study period. He further concluded that HYV / seeds, new techniques and chemical fertilizers should be more productive for crop diversification.

Sharma (2005) conducted a study to understand the pace and pattern of regional agricultural development and the temporal changes in the process of agricultural diversification in terms of changing share of crop production, horticultural crops and changes in the cropping pattern of high value crops, to estimate and compare the costs and returns of high value cash crops and to identify the ecological factors both at micro and macro level, which facilitated the whole

process of change. A total sample of 225 farm households, 75 each from three development blocks, namely the Theog in Shimla, Sangrah in Sirmour and Seraj in Mandi districts of Himachal Pradesh was selected. The study was based on Herfindahl Index during 2001-02. This study concluded that agriculture in Himachal Pradesh recorded fairly high growth rate during the past three decades. The horticultural sector registered a significant increase in terms of area and production of fruits. Further, the status of the agriculture over the years had been diversified toward fruits and offseason vegetables like peas, potato, cabbage, cauliflower etc. The household data showed that the net return was very high from these off- season vegetables. This study further suggested that more potential for crop diversification can be traced out if the State government creates the essential facilities like transport, health and education. Except these facilities, the marketing and production problems of the farmers should also be solved.

Kumar and Kumar (2005) conducted an empirical investigation during 2001-02 in order to ascertain the resource use efficiency as well as to work out the profitability of the selected food grain crops (i.e. maize, wheat and rice) in the low - hill zone of Himachal Pradesh. A total sample of 200 marginal, small and medium famers was selected from two blocks i.e. Ghumarwin and Una falling in Bilaspur and Una district, respectively. By applying Cobb-Douglas production function, they concluded that more use of HYV seeds, insecticides, pesticides and mechanization of agricultural system, more irrigation facilities and increased credit facilities would increase the agricultural production. The consolidation of holdings and redistribution of land in favour of small and marginal farmers would further enhance the agriculture productivity. This study dealt with the returns to scale of few food grains crops i.e. maize, wheat and rice with a view to find out the potential for crop diversification. Returns to scale in vegetables and some more crops should have also been included in the study.

Bala and Sharma (2005) reported a spectacular shift in the cropping pattern over the period 1900-91 to 2002-2003 in the Kullu district of Himachal Pradesh. The findings indicated that traditional cereals crops have been almost completely replaced by the vegetable crops. The dominance of relatively short-term vegetable crops in the cropping pattern has raised the cropping intensity. The vegetable crops being highly labour intensive have generated more employment opportunities in villages. It was

further reported that the agricultural income per farm has increased by 33.20 per cent over the period. Consequently, the general standard of living of the farming community has been perceived to be uplifted.

Ashok and Balsubramania (2006) showed the importance of infrastructure in explaining the extent of diversification. They observed that access to motorable road, market and irrigation determines the extent, success and profitability of diversification through high paying crops. The role of farm size according to their study was insignificant

Brithal et al. (2006) conducted an empirical investigation during 1998 in order to find out the potential for crop diversification in north-eastern region of India. They examined the status of agricultural diversification, the participants of small holders in agricultural diversification, and the driving forces that enabled the products to harness the potential of high-value agriculture. This study concluded that the diversification toward high value crops has considerable potential to accelerate agricultural growth and augment income and employment opportunities for the small farmers. The region can emerge as an important centre of high-value agricultural products provided the lack of infrastructure for production, marketing, processing and other constraints are to be alleviated through appropriate policy and institutional arrangements.

Majumdar (2006) studied the centrality of agriculture in India's economic development. The study examined the vision of agricultural growth in the millennium that it is a means of achieving the broader objectives of food security, employment led growth and poverty reduction. The study reveals that diversification of agriculture is viewed as part of the wider objectives of rural diversification. The livestock sub sector is particularly important because its development will facilitate many marginal farmers – they form 60 per cent of operational holding – crossing the threshold of economic viability.

In Mexico and Argentina, Wehbe et al. (2006) have shown that diversification of agricultural practices might be helpful in mitigating climate risk along with insurance, irrigation development and technologies that are sometimes hindered due to the limitation of financial access, poor information network and market failures. Also differences in diversification and access to coping strategies between large and small farms have been a matter of concern and thus they advocated for the role of public sector.

Bhaumik (2007) studied agricultural diversification among the different categories of farmers in Hooghly and Cooch Behar districts of West Bengal. He took a sample of 600 households of all categories i. e. marginal, small, semi-medium and medium farmers. He concluded that one- third of the rural households were dependent exclusively on the farm sector for their livelihoods. Nearly 57 percent of incomes of the rural households were generated in the farm sector through agricultural diversification while 40 percent of the total employment was generated in this sector through agricultural diversification. It was also seen that the advanced agricultural systems created better employment opportunities also in the non- farm sector. Although all the categories of households attempted to diversify their employment and income portfolios, but the degree of diversification has been greater among those belonging to lower farm size groups. It was also observed that the extent of agricultural diversification increased with an increase in the size of holdings due the fact that households with more workers and workers of younger age tend to diversify more. Education has also been an important factor in agricultural diversification i.e. the inclination for agricultural diversification increased as the educational level improved. The availability of loans from the institutional agencies and ownership of some non- farm assets also encouraged agricultural diversification.

Birthal et al. (2007) presented the evidence of agricultural diversification towards high-value crops and role of small holders in India. The data on crop areas and production were collected from various publications of the Government of India. This study adopted the logic model to examine the role of small farmers towards the diversification of high-value crops. The comparatively high labor endowments of the small farmers, as reflected in their greater family sizes, induced them to diversify towards vegetables. Although fruit cultivation was also labour intensive, fruits were relatively capital intensive, making them a less advantageous choice for small holders who tend to have low capital endowments. Furthermore, both the probability of participation in fruit and vegetable cultivation as well as land allocation to horticulture decreased with the size of landholdings in India. Small or medium holders did not appear to allocate a greater share of land to fruits or vegetables. However, the share allocated to vegetables was significantly higher if the family size was bigger, while the reverse was true in the case of fruits.

Ram and Singh (2008) estimated the income and employment generation in mixed farming system in Gonda district of Uttar Pradesh. They found that the overall average net income obtained from crops of paddy, wheat and sugarcane was ₹ 5,516, 6,614 and 24,142 per hectare per year. The human labour employment was 235.60, 146.42 and 118.81 man-days per annum, respectively. Rearing of buffaloes was an important activity which generated the employment to the tune of 78.41 mandays per annum and the net income from this activity was estimated ₹ 1,064. On an overall, the farm family labour income was ₹ 4,373 per farm.

Lerman et al. (2008) conducted a study on diversification of rural incomes and non-farm rural employment in a transition country i.e., Russia, and focused on the diversification of rural incomes, factors that determine diversification and the relationship between non-farm rural employment activities and social or demographic attributes of rural families. The study revealed that agriculture was no longer the main source of income for rural families. The rural families were diversified, earning non-agricultural income through both non-agricultural wage employment and non-farm self-employment. Although all respondents would like to earn more, however, they were reluctant to consider the option of changing their place of work and were afraid of losing their current job.

Muhammad et al. (2008) examined the factors affecting farm diversification in rice-wheat in Punjab, Pakistan. The sample size for the study was 200 respondents from four villages two of them close to the market and two of them away from the market. For determining the effect of different factors on diversification, a multiple regression model was used. The values of entropy index computed for measuring horizontal diversification were taken as dependent variable and different factors affecting diversification were taken as independent variables. The results showed that the main factors affecting diversification were size of land holding, age of respondents, education level of respondents, farming experience of respondents, off farm income of respondent, distance of farm from main road, distance of farm from main market and farm machinery.

Tingre et al. (2008) examined the changes in cropping pattern and trends in crop diversification and cropping intensity in Akola district of Vidarbha over the period. They observed that cropping pattern has changed substantially in the Akola district and soybean has attained important position in the cropping pattern of the

region. They also revealed that over the period, the trend of crop diversification and cropping intensity increased significantly.

Chakrabati and Kundu (2009) conducted a survey on crop-diversification in three States i. e. West Bengal, Tamil Nadu and Punjab. They concluded that crop-diversification could be a socially beneficial when it is complemented by extensive infrastructural facilities, financial and technological support etc. especially for the localized marginal and small farmers. Furthermore, specific support to organize the marketing network is very crucial for a policy of crop-diversification among these farmers. For this, an appropriate institutional set- up should be organized so that crop-diversification may be increased among the farmers in these States.

Jha et al. (2009) discussed the factors responsible for agricultural diversification at different levels of Kurukshetra district in Haryana, India. This study regressed alternate measures of diversification namely, the Simpson index and concentration of non-food crops, on several possible factors such as income, land distribution, irrigation intensity, institutional credit, road density, urbanization and market penetration. The regression analysis suggests that increased road density, urbanization encourages commercialization of agriculture and with commercialization, farms in a region are increasingly specialized under certain crops and crop-groups as per the resource, infrastructure and institutions of the region.

Jodha (2009) conducted a study on mountain agriculture in order to find out the degree of agricultural diversification. In his study, he concluded that diversities of varying degrees and at different levels has been a dominant feaster of mountain agricultural diversification. Traditionally mountain farmers have been harnessing their gains through various spatial and temporal combination of crops and activities linked to livestock, farm forestry etc, looking to the emerging new market opportunities as well as new production and processing technologies, and over all land use systems have increased significantly. The agricultural diversification can be increased more through appropriate policies and support systems.

Sood et al. (2009) analysed state-level data related to land use, cropped area under major and minor crops, cropping intensity, irrigation, and fertilizer consumption in Punjab (India) for a period of 25 years. They revealed that there was

hardly any scope left for horizontal expansion of the total cultivated area and that the cropping pattern of the state has been transforming from multi-cropping towards mono-cropping. The crop diversification was proposed as an answer to current and future threats by the authors.

Kasemv and Thapa (2011) analysed the determinants and effects of diversification on income and use of inputs in Thailand. They revealed that nearly three-fourth of the land was still being used for rice mono-cropping, indicating little success in the promotion of the crop diversification program in Thailand. Paddy fields, including farms for cultivating rice under mono-cropping and diversified system, still accounted for 90 per cent of the total farmland in the country. The limited impact of the programme on the farming sector was attributed primarily to the variation in land and labour resources available at the farmers disposal as well as soil suitability. The farmer's attendance in training and interaction with farmer groups were the other influential factors. They further revealed that although cropping diversification has provided attractive financial returns particularly to the small farmers, it has also accelerated the use of inorganic fertilizers and pesticides. The broad policy instruments were, therefore, suggested for the effective implementation of future crop diversification programs in Thailand and perhaps elsewhere in Southeast Asia.

Kumar (2011) studied the impact of agricultural diversification on food and non-food grains during 2007- 08. His findings revealed that food grain crops which accounted for about 85 percent of the total cropped area in the State witnessed a small decline of about 4 percent due to agricultural diversification during this period. On the other hand there has been 6.45 percent increase in the total cropped area in case of vegetables. The State has emerged as a model of agricultural diversification towards high- value cash crops, mainly off- season vegetables. Earlier, the production of these high value vegetable crops was confined to selected mid and high- hill zones. But now, the remunerative returns from these off- season vegetables have allured the farmers in low- hill zone also.

Sharma (2011) conducted an empirical study in order to find out the nature of agricultural diversification. He took the sample of 210 households, 70 each from three development blocks namely, Kandaghat in district Solan, Banjar in district Kullu and

Salooni in district Chamba of Himachal Pradesh. His findings revealed that agriculture in the State has recorded a growth of around three percent per annum during the past two and half decades since 1980-81. The ongoing process of crop diversification in the State has become evident from rising proportion of gross cropped area under fruit and vegetable crops. This has also been manifested in increasing the contribution of these crops towards gross value of output originating in agriculture. The household survey data from three different blocks of the State further showed that even the marginal households, owning up to half a hectare of land, have devoted nearly three- fifth of their gross cropped area for the cultivation of these crops. The cultivation of high value crops yields very high net returns and has made a significant impact on the income and employment levels of all the categories of cultivating households. He further concluded that explicit consideration of mountain specificities, namely, inaccessibility, fragility, niche and human adaption mechanism in formulating and implementing development strategies was the single most important factor that set into the whole process of agricultural diversification.

Kumar et al. (2012) examined the status and pattern of crop diversification in eastern India and identified the determinants of crop diversification towards high-value crops, using primary data collected in these selected states. The study has revealed that the crop sector in the region has been diversifying towards high-value crops albeit slowly. Also, there were considerable variations in crop diversification across different states of the region. Regression results have brought out the importance of technology, modern implements, education and road connectivity as the important determinants of crop diversification towards high-value crops, besides the agro-climatic factors.

Sachikumar et al. (2012) examined the economics of farming system in northern transitional Zone of Karnataka. In peri-urban area of Dharwad, the net returns were highest in the system involving crop and dairy, whereas in rural area of Dharwad, the net returns were highest in system involving crops, dairy and plantation. In case of Belgaum peri-urban area the net returns were highest in system involving crops, vegetables, dairy and poultry whereas in rural area the farming system consisting of crops, dairy, goat performed much better. The dairy was most

non-crop component included in almost all the farming systems and it was found profitable in all the farming system in Dharwad area. The vegetables were one of the

important components of the farming systems in the peri-urban areas of Dharwad and Belgaum and found to be profitable in most of the situations.

Sharma and Harinder (2013) analysed the prospects and challenges of diversification in the state of Punjab. They suggested that there was an immediate need to diversify overall economic base of the state, instead of attempting it only in terms of crop diversification. They also revealed that there was a great prospect to diversify the entire economic base of Punjab. The non-farm activities can provide ultimate solution to the rising socio-economic problems in Punjab.

Saraswat and Sharma (2014) examined the cropping pattern in village Kot of district Hamirpur, Himachal Pradesh, during 1959-60, 1989-90 and 2004-05 and the types of socioeconomic changes and diversification that have taken place in the village. The study revealed that agriculture is no longer the mainstay of the village economy as a source of livelihood. The significant changes in demographic and occupational structure showed that the service sector and non-farm employment have acquired economic ascendancy. The cropping pattern has shifted from diversified farming towards maize and wheat cultivation. The cultivation of pulses, fodder crops and other crops had been given up, causing setbacks to the livestock sector, food and nutritional security.

Sharma (2015) examined the growth and prospects of agricultural sector in the state of Punjab by utilizing secondary data pertaining to different time periods. The results of the study revealed that cropping pattern in the state of Punjab did not experience any significant transformation and remained highly favorable towards the production of wheat and paddy during the study period. The study also examined the importance of horticulture sector in the state of Punjab.

Mittal and Hariharan (2016) analysed the trends and drivers of crop diversification in different agro-climatic zones of India. They revealed that agricultural diversification when complemented with sustainable intensification created opportunities for poverty reduction and climate resilience by boosting agricultural productivity, reducing risks and increasing market participation and incomes for the poor. They further revealed that diversification contributed to sustainable intensification by reducing mono cropping and increasing multiple-cropping by reducing the risk of pests and diseases and system resilience. It has been also reported that the risk of crop failure contributed to climate adaptation in

vulnerable regions. The diversification towards water efficient or water saving crops reduced the pressure on the water table while reduced risk of pests and diseases limited the excessive use of chemicals.

Nayak (2016) studied the changing cropping pattern, agricultural diversification and productivity in Odisha. The study revealed that most of the districts in Odisha were experiencing a lateral movement towards crop specialization and crop diversification was seen only in tribal-dominated/technologically less-developed districts. The study observed a reduction in inequality during the studied period and concluded that districts in Odisha were converging as far as agricultural productivity was concerned.

2.3 Constraints and opportunities of different farming systems/ enterprises

Chauhan and Sharma (2000) examined the trends in production, economics and marketing of honey and the constraints in the development of beekeeping in Himachal Pradesh. The study revealed that the migratory beekeepers on average had more beehive boxes, higher yields, lower costs and higher returns compared to stationary bee farms. Costly beehives, non-remunerative prices, non-availability of technical guidance, costly transport and lack of suitable marketing facilities were the major constraints inhibiting the growth of beekeeping enterprises.

kumar and Singh (2002) studied problems in vegetable production. The problems reported were, poor quality seeds (42.2%), insufficient availability of seed (40%), high cost of seed (31%) and non-availability of seed at appropriate time (12.2%). The other problems noticed were high cost of fertilizer, poor state of fertilizer and plant protection delivery system in the district. High wages and shortage of labour was also one of the constraints.

Gavisiddappa et al. (2001) identified the problems in Gherkin production and trade in Haveri district of Karnataka. The sample farmers were unanimous and cent per cent in their opinion with respect to non-availability of seeds, unawareness of potentiality of the crop, lack of irrigation facilities, problem of pests and diseases, lack of cheap labour, no market in India and no storage facilities of refrigerated rooms. Irregular payment made by the company (30 per cent) and lack of research support regarding the crop (34 per cent) were some other problems.

Pathania and Vashist (2007) conducted an empirical study in order to find out the problems of marginal and small farmers as well as the solution for their problems.

They took the sample of 40 marginal and small size of holdings in Nagrota block of Kangra district of Himachal Pradesh. The findings of this study have clearly brought out that the large holding have decreased while small and marginal holdings have increased over the years in the State resulting into higher human labour pressure on agriculture. This trend not only calls for reduction in population dependent on agriculture but also changes in the subsistence agricultural system. This study has concluded that the farmers shifted from cereals to vegetables have earned more income and this has also provided more employment to the people. These farmers can become economically more viable if they follow vegetable farming while the government arranges necessary facilities like irrigation, marketing and infrastructure. The crop diversification is the best option for marginal and small farmers because they cannot meet out the minimum family requirements and are not economically viable where they follow the traditional food-grain agricultural cropping system. Therefore, they need to diversify the cropping system with inclusion of vegetable and other commercial crops.

Sharma et al. (2008) studied the farming system based constraints faced by farmers in Dausa district of Rajasthan to suggest which particular farming system viz crop, dairy, vegetable and labour can provide maximum yield benefit and job opportunity. The most important constraints expressed by the respondents were non-availability of communication facility, financial crisis in the family, very low support price fixed by the Govt., higher input cost and inadequate and untimely rainfall. They suggested that to mitigate the effect of these constraints, communication facilities should be made available to the farmer. The extension agencies should conduct training on leadership development and technology diffusion at village level and co-operative societies should be made effective so that original chemicals for plant protection are available to the farmers. They further reported that long and complicated procedure for loaning should be made simple and support price should be increased.

Adebisi et al. (2011) analysed the production constraints facing fadama vegetable farmers in Oyo State of Nigeria. The unavailability of credit sources, high

cost of inputs (52.1%), irregular fuel supply (24.7%), frequent pump break down (24.7%), irregularities in water pump operation (16.7%) and maintenance of the pump (9.6%) were major constraints against capital use in the study area. The major constraints against labour use were the inability to hire labour. They recommended that there should be provision of credit facilities and initial take off capital for both male and female for the production of vegetable during the dry season. This would enable them to benefit from the high profit usually realized in vegetable production during the period.

Singh and Sidana (2017) analyzed in Punjab that the important constraints in the cultivation of chicory were delayed payment, high labour needs, inadequate facilities for unloading the crop and lack of technical knowledge.

3. MATERIALS AND METHODS

Systematic methodology is the base of any scientific enquiry as it adds the precision, reliability and validity of the findings related to the research problem. An elaborative view of materials and methods employed in any study is helpful to the future researchers for further studies in the same or related fields of this kind. The present study entitled, "Diversification of the existing farming systems under marginal household conditions in Kangra district of Himachal Pradesh" had two objectives viz. i) To characterize the farming system ii) Diversification of the existing farming systems. To full fill the first objective, the data from farmer's information was taken in a pre tested survey schedule. To achieve the second objective, a benchmark survey was done and the trial was carried out on 24 households. The present chapter has been planned to describe detailed methodological procedures followed to accomplish the stated objectives of the study along with selection of study area, sampling design, data collection and analytical framework employed. The different aspects of the methodology used for the present study have been described under the following sections:

3.1 Characterization of the farming system

3.2 Diversification of the existing farming systems

3.1 Characterization of the farming system

3.1.1 Selection of the study area

The study has been conducted in Kangra district of Himachal Pradesh. This district has been selected purposively, as the net sown area is highest among all the other districts in the state. Moreover, the area under major crops is also maximum and the district accounts for highest production of foodgrains in the state. The agriculture is done both under irrigated and rainfed conditions. Throughout the district, a variety of crops/crops enterprises are raised by the farmers under various farming systems.

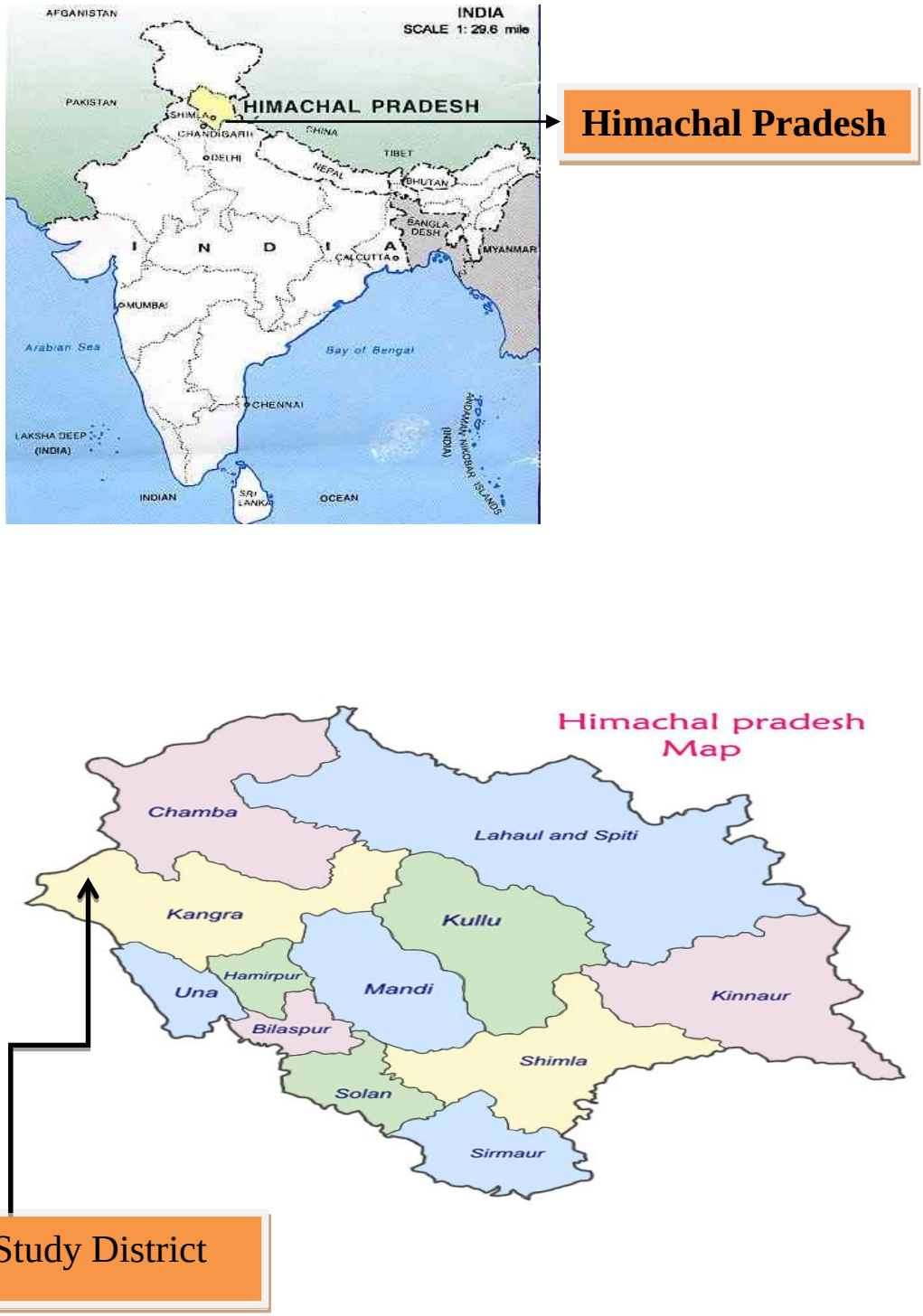


Fig. 3.1 Map showing the location of Himachal Pradesh in India and Kangra District in Himachal Pradesh

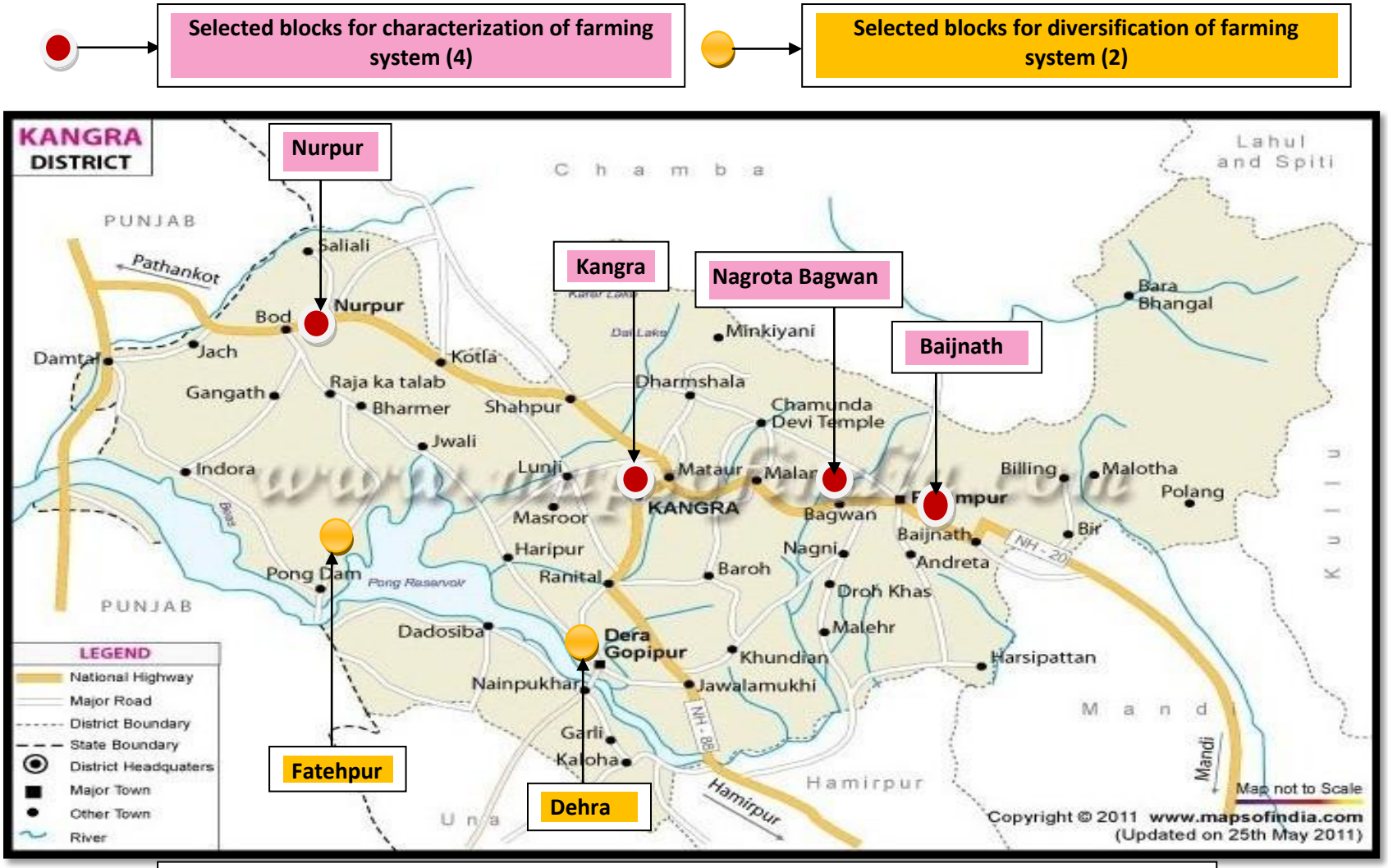


Fig. 3.2 Map showing the location of sample blocks in Kanga district of Himachal Pradesh

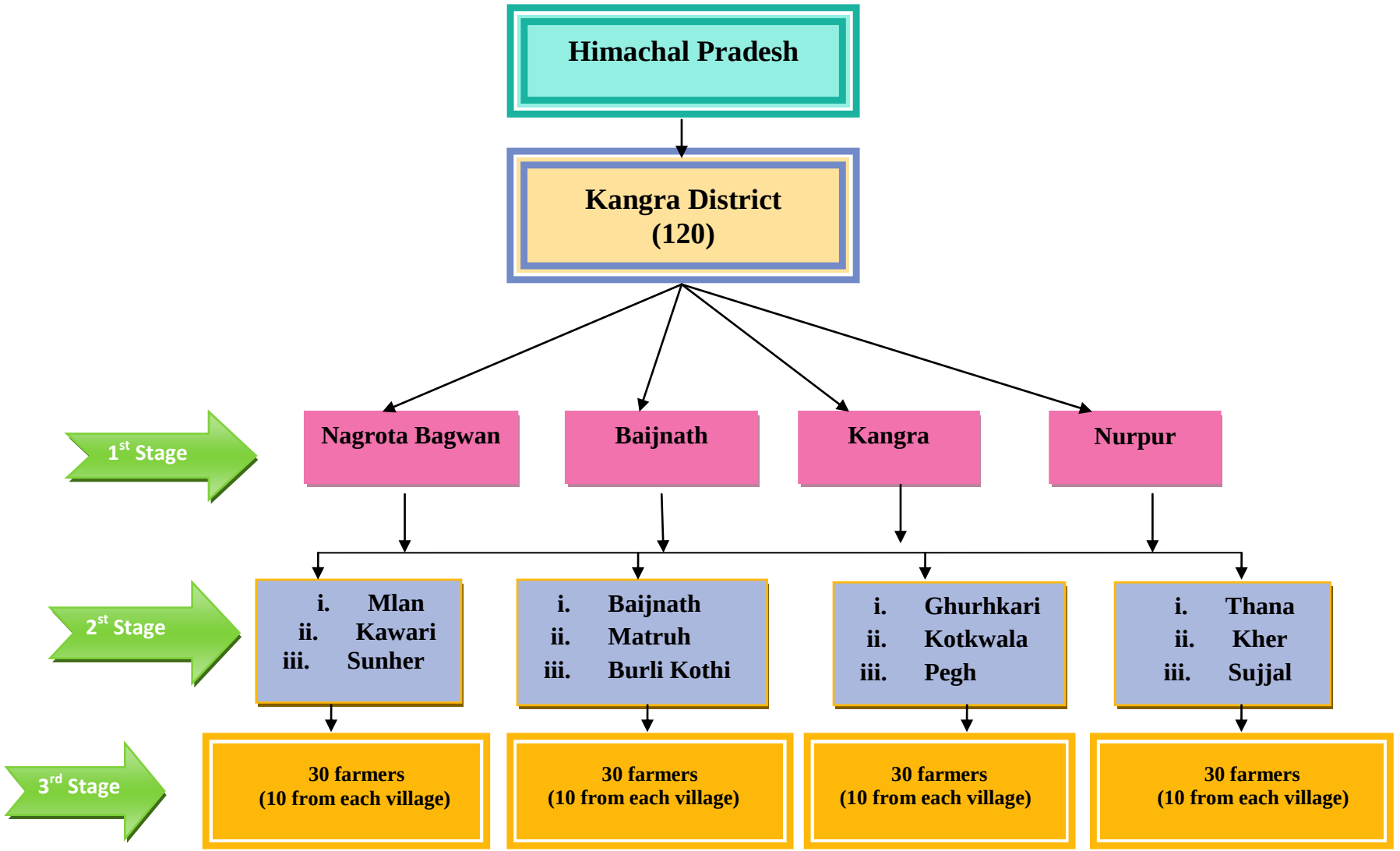


Fig. 3.3 Sampling plan of the study

3.1.2 Sampling design

Multi-stage random sampling technique was employed for the selection of blocks (stage-I), villages (stage-II) and farmers (stage-III). The sampling design was composed of the following steps.

i. Selection of blocks

A list of community development blocks was prepared and four blocks namely, Baijnath, Nagrota Bagwan, Kangra and Nurpur were selected at random out of fifteen blocks **(Fig. 3.2)**.

ii. Selection of villages

A representative sample of 12 villages from each of the selected block was randomly drawn. Care was taken that the selected villages had representation almost from all types of agro-climatic conditions of Kangra district. The surveyed villages have been shown in the map of the Kangra district **(Fig. 3.3)**.

iii. Selection of farmers

Keeping the time and resource availability at the disposal of researcher in view and in order to give proportional representation to each category of farmers (Marginal, small, medium and large) a manageable sample of 120 farmers was taken from the Kangra district.

A complete list of selected farmers was prepared along with the total landholding area. Then selected farmers were grouped into four categories, namely, Marginal, Small, Medium and Large based on total operational land holding. Out of the total 120 farmers, 78 were grouped under marginal farm category (having less than 1 hectare landholding area), 21 farmers were grouped under small farm category (having 1-1.99 hectare landholding area), 7 farmers were grouped under medium farm category (having 2-2.99 hectare landholding area) and 14 farmers were fell under large farm category (having equal and more than 4 hectare landholding area). Based on landholding size, the distribution of sample farmers was given in Table 4.3.

3.1.3 Data collection

The present study was based on primary and secondary data. The primary data were collected through survey method while secondary data were collected from various government publications/annual reports related to the study. The survey schedule was prepared to obtain the detailed information from the sample households (Appendix-I). The data pertain to agricultural year 2016-17.

i. Primary data

The primary data on the following aspects were collected through personal contact on a specially designed and pre-tested schedule.

- Demographic features like age, family size, education, occupation, size of land holding, etc. in the study area.
- Economic parameters like inventory of farm buildings and machinery, land utilization, livestock inventory, inventory of land, cropping pattern, production and utilization of crops and other farm products.
- Farm resources utilization like cropping pattern and inputs use for different crops (planting material, fertilizers, pesticides, bullock labour, tractor hours, human labour, irrigation, etc.)
- Costs and farm returns
- Family expenditure pattern
- Farm, non-farm income
- Problems faced by farmers

ii. Secondary data

The secondary data were collected from Statistical Outline of Himachal Pradesh. The secondary data mainly comprised of the following aspects:

- Descriptive features of the study area
- Population and literacy statistics of the study area
- Land utilization pattern of the sample farms

Plate 3.1 Data collection from farmer

3.1.4 Analytical tools

Tabular analysis using averages, ratios, percentages, etc. was extensively employed to achieve the objectives of study. Categorization of farm households based on their operational land holdings was carried out and information obtained in terms of percentage composition of different category of farmers is presented.

i. **Demographic and crop indices**

The following types of indices were worked out:

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

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

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

3.2 Diversification of existing farming system

3.2.1 General description of study area and methodology

The 24 field experimental trials were conducted in Fatehpur and Dehra blocks of Kangra district under the aegis of on Farm Research unit of AICRP IFS, Palampur centre, Indian Institute Farming System Research, Modipuram. As per mandate in each block, three villages were selected. From each village, four farmers were selected. In all, 24 marginal farmers were selected for the study. The benchmark survey carried out by On Farm Research unit during 2012-13 was utilized for the purpose of farming interventions to be imposed during 2014-15 and 2015-16.

The bench mark net income of the concerned households was recorded. Households surveyed were grouped as

1. Field crops alone
2. Field crops + dairy
3. Field crops + dairy + sheep/goat

Thereafter, constraints limiting the overall crop productivity/profitability in each category were identified. Some critical inputs as interventions were given to the surveyed households. The impact of interventions in the improvement of productivity & increase in net income was carried out.

Table 3.1 Treatments (Modules) conducted for diversification studies

Sr. No.	Treatment/Modules	Interventions on farmers field
1	M_0 Bench mark	Comprehensive survey
2	M_1 Crop diversification	Change in cropping pattern and provided improved varieties with recommended nutrient doses
3	M_2 Livestock diversification	Supply of mineral mixture and ensuring green fodder availability throughout the year
4	M_3 Product Diversification	Providing grading sieves, seedlings of vegetable crops for enhancing the income of households
5	M_4 Capacity Building	Arranged trainings and providing pamphlets regarding trainings

i. M_0 Bench mark

The primary data on the following aspects were collected through personal contact on a specially designed schedule.

Demographic features like age, family size, education, occupation, size of land holding, etc. in the study area. Farm resources utilization like cropping pattern and inputs use for different crops (planting material, fertilizers, pesticides, bullock labour, tractor hours, human labour, irrigation, etc.), costs and farm returns etc.

ii. M_1 Crop diversification

As observed from the benchmark survey the farmers were growing local and traditional varieties of the crops that too with inadequate nutrient application and untimely weed control. To address these constraints improved crop varieties were supplied to all the individual households. Further these crops were applied recommended fertilizer doses and were grown with scientific weed control and proper management of insect pest/diseases.

iii. M_2 Livestock diversification

Major constraints relating to the livestock were mineral deficiency and green fodder shortage particularly during summer season. To address these constraints existing livestock were provided with mineral mixture supplementation and to overcome the green fodder shortage farmers were supplied seed of hybrid sorghum during kharif & berseem +oats during rabi season.

iv. M_3 Product Diversification

This was done to increase the farmer income through grading the available seed by providing grading sieves. Also seedlings of vegetable crops were provided to needy and willing farmers for enhancing the income of households.

v. M_4 Capacity Building

This was done through arranging trainings; for example training on vermicompost making, benefits of sprouting seeds and value addition in soybean and providing this information through pamphlets to enhance the capacity of the farmers regarding farming activities.

3.3 Constraints in adopting high value integrated farming system:

Problems and prospects can be physical or biological, technological and socio-economic. They were obtained by analyzing the personal interviews of the respondents.

3.4 Limitations of the study

The present investigation had been carried out using systematically scientific methodology. Every care has been taken in the study for the analysis of various parameters. The accuracy of the data was ensured through cross checks in the survey schedules. However, a few limitations as expected in every socio-economic survey may not be over ruled. The study was based upon the sample observations collected from only 120 farmers for characterization and 24 farmers for diversification. As no records were maintained by the sampled farmers, the data were collected by survey method on the basis of an oral enquiry and the information given by the farmers was based on their memory and past experience. Although every care was taken to collect the reliable data, but the error on the part of respondents cannot be ruled out.

4. RESULTS AND DISCUSSION

This chapter is of utmost importance as it focuses on the results obtained on the basis of research conducted in the study area. In this chapter, the results are presented on different aspects of the selected households viz., socio-economic parameters, land utilization pattern, livestock inventory, existing farming system, diversified farming system, economics of different enterprises and farm constraints faced by the households in the study area in respect of agriculture and allied activities. A detailed survey of 120 households was conducted to findout the predominant farming system among selected households with a focus on socio-economic information and income of the farms from different farm enterprises. The effect of intervention for diversification on farm income was also investigated. A step by step presentation of findings is imperative for understanding the logical reasons. The results of the study have been presented in this chapter systematically under two main headings which further divided into sub headings according to the objectives of the study.

4.1 Characterization of farming system

4.2 Diversification of existing farming system

4.1 Characterization of farming system

4.1.1 Description of the study area

Himachal Pradesh commonly known as Dev Bhumi is situated in the western Himalayas. The state is compact in shape and almost wholly mountainous, with altitude varying from 300 m in plains of Kangra and Una to nearly 7,000 m in Central Himalayan range of Lahaul and Spiti. It covers a geographical area of 55,673 km^2, which is about 1.69% of India's total area (Census of India 2011). Administratively, Himachal Pradesh is divided into 12 districts. Most of the geographical area of the state comes under forest, pasture, and grazing land; agriculture is possible only on less than ten percent of the state's net area. The physiography and climatic condition in the state favours diversified potential for farming and allied activities.

Himachal Pradesh has a total population of 68,64,602 out of which 89.97 per cent population lives in rural areas. At present there are 102 tehsils, 56 sub-tehsils and 78 blocks in Himachal Pradesh **(Table 4.1).**

Table 4.1: Himachal Pradesh and Kangra District at a glance (2016-17)

Sr. No.	Particular	Himachal Pradesh	Kangra
1.	Area (sq. km)	55673	5739
2.	Tehsils (No.)	102	21
3.	Sub-Tehsils (No.)	56	4
4.	Development blocks (No.)	78	15
5.	Population (No.)	6864602	1510075
6.	Rural population (No.)	6176050	1423794
7.	Urban population (No.)	688552	86281
8.	Total cropped area (ha)	931826	209410
9.	Net sown area (ha)	549964	115748
10.	Cropping intensity (%)	174.69	191.64
11.	Foodgrain production (MT)	1634066	353669
12.	Vegetable production (MT)	1653506	180706
13.	Sex-ratio (Female per 1000 males)	972	1012
14.	Literacy rate (%)	82.80	85.67
	Male	89.53	91.49
	Female	75.93	80.02
15.	Rainfall (mm) average annual	917.7	1602.5
16.	Total livestock (No.)	4844431	805120
17.	Milk production (000'tonnes)	1328.174	-

Source: Statistical abstract of Himachal Pradesh (2016-17), Economics and Statistics Department, Govt. of HP, India.

Study district Kangra lies between 31˚ 21′ to 32˚ 59′ N latitude and 75˚ 47′ 55″ to 77˚ 45′ E longitude. It is situated on the southern escarpment of the Himalayas. The entire area of the district is traversed by the varying altitude of the Shivaliks, Dhauladhar and the higher Himalayas from north-west to south-east. The altitude varies from 500 metres above mean sea level (amsl) to around 5,000 metres amsl. It is encapsulated in the north by the districts of Chamba and Lahaul and Spiti, in the south by Hamirpur and Una, in the east by Kullu and Mandi and in the west by Gurdaspur district of Punjab.

i. Demographic features of the study area

The salient features of district Kangra are presented in **Table 4.1**. It can be seen from the Table that Kangra district accounted for 21.99 per cent of the total population of the state. A majority of the population (about 90%) was concentrated in the rural areas. The sex-ratio was higher (1012 females per 1000 males) as compared to state (972 per 1000 males) which is a healthy sign from the gender sensitivity perspective. The overall literacy level was 85.67 per cent which was higher than the state as a whole (82.80%). The male and female literacy rate was 91.49 per cent and 80.02 per cent, respectively. The cropping intensity of Kangra district is 191.64 per cent which is higher than the state cropping intensity (174.69%). This reflects the fact that nearly two crops a year is the most commonly observed farming sequence in the district.

Table 4.2 Land utilization pattern of Kangra district

Sr. No.	Particular	Area (In ha.)
1.	Total geographical area	577681
2.	Forests	232520
3.	Area not available for cultivation	92517
	i) Barren and uncultivated land	14848
	ii) Land put to non- agricultural uses	77669
4.	Area under pasture/grazing land	87865
5.	Fallow land	1097
6.	Total cropped area	2,09, 4,10
7.	Net sown area	115748
8.	Cropping intensity	191.64

Source: Statistical abstract of Himachal Pradesh (2016-17), Economics and Statistics Department, Govt. of HP, India.

ii. Land utilization pattern

Land use pattern of Kangra district of Himachal Pradesh has been presented in **Table 4.2**. It is evident from the Table that net sown area constituted only 20.03 per cent of the total geographical area. The area not available for cultivation is 16.01 per cent of the total geographical area.

4.1.2 Personal, socio-psychological and structural characteristics of farmers practicing Farming Systems

The socio-economic characteristics of farmers affect the organization and management of farms as well as the production and disposal of different farm commodities to a large extent. Thus, it is imperative to study the existing socio-economic status of the sample households. The nature of ownership of land, cropping pattern, size of family and educational level of farmers have great bearing on decision making in the adoption of innovations and improved practices to great extent. This section, therefore, attempts to throw light on the socio-economic features of the sample households in the study area.

i. Village and category wise detail of farm families surveyed

Land is the only resource that clearly makes distinction between a farmer and any other profession and a farmer with bigger landholding is in an advantageous position than the smaller ones because the worth of the farmer is always been assessed on the basis of land holding. The data in **Table 4.3** gives the information about characterization of the farmers on the basis of their land holding size.

It was observed that in Baijnath, Nagrota Bagwan and Kangra blocks the maximum number of surveyed farmers were in the marginal farmers' category (90, 90 and 80%, respectively) where as in case of Nurpur block the medium farmers dominated (50.00 per cent). The overall data of Kangra district indicated that the majority of farmers fell under marginal farm category (65%) followed by small farmers (17.50%).

Table 4.3 Characterization of farmers according to land holding size (No.)

Block		No. of farmers				Overall
		Marginal (<1 ha)	Small (1-1.99 ha)	Medium (2-3.99 ha)	Large (>=4 ha)	
Baijnath						
Sr.no.	Name of village					
1	Baijnath	10	-	-	-	10
2	Matruh	9	1	-	-	10
3	Burli kothi	8	2	-	-	10
Total		27	3	-	-	30
		(90.00)	(10.00)	-	-	(100)
Nagrota Bagwan						
1	Mlan	8	2	-	-	10
2	Sunher	9	1	-	-	10
3	Kawari	10	-	-	-	10
Total		27	3	-	-	30
		(90.00)	(10.00)	-	-	(100)
Kangra						
1	Ghurkari	7	3	-	-	10
2	Kotkwala	7	3	-	-	10
3	Pehg	10	-	-	-	10
Total		24	6	-	-	30
		(80.00)	(20.00)	-	-	(100.00)
Nurpur						
1	Thana	-	5	3	2	10
2	Kher	-	4	3	3	10
3	Sujjal	-	-	9	1	10
Total		-	9	15	6	30
			(30.00)	(50.00)	(20.00)	(100.00)
Overall total		78	21	15	6	120
		(65.00)	(17.50)	(12.50)	(5.00)	(100.00)

Note: Figures in parentheses indicate percentages to the total in each category

ii. Age-wise distribution of the head of the family on sample farms

It is generally believed that age does act as a vital factor in adoption of any socio-economic transformation. The age of farmer plays an indispensable role in responding to scientific innovations and new thinking. The data in **Table 4.4** depicted the age structure of the head of the sample farms. It indicated that marginal, small and medium farmers (50.00, 61.90 and 53.33%, respectively) mostly belonged to middle age category whereas large farmers had higher population under old age (50.00%) category. It is also reveled that on a whole, majority of the farmers (51.67 per cent) belonged to middle age category followed by young (25.83%) and old age (22.50%) categories. This finding was supported by Kumar and Rao (2004) and Kale (2008).

The probable reason for majority of the farmers in middle age category might be due to the fact that most of the young people are not interested in farming and are looking for better livelihood options in urban areas. Another reason may be middle aged are enthusiastic and have more work efficiency than the older or younger ones. Individual may not be ready to accept the responsibility in the young age itself. Individuals in middle age group have physical vigour and also more responsible towards family than the younger ones. As they become middle aged they will be taking more responsibility for the family.

Table 4.4 Age-wise distribution of the head of the family on sample farms (No.)

Age group (years)	Marginal	Small	Medium	Large	Overall
25-40 (Young)	19	5	6	1	31
	(24.36)	(23.81)	(40.00)	(16.67)	(25.83)
41-60 (Middle)	39	13	8	2	62
	(50.00)	(61.90)	(53.33)	(33.33)	(51.67)
>60 (Old)	20	3	1	3	27
	(25.64)	(14.29)	(6.67)	(50.00)	(22.50)
Total	78	21	15	6	120
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentages to the total in each category

iii. Educational status

The study of educational status is one of important factors to determine the ability of the farming communities to make judicious decisions to adopt new technologies and innovations. Keeping this in view, the educational status of the farmers is depicted in **Table 4.5** and **Fig. 4.1**. It is observed from Table that in Kangra district 20.51 per cent of marginal and 23.81 per cent of small farmers were illiterate whereas; in case of large farmers 16.67 per cent were illiterate. Further, 38.33 per cent of small and marginal (23.08%) farmers were with high school education whereas; medium farmers were 53.33 per cent. The overall data indicated that nearly 20.83 per cent of the farmers were under illiterate category, followed by high school (28.33%) and graduate and above (10.83%). The literacy rate of the small and marginal farmers were 76.19 and 79.49 per cent, respectively, whereas in case of medium and large farmers it was 80.00 and 83.33 per cent, respectively.

Table 4.5 Distribution of head of family on sample farms according to education

Sr.No	Education	Marginal	Small	Medium	Large	Overall
1	Illiterate	16	5	3	1	25
		(20.51)	(23.81)	(20.00)	(16.67)	(20.83)
2	Primary	10	2	-	1	13
		(12.82)	(9.52)	-	(16.67)	(10.83)
3	Middle	16	3	-	-	19
		(20.51)	(14.29)			(15.33)
4	Matric	18	7	8	1	34
		(23.08)	(38.33)	(53.33)	(16.67)	(28.33)
5	Senior Secondary	10	3	2	1	16
		(12.82)	(14.29)	(13.33)	(16.67)	(13.33)
6	Graduate and above	8	1	2	2	13
		(10.26)	(4.76)	(13.33)	(33.33)	(10.83)
	Total	78	21	15	6	120
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
	Literacy rate (%)	79.49	76.19	80.00	83.33	79.17

Note: Figures in parentheses indicate percentages to the total in each category

This might be due to the fact that small and marginal farmers because of their low social strata and status might not be able to find an opportunity of going in for formal education and also the considering farming being an important livelihood option, they might not have ventured for formal education. However, the medium and big farmers with relatively better off with their economic status and social exposure they might have fallen into the medium education category. The results of the study are in line with the observations of Netravathi (2007) and Deepak (2003).

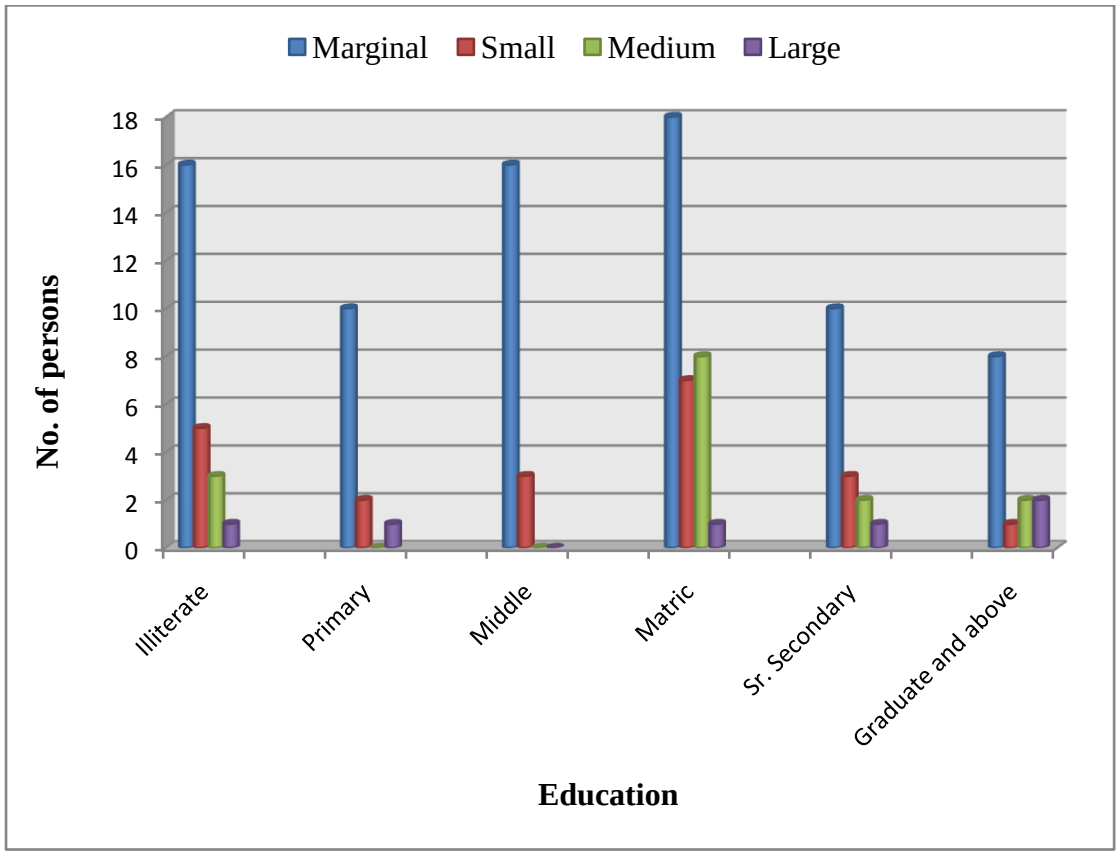


Fig 4.1 Educational status of the head of the family

iv. Occupational pattern of sample farms

The occupational structure of the farmers directly determines the family income and economic soundness of the households. More developed the area, more would be the avenues for employment and income of the family. There could be farmers who have other occupations along with agriculture. This is particularly true in case of subsistence farming. Around 84.5 percent of the total land held by the farming community of Himachal Pradesh is owned by the small and marginal farmers. Under hilly conditions people mainly resort to farm and farm allied activities to generate

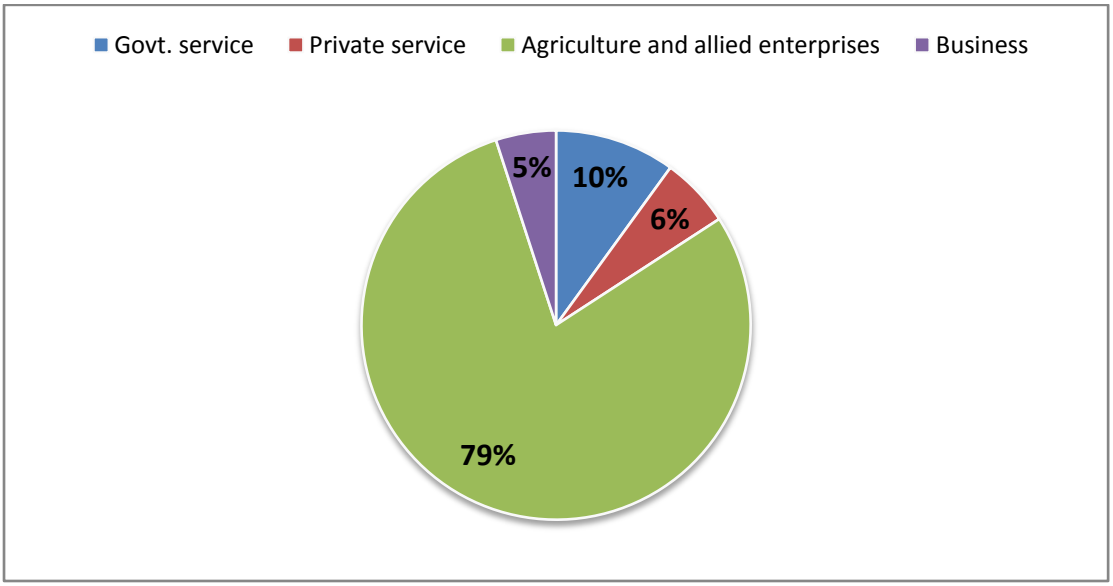
revenue. **Table 4.6** and **Fig. 4.2** give the occupational pattern of the working population in the study area. The agriculture along with allied enterprises such as livestock rearing was found to be the principal source of livelihood for major proportion of the population. The Table shows that in overall farm categories, the portion of total working population engaged in agriculture and allied activities was more than 79 per cent, however, it was highest in case of medium farmers (93.33%). The all farm categories viz marginal, small, medium and large were dominated by agriculture occupation (75.64, 80.95, 93.33 and 83.33%, respectively) followed by government service (8.97, 14.29, 6.67 and 16.67%, respectively). This shows that the dependence on agriculture and allied profession was relatively more in all the farm categories.

Table 4.6 Occupational pattern of the head of the family on sample farms

(No.)

Sr. no	Occupation	Marginal	Small	Medium	Large	Overall
1	Govt. services	7	3	1	1	12
		(8.97)	(14.29)	(6.67)	(16.67)	(10.00)
2	Private	6	1	-	-	7
		(7.69)	(4.76)	-	-	(5.83)
3	Agriculture and allied enterprises	59	17	14	5	95
		(75.64)	(80.95)	(93.33)	(83.33)	(79.17)
4	Business	6	-	-	-	6
		(7.69)	-	-	-	(5.00)
	Total	78	21	15	6	120
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentages to the total in each category



4.2 Fig. Distribution of sample farms according to occupational pattern

v. Age-wise distribution of family members on sample farms

The age-wise distribution of family members has an important bearing on the efficiency of farm business management. The age-wise distribution of total family members also indicates the dependency ratio of a family unit and is not a parameter of less importance for tailoring policy implications related to socio-economic development in the region. The members below 15 years of age and those above 60 years are regarded as dependents in the study.

It can be seen from the **Table 4.7** and **Fig. 4.3** that the population of dependents (below 15 and above 60 years) were 32.95, 33.73, 25.00 and 40.73 per cent under marginal, small, medium and large households, respectively. The total working population in the age group of 15-60 years constituted about 67.04, 66.27, 74.99 and 59.26 per cent under marginal, small, medium and large households, respectively. The sex ratio turned out to be 1011.43, 1024.39, 1000.00 and 928.57 per thousand males under marginal, small, medium and large households, respectively, in study area. The overall sex ratio of the selected household was 1007.93 which indicated higher female population as compared to male population and it's a healthy sign from the gender sensitivity perspective

Table 4.7 Age wise distribution of family members of sample farms (No.)

Sr .no	Age	Marginal			Small			Medium			Large			Overall		
		Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
1	<5	21	11	32	4	1	5	2	1	3	1	-	1	28	13	41
		(12.00)	(6.21)	(9.09)	(9.76)	(2.38)	(6.02)	(9.09)	(4.55)	(6.82)	(7.14)		(3.70)	(11.11)	(5.12)	(8.10)
2	5-15	26	30	56	11	4	15	5	2	7	5	1	6	47	37	84
		(14.86)	(16.95)	(15.91)	(26.83)	(9.52)	(18.07)	(22.73)	(9.09)	(15.91)	(35.71)	(7.69)	(22.22)	(18.65)	(14.57)	(16.80)
3	15-30	43	53	96	9	9	18	8	8	16	2	1	3	62	71	133
		(24.57)	(29.94)	(27.27)	(21.95)	(221.43)	(21.69)	(36.36)	(36.36)	(36.36)	(14.29)	(7.69)	(11.11)	(24.60)	(27.95)	(26.28)
4	30-45	51	45	96	11	16	27	4	5	9	3	5	8	69	71	140
		(29.14)	(25.42)	(27.27)	(26.83)	(38.10)	(32.53)	(18.18)	(22.73)	(20.45)	(21.43)	(38.56)	(29.63)	(27.38)	(27.95)	(27.67)
5	45-60	20	24	44	4	6	10	2	6	8	2	3	5	28	39	67
		(11.43)	(13.56)	(12.50)	(9.76)	(14.29)	(12.05)	(9.09)	(27.27)	(18.18)	(14.29)	(23.08)	(18.52)	(11.11)	(15.35)	(13.24)
6	Above 60	14	14	28	2	6	8	1	0	1	1	3	4	18	23	41
		(8.00)	(7.91)	(7.95)	(4.88)	(14.29)	(9.64)	(4.55)	(0.00)	(2.27)	(7.14)	(23.08)	(14.81)	(7.14)	(9.06)	(8.10)
	Total	175	177	352	41	42	83	22	22	44	14	13	27	252	254	506
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
Sex Ratio			1011.43			1024.39			1000.00			928.57			1007.93	

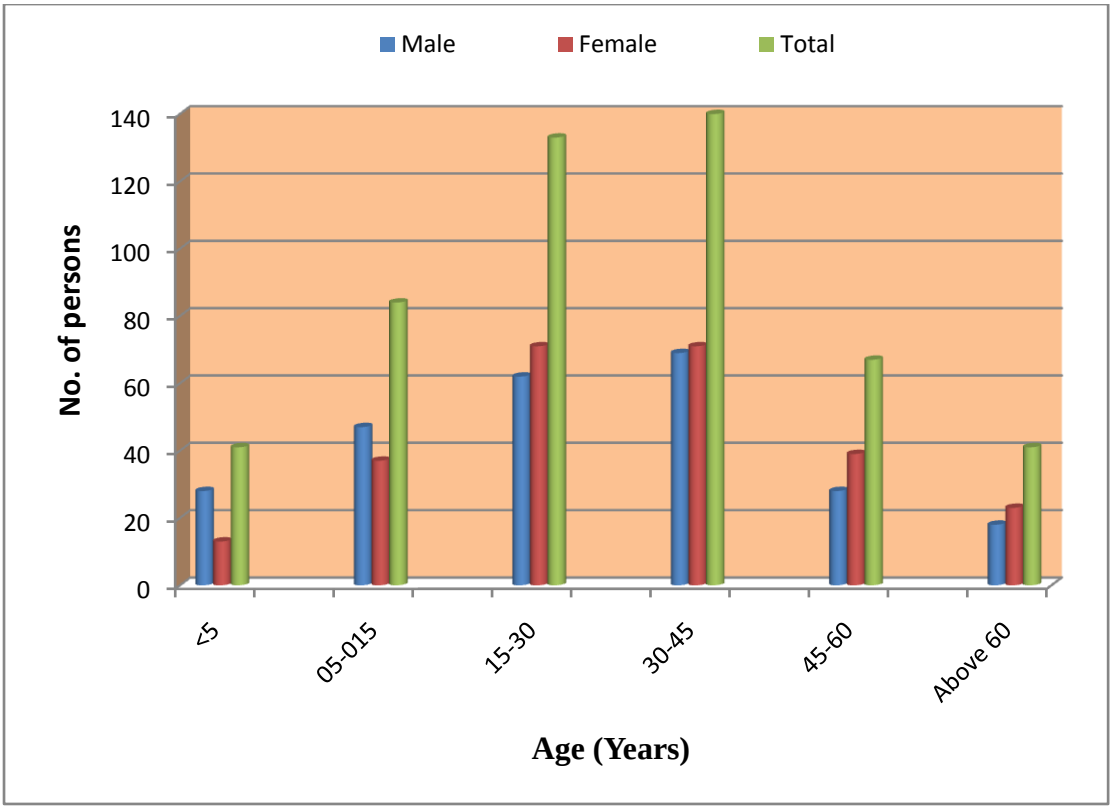


Fig 4.3 Age-wise distribution of the family members

vi. Land utilization pattern

Agriculture by and large is a land based avocation and, as such, land resources are the basic requirement for farming around which economy of farmers revolves. The size of holding that a farmer owns shows the basic strength of the farming family and its utilization shows a reciprocal relationship between the prevailing ecological condition of particular region and men. The systematic utilization of land can contribute to the promotion of economic and cultural advancement. The distribution of land holdings of the sample households has been presented in **Table 4.8**.

The Table revealed that the size of land holding was highest in case of medium farmers (30.00 ha) followed by large farmers (29.21 ha). Area under cultivated land was found highest in case of marginal farmers (25.48 ha) followed by large farmers (23.70 ha). In case of large farmers, after cultivated land, the maximum area was occupied by plantation crops (3.95 ha). The basic reasons for such change is that at the one hand farmers are facing acute shortage of labour because field crops cultivation is mainly labour intensive and on the other hand returns from fruit

cultivation are far higher than that of field crops. The area under pasture and grassland was found highest in case of large farmers (0.66 ha) followed by medium farmers (0.63 ha).

The overall data revealed that about 83.77 per cent of area belonged to cultivated land followed by 6.83 per cent under plantation crops. Fallow land accounted for about 5.42 per cent across the study farms. The area under waste land (uncultivable) was 2.05 per cent.

Table 4.8 Land holding and utilization pattern on sample farms

(ha.)

Sr. no	Particular	Marginal	Small	Medium	Large	Total
1	Owned land	27.17	22.37	30.00	29.21	108.75
		(98.55)	(93.48)	(100.00)	(100.00)	98.23
2	Leased in	0.40	2.16	-	-	2.56
		(1.45)	(9.03)	-	-	2.31
3	Leased out	-	0.60	-	-	0.6
		-	(2.51)			0.54
4	Total (1+2-3)	27.57	23.93	27.59	29.21	110.71
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)
i	Cultivated land	25.48	20.92	22.64	23.70	92.74
		(92.42)	(87.42)	(82.06)	(81.14)	(83.77)
ii	Pasture/ grassland land	0.41	0.44	(0.63)	0.66	2.14
		(1.49)	(1.84)	(2.28)	(2.26)	(1.93)
iii	Plantation	0.14	0.24	3.23	3.95	7.56
		(0.50)	(1.00)	(11.71)	(13.52)	(6.83)
iv	Fallow	0.82	0.98	(0.89)	0.90	6.00
		(2.97)	(4.10)	(3.26)	(3.08)	(5.42)
v	Wasteland/Un-cultivated land	0.72	1.35	0.20	-	2.27
		(2.61)	(5.64)	(0.72)	-	(2.05)
	Total holding	27.57	23.93	27.59	29.21	110.71
		(100.00)	(100.00)	(100.00)	(100.00)	100.00

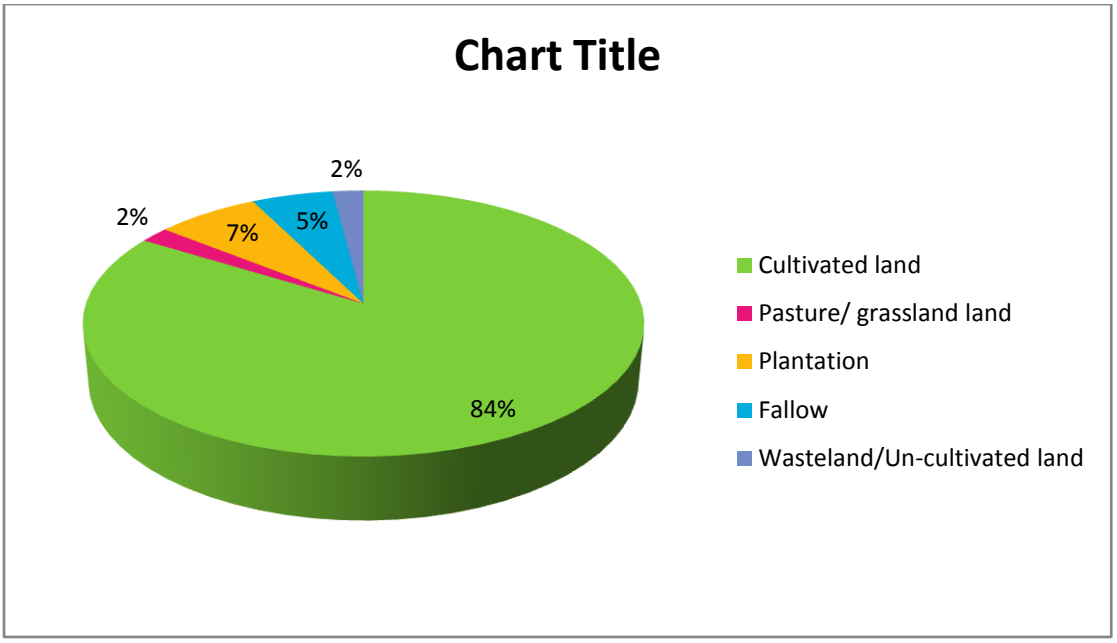


Fig.4.4 Distribution of land holding on sample farms

vii. Livestock inventory

Livestock rearing is an integrated part of farming and holds the distinct complementarily with crop production. The crop by-products on the one hand, make available fodder to livestock that in turn supply precious farm yard manure to the crops. The livestock products like milk, wool, meat, etc. are utilized for meeting the requirement of day-to-day consumption as well as market demand. The detailed description of the livestock reared by sample households is shown in **Table 4.9**. It indicated that the number of total farm animals per household were 3.00, 2.62, 2.40 and 2.34 on marginal, small, medium and large farm situations, respectively. Among the milch animals improved cows and buffaloes were popular under large farmers (35.47 and 50.00%, respectively) as compared to small farmers (23 and 8.67%). This might be due to the reason that large farms were able to provide more feed and fodder inputs from their comparatively bigger size of land holding. The young stock population was highest in case of medium farms (27.50%) followed by small farms (16.41%). The practice of rearing bullocks for ploughing of the field was found to be completely wiped out in case of medium and large farmers due to increased use of farm machinery.

Table 4.9 Livestock Inventory

(No. /farm)

Sr. no	Particulars	Marginal	Small	Medium	Large	Average
1	Cow (Improved)	0.69	0.81	0.73	0.83	0.77
		(23.00)	(30.92)	(30.42)	(35.47)	(29.95)
a)	Milking	0.60	0.57	0.53	0.67	0.59
		(20.00)	(21.76)	(22.08)	(28.63)	(23.12)
b)	Dry	0.09	0.24	0.20	0.17	0.18
		(3.00)	(9.16)	(8.33)	(7.26)	(6.94)
2	Cow (local)	0.17	0.38	0.14	0.17	0.22
		(5.67)	(14.50)	(5.83)	(7.26)	(8.32)
a)	Milking	0.17	0.29	0.07	0.17	0.18
		(5.67)	(11.07)	(2.92)	(7.26)	(6.73)
b)	Dry	-	0.09	0.07	-	0.04
		-	(3.44)	(2.92)	-	(1.59)
3	Buffalo	0.26	0.43	0.87	1.17	0.68
		(8.67)	(16.41)	(36.25)	(50.00)	(27.83)
a)	Milking	0.23	0.29	0.47	1.00	0.50
		(7.67)	(11.07)	(19.58)	(42.74)	(20.27)
b)	Dry	0.03	0.14	0.40	0.17	0.19
		(1.00)	(5.34)	(16.67)	(7.26)	(7.57)
4	Young stock	0.40	0.43	0.66	0.17	0.42
		(13.33)	(16.41)	(27.50)	(7.26)	(16.13)
5	Sheep/goat	1.03	0.24	-	-	0.32
		(34.33)	(9.16)	-	-	(10.87)
6	Bullock	0.45	0.33	-	-	0.20
		(15.00)	(12.60)	-	-	(6.90)
7	Beekeeping (Boxes)	100	-	-	-	25.00
	Total	3.00	2.62	2.4	2.34	2.59
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

*Excluding beekeeping

Note: Figures in parentheses indicate percentages to the total in each category

It has been observed that the practice of rearing sheep and goat was also prevalent in the study area, mainly in case of marginal farms (34.19%) followed by small farm category (9.16%). Beekeeping was also prevalent in case of marginal farmers. It offers a great potential for income generation. With beekeeping, there is no competition for resources used by other forms of agriculture. In contrast with other agricultural projects such as livestock, poultry etc. beekeeping is a relatively low investment venture that can be undertaken by most people (women, youths, the disabled and the elderly). The results are in line with Mujuni et al. (2012).

viii. Durables possessed by different categories

Possession of different types of domestic consumer's durables is not only an indicator of quality of life but also it may be taken as direct indicative of the level of the poverty of the household. In fact the presence of proper income data and possession of domestic consumer durables gives an idea about the living standard of the household. Possession of durables shows considerable variation over different regions and households. Summary of important daily needed durables presented under different farm categories has been shown in **Table 4.10**. The table indicated that the average no. of durables per household was highest in case of large farmers followed by medium, small and marginal farmers in that order. As shown in the Table, the average no. of household assets (6.66) was higher in case of large farmers worth ₹97,766.67 while same was ₹52,683.33 in case of small farmers (3.96). This is because almost all large farmers possess items like T.V., Fridge, washing machine, LPG, Mixer/grinder, Motorcycle and scooter while only a small portion of small and marginal farmers possess these items.

The overall data indicated that out of total durables, 18.44 percent were LPG connections followed by TV (17.82%).

Table 4.10 Durable possessed by the sample farms

(No./farm)

Sr. no	Category	Marginal (78)	Small (21)	Medium (15)	Large (6)	Average (120)
1	TV	0.86	0.90	1.00	1.00	0.94
		(21.72)	(17.68)	(16.86)	(15.01)	(17.82)
2	Fridge	0.56	0.81	0.93	1.00	0.83
		(14.14)	(15.91)	(16.86)	(15.01)	(15.48)
3	Washing machine	0.49	0.81	1.00	1.00	0.83
		(12.37)	(15.91)	(16.86)	(15.01)	(15.04)
4	LPG	0.88	1.00	1.00	1.00	0.97
		(22.22)	(19.65)	(16.86)	(15.01)	(18.44)
5	Mixer/Grinder	0.31	0.76	0.80	1.00	0.72
		(7.83)	(14.93)	(13.49)	(15.01)	(12.82)
6	Cycle	0.17	0.19	0.33	0.33	0.26
		(4.29)	(3.73)	(5.56)	(4.95)	(4.63)
7	Motorcycle	0.60	0.57	0.67	0.83	0.67
		(15.15)	(11.20)	(11.30)	(12.46)	(12.53)
8	Scooter	0.09	0.05	0.20	0.50	0.21
		(2.27)	(0.98)	(3.37)	(7.51)	(3.53)
	Total	3.96	5.09	5.93	6.66	5.41
Average value of durables (☐/farm)		52,683.33	62,271.43	71,720.00	97,766.67	71110.36

Note: Figures in parentheses indicate percentages to the total in each category

xi. Farm implements and equipments possessed by different categories

Farm implements and tools have been analyzed and presented in **Table 4.11**. The total farm machinery was found to be highest in case of large farmers (6.84) followed by medium farmers (2.44). Tractor was found to be major farm machinery in case of large farmers (1.00) followed by medium farm category (0.87).

The average investment on all types of machinery, farm tools and implements was highest in case of large farmers worth ₹ 3,91,217 followed by ₹ 50467.90 in case of marginal farmers and ₹ 1,95,710.00 in case of small farmers. Major share in the total farm investment was on tractors.

Table 4.11 Inventory on farm machinery, implements and tools on sample households (No. /farm)

Sr. no	Category	Marginal (78)	Small (21)	Medium (15)	Large (6)	Average (120)
1	Indigenous/ Improved Plough (no.)	0.73 (29.92)	0.90 (24.19)	0.93 (15.76)	1.00 (14.62)	0.89 (21.12)
2	Tractor (no.)	0.06 (2.46)	0.48 (12.90)	0.87 (14.76)	1.00 (14.62)	0.60 (11.19)
3	Chaff cutter (no.)	0.72 (29.51)	0.81 (21.77)	0.93 (15.76)	1.00 (14.62)	0.87 (20.42)
4	Thresher (no.)	0.03 (1.23)	0.05 (1.34)	0.53 (8.98)	0.67 (9.80)	0.32 (5.34)
5	Spray Pump (no.)	0.72 (29.51)	0.76 (20.43)	1.00 (16.95)	1.00 (14.62)	0.87 (20.38)
6	Leveler (no.)	0.01 (0.40)	0.43 (11.56)	0.47 (7.97)	0.50 (7.31)	0.35 (6.81)
7	Tubewell (no.)	0.08 (3.28)	0.10 (2.69)	0.47 (7.97)	0.67 (9.80)	0.33 (5.94)
8	Water Tank (no.)	0.05 (2.05)	0.14 (3.76)	0.50 (8.47)	0.67 (9.80)	0.34 (6.02)
9	Power Weeder (no.)	0.04 (1.64)	0.05 (1.34)	0.20 (3.39)	0.33 (4.82)	0.16 (2.80)
	Total	2.44	3.72	5.90	6.84	4.73
Average value of durables (No./farm)		50467.90	1,95,710.00	390730.00	391217.00	257031.23

Note: Figures in parentheses indicate percentages to the total in each category

The availability of indigenous/improved plough out of total farm machinery was highest in all farm categories except marginal ones. In case of large farms, along with highest availability of indigenous plough the availability of tractor, chaff cutter and spray pump was also highest with same percentage (14.62%). In

case large farms, the availability of thresher, tubewell and water tank was also higher than other farm categories. The less use of agricultural implements and machinery by small farmers in all farm operations might be due to their low socio economic status whereas high socio economic status might have resulted in better knowledge among medium and large farmers regarding the use of agricultural implements.

The overall data indicated that the availability of major farm machinery such as thresher (5.34%), tubewell (5.94%), leveler (6.81%) and power weeder (2.80%) was less as compared to minor farm machinery such as plough (21.12%), chaff cutter (20.42%) and spray pump (20.38%).

xi. Average expenditure pattern

Information on average expenditure pattern in **Table 4.12** revealed that the expenditure on food items varied from ₹ 30253.85 in respect of marginal farmers to ₹ 46650.67 for large farmers. Among all the farm categories it was found that large (22.39%) and medium (22.59%) farmers spend more money on children education as compared to marginal (18.66%) and small (16.80%) farmers. The total expenditure was found to be highest in case of large farm households (₹1, 02,000.67) followed by medium farmers (₹ 82706.71). This could be due to the fact that the big farmers have large area, and they also adopted other enterprises such as business or horticulture yielding more marketable surplus and they can bargain for more remunerative prices for their produce. "Small holders have low production (due to less inadequate farm practices) and, thereby, less marketable surplus. Their transaction costs are very high. Large farmers also have access to credit, extension, technology, which the small holders do not.

The overall data indicated that the average annual expenditure was found ₹ 80340.85 out of that the maximum expenditure was on food items (₹39333.54) followed by expenditure on children education (₹16500.17).

Table 4.12 Average expenditure pattern

Category	Marginal	Small	Medium	Large	Average expenditure (₹/farm/annum)
Family expenditure on food items (₹)	30253.85	39180.95	41266.67	46650.67	39333.54
	(52.99)	(54.77)	(45.48)	(45.74)	(48.96)
Family expenditure on Medical treatment (₹)	6979.49	9476.19	10106.67	12016.67	9644.76
	(12.23)	(13.25)	(11.14)	(11.78)	(12.00)
Family expenditure on children education (₹)	10650.67	12016.67	20500.00	22833.33	16500.17
	(18.66)	(16.80)	(22.59)	(22.39)	(20.54)
Miscellaneous family expenditure (clothing, entertainment etc) (₹)	9207.69	10857.14	18866.70	20500.00	14857.88
	(16.13)	(15.18)	(20.79)	(20.10)	(18.49)
Total (₹)	57091.7	71530.95	90740.04	102000.67	80340.85
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentages to the total in each category.

x. Women's participation in decision making in existing agricultural operations

Women play a pivotal role in all economic and crop production activities in the hills. About 80 per cent of the field work in agriculture, from sowing to harvesting, post harvest management and dairy management is done by women farmers. In Himachal Pradesh, women farmers are the veritable back-bone of subsistence agriculture. Yet due to gender insensitivity they do not receive the desired recognition. Women farmers' needs and rights have been largely ignored and in many cases their condition is little better than that of farm labour. Women's participation in decision making in existing farming systems has been presented in **Table 4.13**

Table 4.13 Extent of woman participation in agricultural operations (%)

Category	Marginal	Small	Medium	Large	Overall
Consult	43	16	14	4	77
	(55.13)	(76.19)	(93.33)	(66.67)	(64.17)
Consider	26	4	1	2	33
	(33.33)	(19.05)	(6.67)	(33.33)	(27.50)
Final	9	1	-	-	10
	(11.54)	(4.76)	-	-	(8.33)
Total	78	21	15	6	120
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentages to the total in each category

The results indicated that in case of marginal farmers around 11.54 per cent farmwomen finalized the decision of agriculture operations to be performed followed by small farmers (4.76%) whereas in case of medium and large farms, the farm women did not take any decision.

Overall results revealed that 64.17 per cent farmwomen were only consulted for the purpose, 27.50 per cent farm women's opinion was considered whereas 8.33 per cent women finalized the decision.

ix. Cropping pattern on sample farms

Cropping pattern indicates the allocation of total cultivated land under different crops at a particular period of time. A change in cropping pattern would mean a change in the proportionate area under different crops. This shift in the cropping pattern could be advantageous or disadvantageous depending upon the crops. This aspect helps in ascertaining the extent of intensification of cropping on the farms. The results with respect to cropping pattern of sampled farmers are given in **Table 4.14**.

a. Kharif crops

Analysis of studies in the **Table 4.14** on cropping pattern in sample farms revealed that during *kharif,* paddy was occupying largest share of area under all *kharif* season crops. The highest area under paddy was found in case of large farmers

(66.67%) followed by small farmers (66.23%). The per cent share under maize crop was found to be highest in case of large farmers (28.03%) followed by medium farmers (27.81%). Further vegetables were being grown by all farm categories where farmers were having sufficient available cultivable area and resources but were found highest in case of small farm (23%) followed by marginal farmers (15.15%). Pulses were only grown by large farmers and these crops constituted only 2.02 per cent of the total *kharif* crop area.

In case of large farmers, paddy was a leading crop (66.67%), maize at number II (28.03%), pulses at III (2.02%) and vegetables IV position (1.52%). Sorghum as fodder crop was being grown by all households for feeding livestock whatsoever in possession and had highest share in case of marginal farmers (15.15%) followed by small farmers (8.00%).

b. Rabi crops

Likewise studies on cropping pattern in sample households revealed that during *Rabi* season, wheat was occupying largest share of area under all farm categories. The highest area under wheat crop was found in case of large farmers (81.82%) followed by medium farmers (79.47%). The per cent share of area under vegetables was found to be highest in case of small farmers (28%) followed by marginal farmers (12.12%). Besides, berseem was most popular green fodder crop being grown by all farm households varied from 12.12 per cent to 2.78 percent from marginal farmers to large farm category for feeding the livestock population. The cropping intensity, which signifies the extent of crop intensification on the farm, was found to be highest in case of large farmers (196.97%) followed by medium farmers (195.36%). It can be observed from the Table that in both the seasons the large farmers do not prefer to grow pulses, oilseeds and vegetables, it could be due the reason that pulses and vegetables are more vulnerable to adverse weather, leading to higher risk of failure. Rather than pay for crop insurance (where it is available), farmers prefer to simply avoid these crops. Wheat and rice require less care and effort to grow than vegetables.

Table 4.14 Cropping pattern on sample farms

(ha./farm)

	Crops	Marginal	Small	Medium	Large
A.	**Kharif**				
1	Maize	0.02	0.05	0.42	1.11
		(6.06)	(5.00)	(27.81)	(28.03)
2	Paddy	0.20	0.64	1.00	2.64
		(60.60)	(64.00)	(66.23)	(66.67)
3	Vegetables	0.05	0.23	0.04	0.06
		(15.15)	(23.00)	(2.65)	(1.52)
4	Pulses	-	-	-	0.08
					(2.02)
5	Fodder (Sorghum)	0.06	0.08	0.05	0.07
		(15.15)	(8.00)	(3.31)	(0.25)
Total kharif area (A)		0.33	1.00	1.51	3.96
		(100)	(100)	(100)	(100)
B.	**Rabi**				
1	Wheat	0.20	0.55	1.20	3.24
		(68.61)	(55.00)	(79.47)	(81.82)
2	Oat	0.02	0.09	0.09	0.12
		(6.06)	(9.00)	(5.96)	(3.03)
3	Berseem	0.07	0.08	0.14	0.20
		(21.21)	(8.00)	(9.27)	(5.05)
4	Vegetables	0.04	0.28	0.08	0.11
		(12.12)	(28.00)	(5.30)	(2.78)
5	Oilseed (Mustard)	-	-	-	0.29
					(7.32)
	Total Rabi area (B)	0.29	0.93	1.44	3.84
C.	Total cropped area (A+B)	0.62	1.93	2.95	7.80
D.	Net sown area	0.33	1.00	1.51	3.96
E.	Cropping intensity (%)	187.89	193.00	195.36	197.46

4.1.3 Resource use, input and output

i. Crop wise inputs used

The crop wise inputs used and output of different categories of farm in the study area have been given in **Table 4.15**.

a. Input used (kharif)

The use of various inputs in different crops under different farm categories in kharif season were analysed and has been presented in **Table 4.15 (a)**. It can be seen from the Table that in the production of foodgrains, a noticeable difference was observed in the use of various inputs like seed, farm yard manure, fertilizers, chemicals such as herbicides, fungicides and insecticides and human labour. As the size of land holding increased the rate of use of inputs were also increased. The involvements of inputs were found highest under large farmers followed by medium farmers in both the seasons (kharif and rabi) as well as on all types of crops. The overall data indicated that on an average, farmers of different farm categories generally used higher seed rate (27.57 kg/ha) of maize than the recommended one (20 kg/ha). Among fertilizers, urea and IFFCO mixture were the most common fertilizers used for cereals. The farmers were not aware of phosphatic and potassic fertilizers. The average use of urea (51.51 kg/ha) and IFFCO (64.67 kg/ha) was much lower than the recommended dose.

Table 4.15 (a): Crop wise input used (Maize)

(per ha)

Sr. no.	Name of crop	Marginal	Small	Medium	Large	Average
1	Seed (kg)	25.78	26.72	27.20	30.56	27.57
2	FYM (q)	87.54	98.99	88.89	92.86	92.07
3	Fertilizer (kg)					
i)	Urea	46.45	72.56	44.23	42.81	51.51
ii)	IFFCO (NPK)	62.76	43.60	66.58	85.76	64.67
iii)	Others (MOP, SSP)	-	-	-	-	-
	Total	109.21	116.16	110.81	128.57	116.18
4.	Chemicals (Rs)	207.14	242.42	278.88	340.50	204.74
5.	BPD	19.62	15.56	-	-	8.80
6.	Tractor hours	12.50	12.00	12.00	12.50	12.25
7.	Human Labour (Mandays)	99.00	107.00	145.00	150.00	125.00

Likewise in case of paddy **Table 4.15 (b)** revealed that the average seed rate used by farmer was higher (38.18 kg/ha) than recommended rate (25 kg/ha). The rate of application of urea was also higher (110.26 kg/ha) than the recommended dose. The Table 4.16 also indicated that in case of paddy there was no use of IFFCO fertilizer. In both the crops the use of bullock was only found in case of marginal and small farmers. The use of bullocks for ploughing of the field was found to be completely wiped out in case of medium and large farmers due to increased use of farm machiner

Table 4.15 (b) Crop wise input used (Paddy)

(per ha)

Sr. no.	Name of crop	Marginal	Small	Medium	Large	Average
1	Seed (kg)	36.45	38.16	39.46	38.66	38.18
2	FYM (q)	87.56	113.78	102.97	78.95	95.82
3	Fertilizer (kg)					
i)	Urea	98.70	107.45	115.10	119.80	110.26
ii)	IFFCO (NPK)	-	-	-	-	-
iii)	Others (MOP, SSP)	-	-	-	-	-
Total		98.70	107.45	115.10	119.80	110.26
4.	Chemicals (Rs)	302.70	320.92	327.50	333.94	321.27
5.	BPD	18.72	22.53	-	-	10.31
6.	Tractor hours	12.50	13.50	12.50	12.50	12.75
7.	Human Labour	129	145.00	149.00	162.00	146.25

b. Input used (rabi)

The use of various inputs in different crops under different farm categories in *rabi* season were analysed and has been presented in **Table 4.15 (c)**.

Table 4.15 (c) Crop wise input used (Wheat)

(per ha)

Sr. no.	Name of crop	Marginal	Small	Medium	Large	Average
1	Seed (kg)	102.40	110.98	113.11	117.95	111.11
2	FYM (q)	134.80	140.19	122.66	118.63	129.07
3	Fertilizer (kg)					
i)	Urea	40.65	55.33	72.73	76.63	61.34
ii)	IFFCO (NPK)	67.57	80.23	64.52	104.15	79.12
iii)	Others (MOP, SSP)	-	-	37.47	52.58	22.51
	Total	108.22	135.56	174.72	233.36	162.97
4.	Chemicals (Rs)	280.50	334.97	344.57	370.58	332.65
5.	BPD	15.68	14.59	-	-	7.57
6.	Tractor hours	7.50	7.00	7.50	7.00	7.25
7.	Human Labour (Mandays)	119	127	136.00	143	131.25

In case of wheat the average seed rate used by farmer was also higher (111.11 kg/ha) than recommended rate (100 kg/ha). The rate of application of urea was lower (61.34 kg/ha) than the recommended dose. The results also indicated that in case of wheat there was use of MOP and SSP. The use of bullock was only found in case of marginal and small farmers.

ii. Crop wise output

a. Kharif crops

The production of kharif crops on per farm basis has been worked out and displayed in **Table 4.15 (d).** Paddy was the major kharif crop being grown in all the selected blocks of Kangra district. Marginal and small farmers were growing this crop mainly for self consumption but in case of medium and large farmers it was grown for selling purpose as main motive was self consumption. From Table it was indicated that per

farm production of paddy was maximum under large farm (78.61 q/farm) followed by medium farms (28.21 q/farm). The output per unit 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 kharif crops in the study areas have been worked out and given in Table 4.15 (d). It can be seen from the table that the productivity of paddy was quite higher under large farms (29.78 q/ha) as compared to marginal farms (23.55 q/ha). Likewise the byproduct (straw) productivity was also higher under large farms (38.71 q/ha) as compared to marginal farms (30.62 q/ha).

Maize was next important crop being grown mainly by large and medium farmers. Per farm production of maize was maximum under large farm (40.00 q/farm) followed by medium farms (14.50 q/farm). It can be seen from the table that the productivity of maize was quite higher under large farms (36.04 q/ha) as compared to marginal farms (25 q/ha). Likewise the byproduct (straw) productivity was also higher under large farms (285 q/ha) as compared to marginal farms (240 q/ha).

4.15 (d) Crop wise output (kharif)

Sr. no.	Crop area (ha)	Production (q)		Productivity (q/ha)	
		Main	By product	Main	By product
Maize					
Marginal	0.02	0.50	4.80	25.00	240
Small	0.05	1.72	12.50	34.40	250
Medium	0.42	14.50	113.40	34.52	270
Large	1.11	40.00	316.35	36.04	285
Paddy					
Marginal	0.2	4.71	6.12	23.55	30.62
Small	0.64	15.10	22.64	23.59	35.38
Medium	1.00	28.21	36.67	28.21	36.67
Large	2.64	78.61	102.19	29.78	38.71

b. Rabi crop

Wheat was the major rabi crop being grown in all the selected blocks of Kangra district. Marginal and small farms were growing this crop mainly for self consumption where as in respect of large and medium farmers some quantity of wheat produce was being sold out also besides meeting out the family requirement. It can be seen from the **Table 4.15 (e)** that per farm production of wheat ranged between 6.68 to 125.50 quintals per farm. The productivity of wheat crops was quite higher on large farm (38.73 q/ha) as compared to marginal farms (34.25 q/ha). Likewise the byproduct yield of the crop varied from 10.20 to 187.92 q/farm and was found highest in case of large farm category (187.92 q/farm).

4.15 (e) Crop wise output (Rabi)

Sr. no.	Crop area (ha)	Production (q)		Productivity (q/ha)	
		Main	By product	Main	By product
Wheat					
Marginal	0.2	6.85	10.2	34.25	51.00
Small	0.55	19.35	29.01	35.18	52.75
Medium	1.20	43.85	65.76	36.54	54.80
Large	3.24	125.50	187.92	38.73	58.00

4.1.4 Predominant farming systems on sample farms

The overall data in **Table 4.16** revealed that on enterprises based characterization, four types of farms, were identified. These were crops+ livestock, crops+livestock+vegetables, crops+livestock+bee keeping and vegetables+livestock. An overall observation revealed that large portion of farmers (marginal farmers) followed crops+livestock+vegetables farming system (65.83%) followed by crops+livestock (28.33%). Crops+livestock+beekeeing and vegetables+livestock farming system were also adopted with equal percentage (0.83%) of farm households.

Crops+livestock+vegetables was the major farming system under marginal (74.36%) and small farms (76.19%) followed by crops +livestock farming system. 1.28 per cent of marginal farmers also adopted crops+livestock+beekeeing farming system. Crops+livestock farming system was dominant under medium (73.33%) and large farmers (83.33%).

Table 4.16 Predominant farming systems on sample farms

Farming system	Category				
	Marginal	Small	Medium	Large	Overall
Crops only	4	-	-	-	4
	(5.13)				(3.33)
Crops + livestock	14	4	11	5	34
	(17.95)	(19.05)	(73.33)	(83.33)	(28.33)
Crops +livestock+vegetables	58	16	4	1	79
	(74.36)	(76.19)	(26.67)	(16.67)	(65.83)
Crops+livestock+bee keeping	1	-	-	-	1
	(1.28)				(0.83)
Vegetables+livestock	-	1	-	-	1
		(4.76)			(0.83)
Vegetables only	1	-	-	-	1
	(1.28)				(0.83)
Total	78	21	18	6	120
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentages to total in each category

4.1.5 Average farm income from sample farms

Data on average farm income given in **Table 4.17** revealed that the total income of sample households from main occupation i.e. agriculture was highest in case of large farmers (₹1, 54,050) followed by medium farmers (₹1, 50,605.00). Same as in case of livestock, the income was found to be highest in case of large farmers (₹60,185.00) followed by medium farmers (₹12,960.00). As given under occupational structure the business was only carried by marginal farmers and the income from business was only ₹14076.92/annum.

Total farm income (₹/annum) was 88,059.79, 1, 20,228.83, 1.63, 565.00 and 2, 14,235.00 in respect of marginal, small, medium and large households, respectively.

Table 4.17 Average farm income of different sample farms

Category	crops (₹)	Business (trade shops) (₹)	Livestock (₹)	Total farm income (₹/annum)
Marginal	60,563.00	14076.92	13,419.87	88,059.79
Small	1,02,457.40	-	17,771.43	1,20,228.83
Medium	1,50,605.00	-	12,960.00	1,63,565.00
Large	1,54,050.00	-	60185.00	2,14,235.00

4.1.6 Share of crop and livestock enterprises in farm income

The data on % share of different enterprises in farm income has been given in **Table 4.18**. The results revealed that the average % share in income was found to be highest in case of crops+livestock farming system (96%) as compared to crops (79.49%) and livestock (16.51%).

Table 4.18 Share of crop and livestock enterprises in farm income on the sample farms (%)

Farming systems	Marginal	Small	Medium	Large	Average
Crops	68.77	85.22	92.08	71.91	79.49
Livestock	15.24	14.78	7.92	28.09	16.51
Crops+livestock	84.01	100.00	100.00	100.00	96.00

4.1.7 Constraints faced by the farmers practicing integrated high value based farming systems

All sample households were interviewed to identify the constraints in integrated farming system. There were seven constraints in integrated high value based farming system as presented in **Table 4.19** based on their importance and the constraints then ranked from I to VIII according to the percentage. 91.67 % (I) of the respondents reported that lack/uncertainty in price of agricultural produce was the major constraint faced by them. Non – availability of suitable inputs and infrastructure in time was reported as a constraint by 85.83 per cent (II) of the respondents. Next in importance was the lack of family labour due to involvement in another activity (83.33%, III). Irregular supply of water/electricity was reported as a constraint by 82.50 per cent (IV) of the respondents. This was followed by lack of funds (77.50%, V), lack of risk bearing (76.67%, VI), caste factor in adopting piggery, poultry (49.16%, VII) and lack of technical knowhow (35.00%, VIII). All the above mentioned constraints seemed to commonly exist in various parts of the state. These observations derive support from the findings of Pushpa (2010) who revealed that non-availability of labour, inadequate irrigation facilities, lack of credit facilities and uncertainty in price of agricultural produce were the problems faced by farmers.

Table 4.19 Constraints in integrated high value based farming system

(per cent multiple response)

Sr. No	Constraints in integrated high value based farming system	Marginal	Small	Medium	Large	Total	Rank
1	Non availability of suitable inputs/infrastructure	88.46	76.19	86.67	83.33	83.66	II
2	Lack of family labour due to involvement in another activity	87.18	71.43	80.00	83.33	80.49	III
3	Irregular supply of water/electricity	85.90	80.95	73.33	66.67	76.71	IV
4	Lack of funds	83.33	76.19	66.67	33.33	64.88	V
5	Lack of technical know	35.90	38.10	33.33	16.67	31.00	VIII
6	Caste factor in adopting piggery, poultry	38.46	71.43	66.67	66.67	60.81	VII
7	Lack of risk bearing	82.05	71.43	60.00	66.67	70.04	VI
8	Lack of market price	92.31	90.48	93.33	83.33	89.86	I

4.2 Diversification of existing farming system

4.2.1 Description of the study

The present study was conducted at Fatehpur and Dehra block of Kangra district. For this study a benchmark survey of 24 farm families (12 in Fatehpur and 12 in Dehra block) has been already conducted and the surveyed farmers were selected for diversification of their existing farming systems. For the purpose, assistance was taken from on farm research progamme already going on in Fatehpur and Dehra block. The results emanated from the present investigation have been presented in this chapter through Tables and Graphs. The results have been discussed under the following headings:

i. Basic information of farmers

The nature of ownership of land, cropping system and family size of farmer have great bearing on decision making in the adoption of innovations and improved practices to great extent. These farm households were categorized according to their dominant farming practice viz. field crops only, field crops + dairy and field crops + dairy + goat/sheep. During the first year, out of total farm families 58.33 per cent were practicing field crops + dairy farming system where as field crops + dairy + goat/sheepwas dominant among 37.50 per cent farm families. The same was followed for the second year.

Table 4.20 Types of farming systems, mean holding size (ha) and family size (no's)

Sr. no.	Farming System (s)	No. of households	Mean holding size (ha)	Mean family size (no's)
		2014-15		
1	Field crops alone	1 (4.17)	0.60 (30.77)	5.50 (32.64)
2	Field crops+dairy	14 (58.33)	0.67 (34.36)	5.68 (33.71)
3	Field crops+dairy+goat/sheep	9 (37.50)	0.68 (34.87)	5.67 (33.65)
	Total	24 (100)	1.95 (100)	16.85 (100)
		2015-16		
1	Field crops alone	1 (4.17)	0.60 (30.77)	5.50 (32.64)
2	Field crops+dairy	14 (58.33)	0.67 (34.36)	5.68 (33.71)
3	Field crops+dairy+goat/sheep	9 (37.50)	0.68 (34.87)	5.67 (33.65)
	Total	24 (100)	1.95 (100)	16.85 (100)

Note: Figures in parentheses indicate percentages to the total in each category

It can be seen from the **Table 4.20** that field crops + dairy + goat/sheepfarming system was having 34.87 per cent of mean holding size which was higher than field crops alone (30.77%). The mean family size was found to be highest under field crops+dairy (33.71%) farming system followed by field crops + dairy + goat/sheep (33.65%).

ii. Farming system components

In the farming system, it is always emphasized to combine cropping with other enterprises or activities as given in **Table 4.21**. These enterprises are interrelated and interacting among themselves. The end products and wastes of one enterprise are used as inputs in others. For example the wastes of dairying like dung, urine, refuse etc, are used for the preparation of farmyard manure, which is an input in cropping systems. The straw obtained from the crop is used as fodder for cattle. The cattle are used for different field operations for growing crops. Thus, different enterprises of farming system are highly interrelated. The results indicated that in Kangra district maize-wheat and paddy-wheat were the dominant cropping systems with rearing of buffaloes, cows and sheep/goat.

Table 4.21 Different components of farming systems

Sr. no.	Farming system (s)	Components	
		Cropping systems	Livestock
1	Field crops alone	Maize-wheat Paddy-wheat	Bullocks
2	Field crops+dairy	Maize-wheat Paddy-wheat	Buffalo, cow (Local/Crossbred)
3	Field crops+dairy+Goat/Sheep	Maize-wheat Paddy-wheat	Buffalo, Cow (Local/Crossbred) Goat/Sheep

iii. Benchmark status of the area

The benchmark status of the area and net income from the various modules as shown in **Table 4.22** revealed that field crops + dairy farming system provides maximum income (₹ 22465) followed by field crops + dairy + goats/sheep (₹ 20147) whereas in case of field crops alone the net income was ₹ 9230.

Table 4.22 Benchmark status of area & net income from various modules

Farming System (s)	Benchmark net income (₹/household)				
	Cropping systems	Livestock	Other components if any	Product diversification	Total
Field crops alone	4380	4850	-----	----	9230
Field crops+dairy	8465	14180	------	------	22465
Field crops+dairy +goat/sheep	12261	7886	------	--------	20147

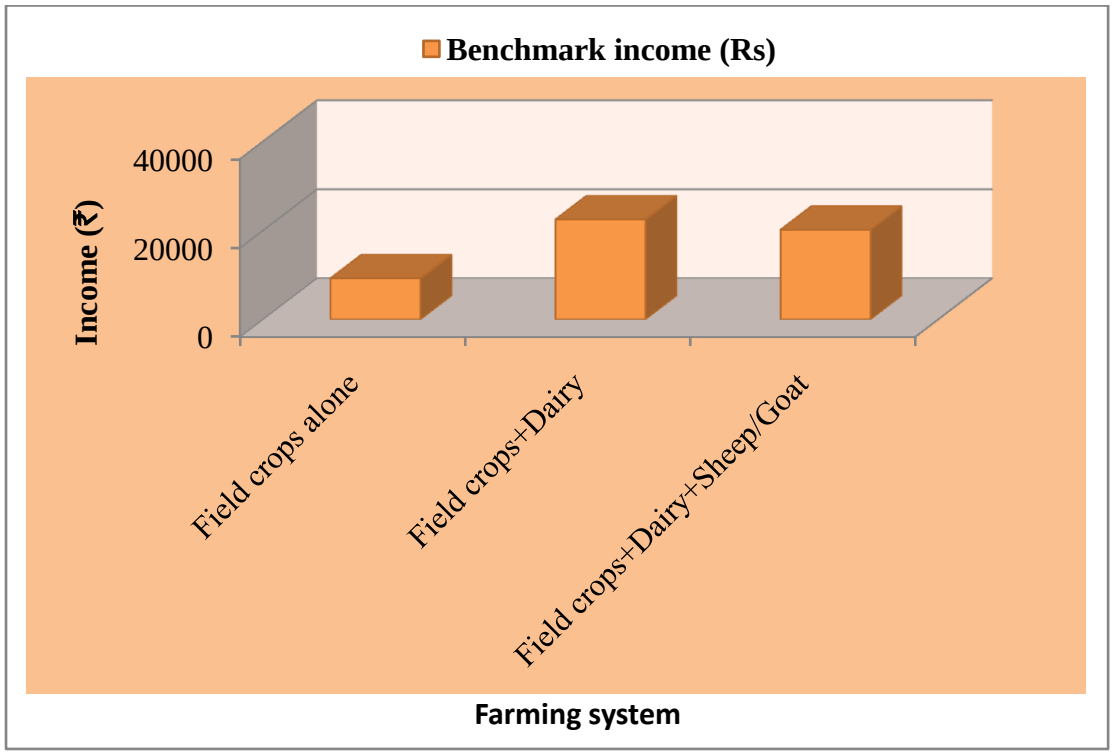


Fig.4.5 Benchmark net income under different modules

iv. Details about constraints in the existing farming system and interventions provided under different modules

On the basis of information collected through benchmark survey, the **Table 4.23** indicated the constraints limiting the overall crop productivity/profitability in each farming system. These were use of local varieties, inadequate nutrient application and untimely weed control in case of field crops alone, whereas in case of

field crops+dairy or goat/sheep farming system, the dominant constraints were mineral deficiency and green fodder shortage.

Some critical inputs as interventions given in **Table 4.23** were provided to the surveyed households. The seedlings of vegetable crops were also provided to needy and willing farmers to increase their livelihood status. The selected households got benefit by way of free fertilizer, seed and plant protection measures etc. The impact of interventions in the improvement of productivity and increase in net income was carried out.

v. Existing cropping pattern of the sample farmers selected for diversification

The details of existing cropping pattern are presented in **Table 4.24**. Use of local varieties, under dose of nutrients and improper and untimely weed control were the practices because of which the farmers were getting lower income of their produce. Local varieties such as Sathu in case of maize, Permal, Begum, Aachu and Chainu in case of paddy, 108, 308, Kalyan, 343 and 23 in case of wheat, Kufri jyoti in case of potato were mostly used by the farmers with under dose of nutrients and improper weed control. In case of fodder crops, farmers were not using any fertilizer. Likewise due to lack of awareness they were not capable of managing diseases and insect/pest problems in their fields.

vi. Interventions and diversified cropping pattern of sample farmers

The details about interventions provided to the selected farmers and diversified cropping pattern are presented in **Table 4.25**. Interventions were like sowing improved crop varieties with recommended fertilizer doses, timely & scientific weed control, proper management of insect/pest, disease, increase in income through inclusion of oilseeds (gobhi-sarson) and vegetables (potato and onion). Interventions in the Table 4.28 were given to the farmers to increase their income. Kanchan hybrid 101 for maize, Kasturi basmati and HPR 2612 for rice, HPW 236/115 for wheat, Pukhraj for potato, N-53 in case of onion, HPN-3 in case of gobhi-sarson were some improved varieties which were used as intervention for diversification.

Table 4.23 Salient features of interventions for diversification in each module

Farming System	Diversification module	Constraints in existing farming system	Interventions
Field crops alone	Crop	Use of local variety, inadequate nutrient application, untimely weed control	Sowing of improved crop varieties with recommended fertilizer doses, timely & scientific weed control, proper management of insect/disease, increase in income through inclusion of gobhi-sarson, potato & onion crops.
	Product	Surplus crop produce	Supply of sieves, proper grading of produce
	Capacity building		Training on complete Package of practices for cereal/ vegetable Crops
Field crops+dairy or Field crops+dairy+goat/sheep	Crop	Use of local variety, inadequate nutrient application, untimely weed control	Sowing of improved crop varieties with recommended fertilizer doses, timely & scientific weed control, proper management of insect/disease, increase in income through inclusion of gobhi-sarson, potato & onion crops
	Livestock	Mineral deficiency, green fodder shortage	Mineral mixture supplementation, sowing of improved fodder varieties & to ensure green fodder supply throughout the year
	Product	Surplus crop produce	Supply of sieves, proper grading of produce
	Capacity building		Training on complete Package of practices for cereal/ vegetable crops & on compost making

Table 4.24 Existing cropping pattern of sample farmers

	Name of crop	Benchmark status of cropping pattern Variety	NPK	Weed control	Disease/insect pest
kharif					
1	Maize	Sathu Local/traditional	Under dose of nutrients, mostly N application (30-40 kg/ha)	Improper, untimely weed control,	Lack of awareness
2	Rice	Permal, Begum, Aachu, Chainu Local/traditional	Under dose of nutrients, mostly N application (55-60kg/ha)	Improper untimely weed control	Lack of awareness
3	Sorghum	Local/traditional	-	-	-
Rabi					
1	Wheat	108,308,kalyan,343,23 (Local/traditional)	Under dose of nutrients, mostly N application (45-60kg/ha)	Improper untimely weed control	Lack of awareness
2	Onion	Local/traditional	Under dose of nutrients	Improper untimely weed control	Lack of awareness
3	Potato	Kufri/jyoti Local/traditional	Imbalanced use of nutrients mostly N application	Improper untimely weed control	Lack of awareness
4	Barseem	Local/traditional	-	-	-
5	Oats	Local/traditional	-	-	-

Table 4.25 Details of interventions and diversified cropping pattern of sample farmers

Sr. No.	Name of crop	Variety	Seed rate (kg/ha)	N	P	K	Weed control (kg/ha)	Disease/insect pest
Kharif								
1	Maize	Kanchan hybrid 101	20	90	45	30	Atrazin pre-emergence @ 1.5	-
2	Rice	HPR -2612 Kasturi basmati	25	90	40	40	Butachlor @ 1.25	-
3	Sorghum	Hybrid	55	80	60	-		-
4	Soybean	Megha	75	20	60	40	-	-
Rabi								
1	Wheat	HPW-236/ HPW-155	100	120	60	30	Isoproturon @ 1.25	Seed treatment with bavistin @ 2.5 g/kg seed
2	Potato	Pukhraj	2000-2500	120	80	60	-	
3	Onion	N-53	10-12	125	75	60	-	-
4	G.Sarson	HPN-3	6	120	80	60		-
5	Barseem	Improved variety	25	25	60	-		
6	Oats	Improved variety	100	70	40			

vii. Difference in yields before and after intervention/diversification

By giving interventions along with package of practices, there was an increase in maize equivalent yield as compared to bench mark yield. **Table 4.26** indicated that in field crops+dairy farming system maize equivalent yield was 76.12% more than benchmark yield because of inclusion of oilseeds (gobhisarson) and vegetables. In case of Field crops+dairy+goat/sheep farming system during first year of diversification, there was an increase in maize equivalent yield by 55.18% due to interventions but in second year of diversification there was increase in the yield of respective crops but decrease in total maize equivalent yield by 51.75%. The increase was due to interventions but the total decrease was due to absence of interventions in the respective year.

Table 4.26 Maize equivalent yield (q/ha)

		Benchmark	Diversification (2014-15)	Diversification (2015-16)
Sr.no	Name of crop	Maize equivalent yield (q/ha)	Maize equivalent yield (q/ha)	Maize equivalent yield (q/ha)
Field crops alone				
1	Maize	17.3	33.0	35.7
2	Wheat	14.6	23.3	35.0
3	Sorghum	29.2	34.2	45.0
	Total	61.0	90.5	115.7
Field crops +Dairy				
1	Maize	18.6	26.3	30.3
2	Wheat	23.2	38.9	39.9
3	Sorghum	22.7	27.6	38.9
4	Rice	37.9	52.0	52.0
5	Berseem+Oats	29.8	42.7	47.7
6	Gobhisarson*	0.0	60.2	61.0
7	Onion*	0.0	175.6	283.9
	Total	132.2	423.4	553.7
Field crops+dairy+goat/sheep				
1	Maize	16.9	21.3	27.2
2	Wheat	23.6	33.8	38.5
3	Sorghum	13.9	38.1	38.5
4	Rice	33.3	56.4	56.6
5	Berseem	22.7	66.1	78.6
6	Gobhi-Sarson*	27.8	44.4	47.0
7	Onion*	-	231.5	-
8	Soybean*	-	88.8	-
9	Potato*	-	129.7	-
	Total	138.2	710.0	286.4

*inclusion of new crops

viii. Average milk yield before intervention and after intervention

The effect of interventions on milk yield was shown in **Table 4.27**. The average milk yield after interventions was increased as compared to benchmark average milk yield. The increase in milk yield was due to providing proper mineral nutrition and green fodder supply through sowing of improved fodder seed. In first year, there was 11.93 per cent increase in average milk yield in case of field crops+dairy+goat/sheep farming system followed by field crops+dairy farming system (8.26%). In second year in case of field crops +dairy farming system, the increase in average milk yield was lesser (2.98%) than first year due to dry period of the milch animals whereas in case of field crops+dairy+goat/sheep farming system, the average milk yield was increased by 16.39 per cent as compared to bench mark yield.

ix. Per farm profitability from product diversification

Technology related factors covering not only seed, fertilizers, marketing, storage but also processing. There was no equipment already possessed by farmers for grading the food grains. Farmers get the low price for food grain and also lack of technical knowledge about value addition. To adopt the product diversification, farmers were provided knowledge for use of grading food grain, grading sieves were given to them. They were provided with seedlings of vegetables (cauliflower, okra, broccoli and onion) to raise the product. The profitability from product diversification is indicated in **Table 4.28**. The data in the Table indicated that per farm profitability was depending upon the quantity of the raw material provided for product development. In first year of diversification, per farm profitability was found highest in case of field crops+dairy farming system (₹ 1699.12) followed by field crops+dairy+goat/sheep farming system (₹ 1526.08). This was mainly due to providing more number of products such as cauliflower, okra, onion seedlings and sieves for grading to the selected farmers in case of field crops+dairy farming system as compared to field crops+dairy+goat/sheep farming system. Likewise in second year, per farm profitability was found to be highest in case of field crops+dairy farming system (₹ 1990.24) followed by field crops alone (₹ 1680.00).

Table 4.27 Average milk yield before intervention and after intervention

Sr. no.		Benchmark status			Interventions	After intervention	
		No. in lactation	Average no.	Average milk yield (lt/animal/lactation)		No. in lactation	Average milk yield (lt/animal/lactation)
				First year			
Field crops+dairy							
1	Cows (8)	3	0.57	900	Mineral mixture, Green fodder supply	4	1000.00
2	Buffaloes (19)	15	1.36	1054		15	1130.00
	Total			1954.00			2130.00
Field crops+dairy+goat/sheep							
1	Cows (5)	5	0.56	760	Mineral mixture, Green fodder supply	5	827
2	Buffaloes (9)	7	1.00	1000		7	1171.42
3	Goat/sheep (18)	-	2	-		-	-
	Total			1760.00			1998.42
				Second year			
Field crops+dairy							
1	Cows (8)	3	0.57	900	Mineral mixture, Green fodder supply	4	993.75
2	Buffaloes (19)	15	1.36	1054		13	1069.23
	Total			1954.00			2062.98
Field crops+dairy+goat/sheep							
1	Cows (5)	5	0.56	760	Mineral mixture, Green fodder supply	5	855.00
2	Buffaloes (9)	7	100	1000		5	1250.00
3	Goat/sheep (18)	-	2.00	-			-
	Total			1760.00			2105.00

Table 4.28 Per farm profitability from product diversification

Sr No.	First year				Second year			
	Product	Total product obtained after processing (kg)	Price of the processed product (₹/kg, ₹/unit)	Total value (₹)	Product	Total product obtained after processing (kg)	Price of the processed product (₹/kg, ₹/unit)	Total value (₹)
Field crops alone								
1	Cauliflower	70.00	20.00	1400.00	Cauliflower	84	20	1680
Total (per farm)				1400.00				1680.00
Field crops+dairy								
1	Cauliflower	975.00	16.50	16087.50	Cauliflower	1524	14.1	21488.4
2	Okra	130.00	15.00	1950.00	Broccoli	69	30	2070.0
3	Onion	210.00	10.00	2100.00	Manual grading of surplus produce	100 (75+25)	30&15	2625.0
4	Manual grading of surplus wheat seed produce	125 (100+25)	24&10	2650.00				
Total				23787.5				27863.4
Per farm				1699.12				1990.24
Field crops+dairy+goat/sheep								
1	Cauliflower	212.00	17.50	3710.00	Cauliflower	293	15.67	4591.31
2	Okra	85.00	15.00	1275.00	Broccoli	49	30	1470
3	Onion	90.00	10.00	900.00	Sieves (Manual grading)	200 (150+50)	30 &15	5250
4	Manual grading of surplus wheat seed produce	325 (250+75)	24 &11.33	6849.75	-	-	-	-
Total				13734.75				11311.31
Per farm				1526.08				1256.8

x. Capacity Building

This was done through arranging trainings. For example training on vermicompost making, benefits of sprouting seeds and value addition in soybean. The information provided through pamphlets to enhance the capacity of the farmers regarding farming activities. In this study the capacity building of the farmers could not be quantified.

xi. Interventional cost and net income of different modules

Interventional cost and net income of different modules has been presented in **Table 4.29 (Fig. 4.6) and 4.30 (Fig. 4.7)**. The overall data in Table 4.29 and 4.30 indicated that in first year of diversification, in field crops+ dairy farming system with total cost of interventions of ₹ 3594 in all the modules, net returns realized were ₹ 20126 whereas for the field crops+dairy+goat/sheep farming system with total cost of interventions ₹ 3505 net returns realized were ₹ 25231. Due to diversification, increase in benchmark income recorded in respect of field crops+dairy farming system was 35% whereas corresponding increase in benchmark income in respect of field crops+dairy+goat/sheep farming system was 79%.

During second year in field crops+dairy farming system with total cost of interventions of ₹ 3465 in all the modules net returns realized were ₹ 26504 whereas for field crops+dairy+goat/sheep farming system and with total cost of interventions of ₹ 4153 net returns realized were ₹ 25630. The results revealed that crop yields as well as overall profitability from crop component can satisfactorily be increased by diversifying the existing cropping systems through inclusion of high yielding recommended crop varieties and adopting recommended package for the component crops in the system. Same way encouraging results in income have been recorded when the existing livestock is supplemented with recommended doses of mineral mixture and also when fed with green fodder particularly during acute shortage periods.

Table 4.29 Cost of interventions

(₹/household)

Farming Systems	Holding size (ha)	Interventional cost (₹)			
		Cropping systems	Livestock diversification	Product diversification	Total
First year					
Field crops alone	0.40	2865	313	416	3594
Field crops+dairy	0.34	2833	574	192	3599
Field crops+dairy +goats/sheep	0.35	2769	548	188	3505
Second year					
Field crops alone	0.40	3027	120	185	3332
Field crops+dairy	0.34	2772	531	162	3465
Field crops+dairy +goats/sheep	0.35	3496	524	133	4153

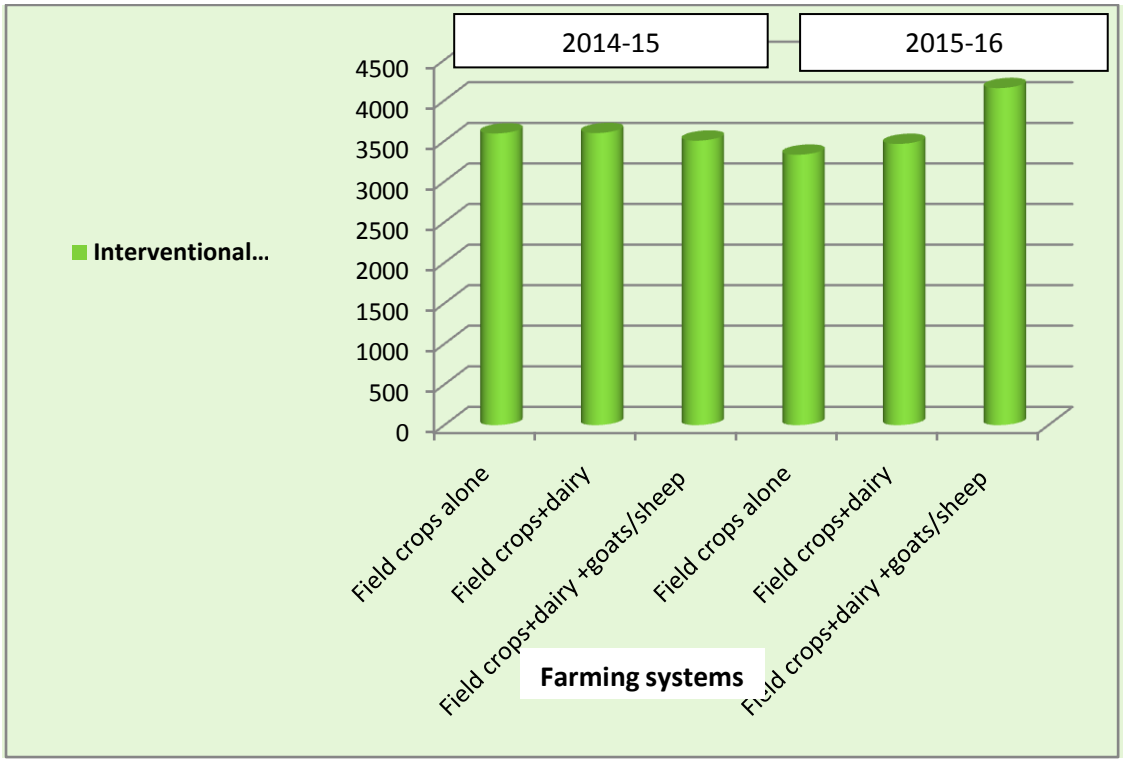


Figure 4.6 Total cost of interventions under different modules

Table 4.30 Net income due to intervention

(₹/household)

Farming Systems	Holding size (ha)	Net income (₹)			
		Cropping systems	Livestock diversification	Product diversification	Total
2014-15					
Field crops alone	0.40	9136	2562	984	12682
Field crops+dairy	0.34	15709	3350	1067	20126
Field crops+dairy +goat/sheep	0.35	14745	9838	648	25231
2015-16					
Field crops alone	0.40	17200	2695	1280	21175
Field crops+dairy	0.34	17658	7689	1157	26504
Field crops+dairy +goat/sheep	0.35	15418	9423	799	25630

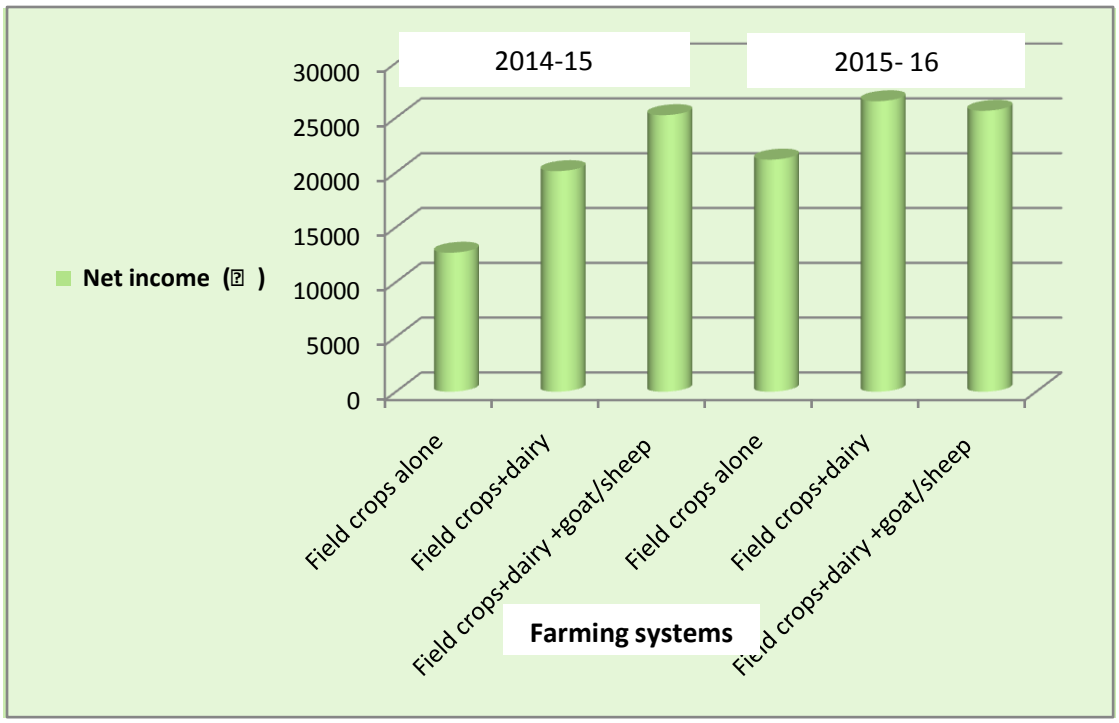


Figure 4.7 Net income under different modules

xii. Improvement of total net income

Keeping in the view, the cost of interventions only some part of the area of the household could be selected for diversification in each farming system/module. But if whole area of the each selected farmer was considered for diversification then the anticipated net farm income would be as shown in **Table 4.31** and **Fig. 4.8**. In the two years study on diversification, increase in benchmark income recorded in respect of in respect of field crops + dairy farming system was 85 per cent whereas as corresponding increase in benchmark income in respect of field crops + dairy+ goat/sheep farming system was 100 per cent.

Table 4.31 Improvement of total net income

(₹/household)

Farming Systems	Holding size (ha)	Benchmark	2014-15	2015-16
Field Crops Alone	0.60	9230	19023	28836
Field crops+dairy	0.67	22465	30228	41748
Field crops+dairy+Goats/Sheep	0.68	20147	36252	40453

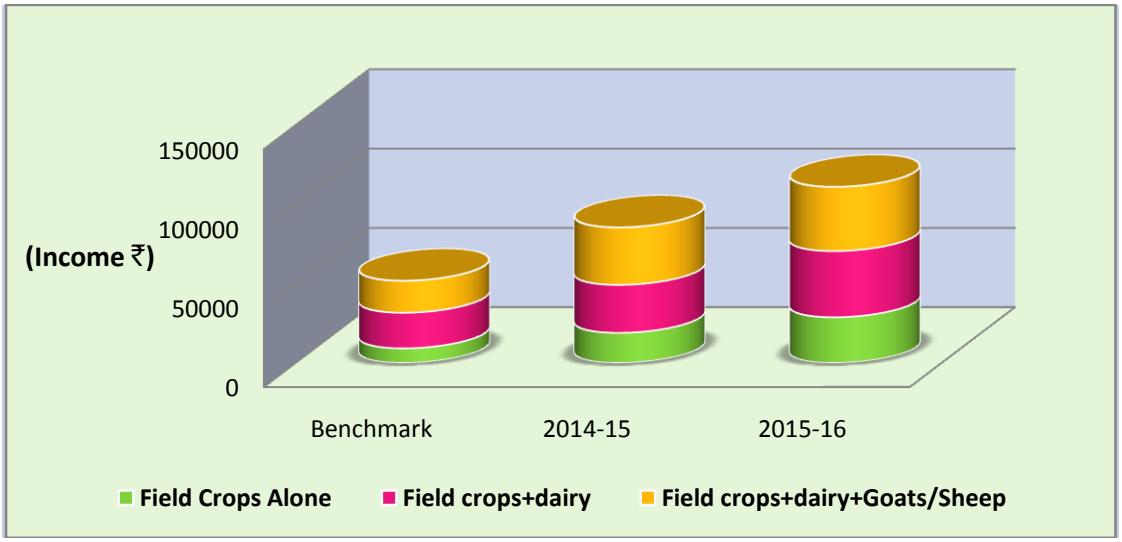


Fig 4.8 Improvement of total net income

5. SUMMARY AND CONCLUSIONS

5.1 Introduction

Farming system represents an appropriate combination of farm enterprises (cropping systems, horticulture, livestock, fishery, forestry, poultry etc.) and the means available to the farmer to raise them for profitability. It interacts adequately with environment without dislocating the ecological and socio-economic balance on one hand and attempts to meet the national goals on the other. The farmer has to be assured of a regular income for a reasonable standard of living by including other enterprises and by efficient management of inputs available on the farm to increase the average income. Himachal Pradesh has limited scope of the extension of cultivated area, because of their topographic feature; the only scope for the agriculture growth is increasing productivity of cash crops and spread the pace of diversification with different agro-climatic condition in the state. To strengthen the economic security, it is imperative to intensify and diversify the existing rice-wheat and maize-wheat cropping systems. In general, farmers in some pockets are growing pulses, oilseeds, vegetables and even fruit crops to sustain their income. However, rearing one or two livestock along with crops is a common feature in farming. Mostly farmers follow subsistence farming. However farming system approach to gear up the economic conditions of farmers besides looking into the nutritional security is the need of the hour. Therefore, it is important to diversify the existing farming system with inclusion of profitable enterprises as well as value addition of the farm produce to have better returns to the farmers. With this background, the present study was undertaken to assess the diversification the existing farming systems under marginal household conditions in Kangra district of Himachal Pradesh with the following objectives:-

5.2 Objectives

The specific objectives of the study were;

1. To characterize the farming systems of Kangra district and
2. to diversify the existing farming systems under marginal household conditions

5.3 Methodology

The present study was conducted in Kangra district of Himachal Pradesh. This district has been selected purposively, as the net sown area is highest among all the other districts in the state. Moreover, the area under major crops is also maximum and the district accounts for highest production of foodgrains in the state. It has vast potential for diversification and commercialization of agriculture. To fullfill the first objective three stage random sampling technique was employed for selection of blocks (stage 1), villages (stage 2) and farmers (stage 3). In the first stage, a complete list of development blocks was prepared and four blocks namely, Baijnath, Nagrota Bagwan, Kangra and Nurpur were selected randomly for the study. In the second stage, a complete list of villages was prepared and three villages were selected randomly from each block, thus making a total sample of 12 villages. In the third stage, a random sample of 10 farmers was drawn each from the selected village, thus making a total sample of 120 farmers. The sample farmers were categorized into four categories namely, marginal, small, medium and large on the basis of operational landholding. 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 Kangra district and Himachal Pradesh were gathered from Statistical Year Book of Himachal Pradesh, 2016-17. The data pertained to the agricultural year 2016-2017. Both tabular and statistical analysis was done for the study. To fullfill the second objective, 24 field experimental trials were conducted in Fatehpur and Dehra blocks of Kangra district under the aegis on Farm Research unit AICRP IFS- Palampur centre. As per mandate in each block, three villages and from each village, four farmers were selected. Thus total 24 marginal farmers were selected for the study. The benchmark survey carried out by On Farm Research unit during the year 2012-13 was utilized for the purpose and the diversification field studies were conducted during the years 2014-15 and 2015-16. The bench mark net income of the concerned households was recorded. Households surveyed were grouped as

1. Field crops alone
2. Field crops + dairy
3. Field crops + dairy + sheep/goat

Thereafter, constraints limiting the overall crop productivity/profitability in each category were identified. Some critical inputs as interventions were given to the surveyed households. The impact of interventions in the improvement of productivity & increase in net income was carried out.

5.3 Major findings

i. Characterization of the farming system

1. The socio-economic survey of sample farms in study area revealed that the majority of farmers belonged to middle age (51.67%) followed by young age group (25.83%).
2. The overall data regarding education revealed that 28.33 per cent of farmers studied upto matric level followed by middle level (15.33%) and around 20.83 per cent of the family members were illiterate. The overall literacy rate was 79.17 per cent which was varied from 76.19 to 83.33 percent from small to large farms.
3. Agriculture and allied enterprises was the main occupation of majority of sample farms (79.17%) followed by government services (10%) on an average farm.
4. The overall sex-ratio was found to be approximately 1008 females per thousands of males. The working force (15-60 years) constituted about 67 per cent of total population in the study area followed by 6.98 per cent in plantation crops.
5. The land utilization pattern showed that the total size of farm holdings was 110.7 ha, out of which 83.77 per cent was under cultivated land followed by plantation land (6.83%)
6. The number of total farm animals per household was 3.00, 2.62, 2.40 and 2.34 on marginal, small, medium and large farm situations, respectively. Among the milch animals improved cows and buffaloes were popular under large farmers (35.47 and 50.00%, respectively as compared to small farmers (23 and 8.67%). It has been observed that the practice of rearing sheep and goat was

also prevalent in the study area, mainly in case of marginal farms (34.19%) followed by small farm category (9.16%).

7. The total no. of durables per household was highest in case of large farmers (6.66) followed by medium (5.93), small (5.09) and marginal (3.96) farmers in the order given. The total no. of household asset was higher in case of large farmers worth ₹ 97,766.67 followed by worth of ₹52,683.33 in case of small farmers.

8. The average data indicated that the availability of major farm machinery such as thresher (5.34%), tubewell (5.94%), leveler (6.81%) and power weeder (2.80%) was less as compared to minor farm machinery such as plough (21.12%), chaff cutter (20.42%) and spray pump (20.38%).

9. Information on average expenditure pattern revealed that the expenditure on food items varied from ₹ 30253.85 to ₹ 46650.67 from marginal farmers for large farmers. It was found that large (22.39%) and medium (22.59%) farmers spend more money on children education as compared to marginal (18.66%) and small (16.80%) farmers.

10. The overall data indicated that the average annual expenditure was ₹ 80340.85. Out of that the maximum expenditure was on food items (₹39333.54) followed by expenditure on children education (₹16500.17).

11. Overall results revealed that 64.17 per cent farmwomen were only consulted for decision making; out of which 27.50 per cent farm women's opinion was considered whereas 8.33 per cent women's finalized the decision.

12. In case of large farmers, paddy was a leading crop I (66.67%), maize at number II (28.03%), pulses at III (2.02%) and vegetables at IV (1.52%). Sorghum as fodder crop was being grown by all households for feeding livestock whatsoever in possession and found highest in case of marginal farmers (15.15%) followed by small farmers (8.00%).

13. During *Rabi* season wheat was occupying largest share of area under all farm categories. The highest area under wheat crop was found in case of large farmers (81.82%) followed by medium farmers (79.47%). The per cent share

of area under vegetables was found to be highest in case of small farmers (28.00%) followed by marginal farmers (12.12%). Besides, berseem was most popular green fodder crop being grown by all farm households varied from 12.12 per cent to 2.78 percent from marginal farmers to large farm category.

14. The cropping intensity, which signifies the extent of crop intensification on the farm, was found to be highest in case of large farmers (196.97%) followed by medium farmers (195.36%).

15. The involvements of inputs were found highest under large farmers followed by medium farmers in both the seasons (kharif and rabi) as well as on all types of crops.

16. The results indicated that the per farm production of paddy was maximum under large farm (78.61 q/farm) followed by medium farms (28.21 q/farm). The productivity of paddy was quite higher under large farms (29.78 q/ha) as compared to marginal farms (23.55 q/ha). Likewise the byproduct productivity was also higher under large farms (38.71 q/ha) as compared to marginal farms (30.62 q/ha).

17. Per farm production of maize was maximum under large farm (40.00 q/farm) followed by medium farms (14.50 q/farm). The productivity of maize was quite higher under large farms (36.04 q/ha) as compared to marginal farms (25.00 q/ha). Likewise the byproduct productivity was also higher under large farms (285 q/ha) as compared to marginal farms (240 q/ha).

18. Per farm production of wheat was ranged between 6.68 to 125.50 quintals per farm. The productivity of wheat crops was quite higher on large farm (38.73 q/ha) as compared to marginal farms (34.25 q/ha). Likewise the byproduct yield of the crop varied from 10.20 to 187.92 q/farm and was found highest in case of large farm category (187.92 q/farm).

19. The overall data revealed that on enterprises based characterization, four types of farms, were identified. These were crops+livestock, crops+livestock+vegetables, crops+livestock +bee keeping and vegetables+livestock. The large portion of farmers (marginal farmers)

followed crops+livestock+vegetables farming system (65.83%) followed by crops+livestock (28.33%). Crops+livestock+beekeeing and vegetables+ livestock farming system were also adopted with equal percentage (0.83%) of farm households.

20. The total income of sample households from main occupation i.e. agriculture was highest in case of large farmers (₹1, 54,050) followed by medium farmers (₹1, 50,605.00). Same as in case of livestock, the income was found to be highest in case of large farmers (₹60,185.00) followed by medium farmers (₹12,960.00). As given under occupational structure the business was only carried by marginal farmers and the income from business was only ₹14076.92/annum.
21. Total farm income (₹/annum) was 88,059.79, 1, 20,228.83, 1.63, 565.00 and 2, 14,235.00 in respect of marginal, small, medium and large households, respectively.
22. The overall observation revealed that the % share in income was found to be highest in case of crops+livestock farming system (76.24 per cent) as compared to crops only (67.16 per cent).
23. The pertinent problems faced by the farmers in the study area were lack/uncertainty in price of agricultural produce, non – availability of suitable inputs and infrastructure in time, lack of family labour due to involvement in another activity, irregular supply of water/electricity etc.

ii. Diversification of existing farming system

1. According to bench mark survey out of total farm families, 58.33 per cent practiced field crops + dairy farming system where as field crops+dairy+goat/sheep was dominant among 37.50 per cent farm families. The mean family size was found to be highest under field crops+dairy (33.71%) farming system followed by Field crops+dairy+goat/sheep (33.65%).
2. The benchmark survey revealed that field crops+dairy farming system provides maximum income (₹ 22465) followed by Field crops+dairy+Goats/Sheep (₹ 20147) whereas in case of field crops alone the net income was ₹ 9230.

3. On the basis of information collected through benchmark survey, the constraints limiting the overall crop productivity/profitability in each farming system were use of local varieties, inadequate nutrient application and untimely weed control in case of field crops alone, whereas in case of Field crops+dairy or Goat/Sheep farming system the dominant constraints were mineral deficiency and green fodder shortage.
4. Some critical inputs as interventions were provided to the surveyed households and these were sowing of improved crop varieties with recommended fertilizer doses, timely, scientific weed control, proper management of insect/disease, increase in income through inclusion of gobhi-sarson, the seedlings of vegetable crops were also provided to needy willing farmers to increase their livelihood status. Sowing improved fodder varieties to ensure green fodder supply throughout the year, mineral mixture supplementation and supply of sieves for proper grading of produce etc.
5. By giving interventions along with package of practices there was an increase in maize equivalent yield as compared to bench mark yield. In Field crops+dairy farming system maize equivalent yield was 76.12% more than benchmark yield. In case of Field crops+dairy+goat/sheepfarming system during first year of diversification, there was increase in maize equivalent yield (55.18%) due to interventions but in second year of diversification there was increase in the yield of respective crops but decrease in total maize equivalent yield (51.75%).
6. The average milk yield after interventions was increased as compared to benchmark average milk yield.
7. In first year, there was 11.93 per cent increase in average milk yield in case of Field crops+dairy+goat/sheepfarming system followed by Field crops+dairy farming system (8.26%). In second year in case of field crops +dairy farming system the increase in average milk yield was lesser (2.98%) than first year. In case of Field crops+dairy+goat/sheepfarming system the average milk yield was increased by 16.39 per cent as compared to bench mark yield.

8. In first year of diversification, per farm profitability was found highest in case of Field crops+dairy farming system (₹ 1699.12) followed by Field crops+dairy+goat/sheepfarming system (₹ 1526.08). In second year per farm profitability was found to be highest in case of Field crops+dairy farming system (₹ 1990.24) followed by field crops alone (₹ 1680.00).
9. During first year of diversification, in field crops+ dairy farming system with total cost of interventions of ₹ 3594/- in all the modules, net returns realized were ₹ 20126/- whereas for the field crops+dairy+goat/sheep farming system with total cost of interventions ₹ 3505/- net returns realized were₹ 25231/.
10. Due to diversification, increase in benchmark income recorded in respect of field crops+dairy farming system was 35% whereas corresponding increase in benchmark income in respect of field crops+dairy+goat/sheep farming system was 79%.
11. During second year in field crops+dairy farming system with total cost of interventions of ₹ 3465/- in all the modules net returns realized were ₹ 26504/- whereas for field crops+dairy+goat/sheep farming system and with total cost of interventions of ₹ 4153/- net returns realized were ₹ 25630/-.

b) In the two years study on diversification, increase in benchmark income recorded in respect of in respect of field crops + dairy farming system was 85 per cent whereas as corresponding increase in benchmark income in respect of field crops + dairy+ goat/sheep farming system was 100 per cent.

5.4 Suggestions and policy implications

1. Majority of the farmers are marginal and small and there is high scope for the low cost and no cost technologies related to agriculture and animal husbandry. Such technologies need to be focused & then disseminated to farmers so that their rate of adoption may enhance.
2. Farmwomen should be encouraged in making final decision related to different agricultural operations and they must be well trained on different farm activities.
3. For increasing productivity from livestock component, farmers need to be educated regarding benefits of mineral mixture supplementation, feeding with legume+ cereal fodder & benefits of feeding concentrates.

4. Also since majority of the farmer faced problem of suitable market price for their produce, government should a suitable rate of minimum support price for the farm produce so that farmers can earn a good profit from their produce.

5.5 Conclusion

1. The overall data of Kangra district indicated that the majority of farmers fell under marginal farm category (65%) followed by small farmers (17.50%).
2. On enterprises based characterization, four types of farms, were identified. These were crops+livestock, crops +livestock+vegetables, crops+vegetables+bee keeping and vegetables+livestock. The large portion of farmers (marginal farmers) followed crops+livestock+vegetables farming system (65.83%) followed by crops+livestock (28.33%). Crops+livestock+beekeeing and vegetables+livestock farming system were also adopted with equal percentage (0.83%) of farm households.
3. The results revealed that crop yields as well as overall profitability from crop component can satisfactorily be increased by diversifying the existing cropping systems through inclusion of high yielding recommended crop varieties and adopting recommended package for the component crops in the system. Same way encouraging results in income have been recorded when the existing livestock is supplemented with recommended doses of mineral mixture and also when fed with green fodder particularly during acute shortage periods. Thus it can be concluded that diversification in existing farming system through inclusion of high recommended crop varieties, adopting recommended package of practices and in case of overall animal health supplementation with mineral mixture and green fodder supply during shortage period on marginal landholdings was profitable.

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APPENDICES

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CHARACTERIZATION OF FARMING SYSTEM OF KANGRA DISTRICT

A. Farmer's Introduction

1	Date of visit		7	Name of village	
2	Name of the respondent		8	Name of block	
3	Father's/husband's name of resondent		9	Name of district	
4	Age of respondent		10	Name of the nearest town	
5	Education of respondent		11	Distance of nearest town from village	
6	Caste		12	Holding (farm land size (ha)	

B. Family details

Sr. no	Name of family member	Father's/ Husband's name	Age	Sex (M/F)	Education	Occupation	Income (in ₹)	
							Monthly	Yearly
1								
2								
3								
4								
5								
6								

C. Asset Position

i) Farm land details

S. no	Land details	Area in ha		
1	Area under crops			
2	Area under ponds			
3	Farm buildings			
	a) Dwelling house			
	b) Pump shed			
	c) Cattle shed			
	d) Poultry shed			
	e) Pig shed			
	f) store			
	g) for other uses (specify)			
4	Uncultivated area			
	Total			

ii) Household articles

S. no	Article name	Number		
1	T.V Colour			
2	T.V. Black & White			
3	Fridge			
4	Washing machine			
5	LPG connection			
6	Mixer and grinder			
7	Cycle			
8	Motorcycle			
9	Scooter			
10	Car/Jeep			
11	Other (specify)			

iii) Farm machinery and equipments

S. no	**Article name**	**Number**	**Purchased**		Present Value (₹)	Annual repair
			Year	Value (₹)		
I.	**Ploughing**					
1	Wooden plough					
2	Iron plough					
3	Plankers					
4	Yokes					
II.	**Cutting and Harvesting**					
1	Darat					
2	Sikels					
3	Axes					
III. 7	**Intercultural operations**					
1	Rakes					
2	Spade					
3	Khurpi					
4	Clod breaker					
IV.	**Miscellaneous machinery**					
	Tractor/power tiller					
	Seed drill					
	Chaff cutter					
	Motor/engine					
	Thresher					
	Spray equipments					
	Tube-well					
	Water tank					
	Plastic pipes					
	Any other					

iv) Animal Possession

S. no	**Article name**	**Number**		
1	Local cow			
2	Cross bed			
3	Dairy buffalo			
4	Bullocks			
5	Calves			
6	Goat			
7	Sheep			
8	Pig			
9	Poultry			
10	Bee hives			

D. Crops and cropping systems/rotation followed on the farm

i) Cropping systems/rotation followed on the farm

Sr. No.	Crop	Area (kanals/bighas)	Crops grown (In succession period/mixed)			Remarks
1.			1st	2nd	3rd	
2.						
3.						
4.						
5.						
6.						

E. Crop wise input use in crop production and output produced

Sr. no	Name of crop	Area (ha)	Seed (kg)	FYM (q)	Fertilizers (kg)				Chemicals (Rs.)	BL (pair)	Tractor (hrs)	HL (man days)	Production (q/ha)		Oty sold (q)
					urea	IFFCO	Others (SSP, MOP)	Total					Main	By	

HL= Human labour, BL=bullock labour

F. Maintenance of farm animals/others

Sr no.	Items	Quantity	Price/unit	Total cost
1.	**Dairy animals**			
	Dry fodder (q)			
	Green fodder (q)			
	Concentrate (q)			
	Mineral mixter (rs)			
	Medicine (rs)			
	Total labour			
	Others (specify)			
2.	**Piggery**			
	Roughages			
	Concentrate			
	Mineral mixture			
	Medicine			
	Total labour			
	Others (Specify)			
3.	**Sheep /goat**			
	Dry fodder (q)			
	Green fodder (q)			
	Concentrate (q)			
	Mineral mixture (kg)			
	Medicine (Rs.)			
	Total labour			
	Other (specify)			
4.	**Fsheries**			
	Cow dung			
	Cal carbonate			
	Amm. Sul			
	Ssp			
	Mop			
	Rice bran			
	Mustard cake			
	Water supply			
	Finger lings			
	Medicine			
	HL			
	Harvesting exp.			
5.	**Poultry**			
	Starter feed			
	Finisher feed			
	Medicine			
	Total labour			
	others			
6.	**Bee keeping**			
	Total labour (man days)			
	Others (specify)			

G. Gross income from sale of other farm produce

S. no	particulars	Oty. produced	Oty sold Kg/no	Value (in ₹)	Qty where sold
1	**Product and by product form animals**				
	a) Milk				
	b) Ghee				
	c) Broiler				
	d) Egg				
	e) Pork				
	f) Fish				
	g) Mutton				
	h) Uple				
	i) FYM				
2.	**Sale of animals**				
	a) Milch animal (cow & buffalo)				
	b) Dry animal (cow & buffalo)				
	c) Draft animal (bullock & he-buffalo)				
	d) Pregnant animal (cow & buffalo)				
	e) Male and female calves (cow & buffalo)				
3.	**Sale of sheep/goat**				
4.	**Bee keeping**				
	a) Honey				
5.	**Sales of trees**				
6.	**Farm machinery and implements**				

H. Family expenditure

S. no.	particulars	Value (₹)
1	Family Expenditure on food items	
2	Family Expenditure on medical treatment	
3	Family Expenditure on children education	
4	Miscellaneous family Expenditure (Clothing, entertainment etc.)	

I) Extent of participation of woman in decision making in farming systems

Decision making areas	Extent of participation			
	Nil	Only consulted	Opinion considered	Final decision
Crop to be sown				
Quality of seed				
Fertilizer to be used				
Means of irrigation				
Agricultural operations (overall)				

J. Farmers perceptions

i. Constraints in integrated high value based farming system (give weight age out of 10)

1. Non availability of suitable infrastructure like sheds and houses
2. Scarcity of family labour due to involvement in non farming activity
3. Irregular supply of water and electricity
4. Scarcity of owned fund/ margin money to diversify farm activities
5. Lack of technical knowledge
6. Social/caste factor in adopting like piggery, goatry etc
7. Lack of risk bearing availability
8. Lack of suitable market price

Brief Biodata of student

Name Meenakshi

Mother's Name Smt. Anjna Kumari

Father's Name Sh. Pradeep Kumar

Date of Birth 09th January, 1992

Permanent Address V.P.O Kawari (Nagrota Bagwan) Teh. & Distt. Kangra (Himachal Pradesh) 176047

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Academic Qualification

Qualification	Year	School/Board/ University	Marks (%)	Division	Major subject
10th	2007	MNSS/H.P. Board	71.57	First	English, Hindi, Science, Maths, Social Science
10+2	2009	GFSS/H.P. Board	75.40	First	Non Medical
B.Sc. Agri.	2013	CSK HPKV, Palampur	71.30	First	Agriculture
M. Sc. (Agronomy)	2015	CSK HPKV, Palampur	80.80	First	Agronomy
P.h.D (Agronomy)	2018	CSK HPKV, Palampur	83.80	First	Agronomy

Thesis title in M. Sc.: Effect of nutrient management system on the productivity and sustainability of baby corn-chinese cabbage- onion cropping system.

Fellowships/Scholarships/Gold Medals/Awards/Any other distinction

- Certificate of Honours in Master's degree
- Qualified Agricultural Scientists Recruitment Board (ASRB) - National Eligibility Test (NET - 2016)
- Working as Agriculture Development Officer (ADO) in the state Department of Agriculture from 25.08.2017 till date

Publications
Research papers - One
Popular articles - 3