A LIVELIHOOD STUDY ON FRENCH BEAN (*Phaseolus vulgaris* L.) GROWERS OF NAGALAND

Thesis

submitted to

NAGALAND UNIVERSITY

in partial fulfillment of requirements for the Degree

of

Doctor of Philosophy

in

Agricultural Extension

by

BENJONGTOSHI
Admn. No. Ph – 169/14 Regn. No. 816/2018

Department of Agricultural Extension
School of Agricultural Sciences and Rural Development,
Nagaland University, Medziphema Campus – 797 106
Nagaland
2020

DECLARATION

I, Mr. Benjongtoshi, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form the basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis had not been submitted by me for any research degree in any other university/institute.

This is being submitted to Nagaland University for the degree of Doctor of Philosophy in Agricultural Extension.

Date:

Place: (**BENJONGTOSHI**)

………………………..
Supervisor

CERTIFICATE – I

This is to certify that the thesis entitled *"A Livelihood Study on French Bean (Phaseolus vulgaris L.) Growers of Nagaland"* submitted to Nagaland University in partial fulfillment of the requirements for the award of degree of Doctor of Philosophy (Agriculture) in Agricultural Extension is the record of research work carried out by Mr. Benjongtoshi Registration No. 816/2018 under my personal supervision and guidance.

The results of the investigation reported in the thesis have not been submitted for any other degree or diploma. The assistance of all kinds received by the student has been duly acknowledged.

Date:
Place: …………………………
                                                     Dr. N. K. PATRA
                                                     Supervisor

CERTIFICATE – II

VIVA VOCE ON THESIS OF DOCTOR OF PHILOSOPHY IN AGRICULTURAL EXTENSION

This is to certify that the thesis entitled **"A Livelihood Study on French Bean (*Phaseolus vulgaris* L.) Growers of Nagaland"** submitted by Mr. Benjongtoshi, Admission No. Ph-169/14 Registration No. 816/2018 to the NAGALAND UNIVERSITY in partial fulfilment of the requirements for the award of degree of **Doctor of Philosophy** in Agricultural Extension has been examined by the Advisory Board and External examiner on **18-12-2020.**

The performance of the student has been found **Satisfactory/Unsatisfactory.**

Members   Signature

1. Dr. N. K. Patra   ………………
   (Supervisor & Chairman)
2. Prof. Atanu Sarkar   ………………
   (External examiner)

3. Dean, SASRD   ………………
   (Pro Vice Chancellor Nominee)

Members of Advisory committee

1. Prof. J. Longkumer   ……………….

2. Prof. K.K. Jha   ……………….

3. Dr. Sanjoy Das   ……………….

4. Prof. M. Aleminla Ao   ..………………

Head	Dean
Department of Agricultural Extension	School of Agricultural Sciences and Rural Development

ACKNOWLEDGEMENT

Date:

Place: *(BENJONGTOSHI)*

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

Abbreviations/symbols	Meaning
M	: Mean
F	: Frequency
/	: per
%	: percent
&	: and
<	: Less than
>	: More than
μ	: Mean
$\sum$	: Summation
N	: Number of respondents
mm	: Millimeters
msl	: Mean Sea Level
et al.	: and others
etc.	: et cetera
ha	: Hectare
Kg	: Kilogram
MT	: Metric tone
i.e.,	: that is
SD	: Standard Deviation

RD	: Rural Development
Fig	: Figure
Agri	: Agriculture
Sl.No.	: Serial Number
RCC	: Reinforced Concrete Cement
KVK	: Krishi Vigyan Kendra
NGO	: Non-Governmental Organization
ATMA	: Agricultural Technology Management Agency
SASRD	: School of Agricultural Sciences and Rural Development
FAOSTAT	: Food and Agriculture Organization Corporate Statistical Database

INTRODUCTION

Livelihood refers to means of securing the basic necessities, food, water, shelter and clothing of life. "A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Chambers and Conway, 1991). "How people access and use the assets and capabilities within the social, economic, political and environmental contexts, form a livelihood strategy" (UNDP, 2010). According to Young *et al.* (2002), livelihoods are the "ways in which people access and mobilize resources that enable them to pursue goals necessary for their survival and longer-term well-being, and thereby reduce the vulnerability created and exacerbated by conflict".

The term 'sustainable livelihood' "is defined as an extensive set of issues which encompass much of the broader debate about the relationships between poverty and environment" (Hussein and Nelson, 1998). Therefore, the term sustainable livelihood denotes to a livelihood that can cope up and bounce back from stresses and shocks, as well as retain or enhance its capabilities and assets both now and in the future, without undermining the natural resource base. The sustainable livelihood approach improves livelihood status of the poor. It organizes the factors that inhibit or enhance livelihood opportunities and shows how they relate (Serrat, 2010).

Livelihood status in Nagaland

The State is predominantly rural, with 71.03 per cent of the population living in villages (Government of Nagaland, 2012). The main economic and livelihood activity of the villagers is agriculture, with the rearing of livestock, weaving, blacksmith and handicrafts as supplementary. The State does not have any major industry, and almost the entire urban population depends on the Government jobs for employment and livelihood (Government of Nagaland, 2009). Nagaland being an agriculture-dependent state, where the tribal people have numerous livelihood strategies of which French bean cultivation is also an important livelihood strategy, existing in the eastern part of the State. Different communities adopt different practices to secure their means of livelihood and have different approaches to it. They have their ways and means, customs and practices that have enabled them to gain a sustainable livelihood (Zingkhai, 2015). Out of the total population of the state (19,80,602), about 71.03 per cent live in rural areas (Jamir and Naromongla, 2012).

Similarly, at 2,77,491, rural households make up 70.8% of the total households in the State (Government of Nagaland, 2012). The distribution of working persons in the rural sector/area showing that 74.6 per cent employed in agriculture and allied sectors, followed by public administration at 17.4 per cent, with 3.5 per cent in trade hotel or restaurant. In terms of self-employment in rural areas, 56.5 per cent are involved in agriculture and allied activities (Govt. of Nagaland, 2009).

Botany of French bean

"French bean (*Phaseolus vulgaris* L.) is known as kidney bean (also known as *rajma* in Hindi and *kholar* in nagamese local dialect), and it is a variety of common bean (*Phaseolus sp*). The common dry bean (*Phaseolus vulgaris* L.) is the most important legume food for direct consumption in the

world. Among major food crops, it has one of the highest levels of variation in, seed characteristics (size, shape, colour), maturity, growth habit, and adaptation. It also has tremendous variability (> 40,000 varieties)" (Jones, 1999). French bean is a herbaceous annual plant. Worldwide, the purpose of growing is for its edible fruit, either the dry seed or the unripe fruit, both of which are referred to as beans. The leaf and tender shoot are also occasionally used as a vegetable. The straw and crop residue can be used for fodder.

Along with other species of the bean genus (*Phaseolus*), it is botanically classified into the leguminous family (*Fabaceae*), most of whose members fix atmospheric nitrogen through a symbiotic association with *rhizobia* (a species of nitrogen-fixing bacteria). There are various classifications of kidney beans, namely, red kidney bean (also known as common kidney bean), red speckled kidney bean, white kidney bean (also known as *cannellini*) and lightly speckled kidney bean (long shape light speckled kidney bean).

Nutritional facts of French bean

French bean is also known as kidney beans or red beans, are named for their visual resemblance in shape and colour to kidneys. The food value of French bean is excellent, and in terms of safe food and healthy food supply, beans (*Phaseolus spp.*) are a rich source of protein, vitamins, minerals and carbohydrates especially for poor populations throughout the world (Celmeli *et al.*, 2018). Although the kidney bean is not of Indian origin, it is a part of regular diet in Northern India and North East India. French bean is a highly profitable crop of North Eastern Hill Region of India.

"French bean contains protein, fat, calcium, phosphorus, vitamin A, vitamin B, vitamin C, vitamin D, vitamin K, manganese, magnesium, potassium, folate, thiamine, riboflavin, copper, protein, omega 3 fatty acids, niacin, starch and plenty of iron. It is low in calories and contains water and, fat-soluble anti-oxidant" (Gerita, 2015).

Table 1.1 Nutritional facts of French bean

Nutrients	Units
Calories	322 Kcal
Protein	21.8 g.
Fats	2.5 g.
Carbohydrates	55.4 g.
Thiamine	0.63 mg.
Riboflavin	0.17 mg.
Niacin	1.8 mg.
Calcium	183 mg.
Iron	4.7 mg

Source: Arenas *et al.,* 2013.

French bean production in Nagaland and India

French bean also known as *kholar* in local dialect is a traditional crop grown in the eastern part of Nagaland. The major French bean growing districts of Nagaland are Tuensang, Kiphire, and Zunheboto. According to the department of agriculture, Govt. of Nagaland (2014), the total area of French bean production was 9.23 thousand hectares with a total output of 11.64 thousand metric tonnes with a yield of 1,261 kilograms per hectare. French bean sometimes serves as staple food apart from rice and maize as well as the green and tender bean is used as a vegetable by the local people. The following table shows the district wise area and production of French bean in Nagaland.

Table 1.2 District wise area, production and productivity of French bean in Nagaland

Sl. No	District	Area (ha)	Production (m.t.)	Productivity (m.t/ha)
1	Phek	550	690	1254.5
2	Mokokchung	1150	1450	1260.86
3	Tuensang	5880	7480	1272.1
4	Mon	1150	1450	1260.86
5	Dimapur	-	-	
6	Wokha	780	1000	1282.05
7	Zunheboto	810	1030	1271.6
8	Peren	-	-	
9	Kiphire	3120	3980	1275.64
10	Longleng	1780	2240	1258.42
12	**Nagaland**	**15,870**	**20,140**	**1269.06**

Source: Government of Nagaland, 2017

In India, French bean also called as *Rajma* is an important pulse crop, with high yielding ability as compared to the gram, pea and other pulses. In spite of the potentiality of French bean, it is not capitalised to address the food and nutrition security of rural India. Therefore, it requires focused attention both at the development and policy front to en-cash the potentiality. It is grown in Maharahstra, Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir, and NE states covering 80- 85 thousand hectares area under this crop. "However, its cultivation during rabi and summer is also gaining popularity in northern Indian plains" (Tiwari and Shivhare 2017). "While its cultivation is mainly restricted to the hilly region of north India, its consumption is more in the plains of north and central India, where its demand is not fully met" (Sardana *et al.,* 2000). The feasibility of growing French bean as a potential rabi crop in

the plains of north India was reported by Chandra and Ali (1986). "Introduction of this crop to northeastern plains of India as a winter crop has generated a lot of interest in the farming community due to its higher productivity, responsiveness to inputs and remunerative price" (Sardana *et al.,* 2000).

Table 1.3 Global ranking of Pulses* in terms of area, production, and productivity

Crop	Area (lakh ha)	% to total	Production (lakh tonnes)	% to total	Productivity (kg/ha)
Chickpea	139.81	16.41	137.31	17.72	982
Lentil	45.24	5.31	48.27	6.23	1067
Pigeon pea	70.33	8.26	48.90	6.31	695
Pea	69.32	8.14	111.86	14.44	1614
Beans	306.13	35.93	245.16	31.64	801
Total Pulses	**851.91**		**774.73**		**909**

Source: FAO Statistics 2014; *Data on French bean is not available

Table 1.4 Area, production and productivity of major pulses* in India

Particulars	Area (lakh ha)	Per cent	Production (Lakh tonnes)	Per cent	Productivity (kg/ha)
Chickpea	73.7	38.71	58.9	48.28	799.19
Pegion pea	36.3	19.07	27.6	22.62	760.33
Mungbean	34.4	18.07	14	11.48	406.98
Uradbean	31	16.28	14	11.48	451.61
Lentil	15	7.88	9.5	7.79	633.33
Total	**190.4**	**100.00**	**124**	**101.64**	**651.2**

Source: Agropedia 2019 *Data on French bean is not available

Table 1.5 State-wise Production of Pulses from 2012-13 to 2014-15*

States	Production ('000 tonnes) - 2012-13	Production ('000 tonnes) - 2013-14	Production ('000 tonnes) - 2014-15
Andhra Pradesh	1623	1551	1213
Assam	84.4	104.3	111
Bihar	542.8	522	493.8
Chhattisgarh	648.7	482.1	736.5
Gujarat	572.2	729	574.5
Haryana	130.4	125.1	56.1
Himachal Pradesh	46.1	51	38.3
Jammu and Kashmir	14.2	13.9	9.2
Jharkhand	609.3	578.6	597.1
Karnataka	1259.3	1600.5	1390
Kerala	3.2	4	1.4
Madhya Pradesh	5165.9	4644.3	4828.3
Maharashtra	2306	3169	2053
Odisha	424.4	419.3	439.3
Punjab	53	39.6	41.6
Rajasthan	1956.8	2490.9	1951.8
Tamil Nadu	209.9	613.8	753.2
Uttar Pradesh	2332	1697.5	1438.7
Uttarakhand	51.3	56.5	54.6
West Bengal	192.3	241.7	236.5
Others	117.4	120	132.4
All India	18342.5	19254.1	17150.3

Source: Govt. of India, 2019; *Data on French bean is not available

Profile of the study area

Nagaland State situated in the northeastern part of India lies between 25^06' and 27^04' latitude North of Equator and between the Longitudinal lines 93^020'East and 95^015'East and having a Geographical area of 16,527 sq km (Government of Nagaland, 2006), and the total population is 1,980,602 (Government of Nagaland, 20112). The density of population is around 120 per sq km. Average annual rainfall ranges from 2,000-3,000 mm and temperature ranges from 4^0C to 31^0C. "The topography of the State is undulating, full of rugged ranges which breaks into wide chaos of spurs and

ridges. The altitudes vary between 194 to 3,840 meters above the Mean Sea Level" (Government of Nagaland, 2017). Owing to the wide variation in geophysical, environmental and spatial conditions, the state is a heaven for nurturing rich flora, fauna, biodiversity along with diversified crops' treasury.

The state of Nagaland has a beautiful landscape and consists of 12 administrative districts, *viz*. Kohima, Dimapur, Kiphire, Longleng, Mokokchung, Mon, Peren, Phek, Tuensang, Wokha, Zunheboto and Noklak. The state covers a total geographical area of 16,579 sq.km out of which 7,225 sq.kms (43.37%) is a cultivable area of the state. At present, 71.1 per cent of people are living in the rural area and 55.2 per cent of the total populations are farmers (Maongtoshi and Sinha, 2014). Therefore, agriculture plays an important role in the life of the people as well as the state's economy largely depends upon the agricultural and allied sector. Being the majority of the people are living in rural area and are maintaining a livelihood, based on agriculture and allied activities.

So, agriculture and allied activities are considered as the primary livelihood alternatives for rural people of Nagaland. It plays a vital role in the economy of Nagaland. For instance, in 2008-2009, the agriculture and allied sector had contributed about 21 per cent to the Net State Domestic Product. The agriculture and allied sectors have employ 68 per cent of the total workforce of the state, which is more than the national average *i.e.* 47 per cent (Maongtoshi and Sinha, 2014). Thus, agriculture and allied sectors are contributing to the state economy and playing an immense role in the rural economy by providing employment and various livelihood alternatives to the rural people of Nagaland. The agriculture and allied sectors of the state are diversified and important crops of the state (except in some parts of the eastern region) are rice, maize, millets, pulses, oilseeds, taro, sugarcane, spices and aromatic crops, medicinal crop, different vegetables and non-timber forest

products, apple, orange, pineapple, tea, coffee, rubber, cardamom, black pepper, peach, kiwi, agar and so many others.

Statement of the problem

In a development scenario, the concept of livelihood and sustainable livelihoods is increasingly important. The term livelihood refers to the activities required for a means of living, whereas sustainable livelihood refers to the relationships between poverty and the environment. Surprisingly, attention of the development sector was mainly confined to the improvement of livelihood of the people by the adoption of some external means of livelihood, and the issues of sustainability of newly introduced ways were over sighted and existing livelihoods and its sustainability were relatively less emphasized. The present study may provide valuable information to the academicians, planners, policymakers and extension workers about existing livelihood pattern, livelihood strategies and performance of different livelihoods maintained by the farmers, French bean growers as well as the rural people of the State. The study was also attempted to explore the potentiality and prospect of French bean-based livelihood strategy concerning sustainability.

In spite of huge potentiality, prospect and prominent contribution of the crop to the livelihood of the traditional people of the Nagaland, the documentation and database generation about it was extremely lacking. Keeping these in view, a study entitled, "A Livelihood Study on French Bean (*Phaseolus vulgaris* L.) Growers of Nagaland" was carried out with the following objectives:-

1.   To characterise the French bean growers and their socio-economic features,

2. To explore the role of French bean as a livelihood component in the area under study,

3. To examine the sustainability through French bean-based livelihood system, and

4. To identify the problems associated with French bean, a cultivated species and to suggest the mitigation measures, if any.

Limitations of the study

The present study had the limitations of time and resources usually faced by a student researcher. The present study was a livelihood representation of only two selected districts out of the numbers of French bean growing districts in Nagaland. Due to the wide-spread of French bean growing area across the state, the need for resources to explore the whole French bean growing areas was a limiting factor. However, thought and effort were adopted and exercised to minimize the influence of limiting factors and making the study as unique and systematic as possible. The data so collected for the study were based on individual honesty and sincerity. Therefore, the information obtained for the study may be based on the individual biasness in providing pertinent information.

Organization of the study

The thesis is organized as follows. The second chapter, following the first introduction, deals with the review of literature related to the study. The third chapter deals with the research methodology of the study. The next chapter contains the results and discussion. Chapter 5 presents the summary and conclusion and recommendation of the study. The references and appendices have been given respectively and form the last section of the thesis.

REVIEW OF LITERATURE

This chapter deals with the review of literature based on the livelihood studies of the farmers. A thorough investigation of the review of literature is crucial in gaining valuable ideas and to ascertain a proper analytical frame work for the study. Therefore, review of literature was collected, keeping in view the objective of the study. The collected reviews were chronologically organized and presented under the following sub-heads:

2.1 Concept of livelihood and sustainable livelihood.

2.2 Socio-economic characteristics of the farmers.

2.3 Farming as a livelihood component.

2.4 Sustainability and sustainable livelihood.

2.5 Problems associated with French bean cultivation.

2.1 Concept of livelihood and sustainable livelihood

According to Brown *et al.* (1987), the concept of sustainable agriculture features such factors of long-term protection of natural resources, optimal production with minimum production inputs, engendering sufficient income from each operation unit, and meeting all the demands of the rural population and other inevitabilities.

Chambers and Conway (1991) stated that a livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living.

According to Chambers and Conway (1992), a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for

the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long-term.

Engberg (1996) stated livelihood as "the mix of individual and household survival strategies, developed over a given period of time that seeks to mobilize available resources and opportunities."

According to Hussein and Nelson (1998) livelihood diversification refers to attempts by individuals and households to find new ways to raise incomes and reduce environmental risk, which differ sharply by the degree of freedom of choice (to diversify or not), and the reversibility of the outcome.

Carney (1998) suggested that the concept of livelihoods has gained wide acceptance as a valuable means of understanding the factors that influence peoples' lives and well-being, particularly those of the poor in the developing world.

Scoones (1998) defines livelihood as "the capabilities, assets (both material resources and social resources), and activities required for a means of living."

According to Long (2000) livelihood best expresses the idea of individuals and groups striving to make a living, attempting to meet their various consumption and economic necessities, coping with uncertainties, responding to new opportunities, and choosing between different value positions.

Ellis (2000) conceptualized livelihood as going beyond income, not only to include both cash and kind, but also other factors, such as social institutions, gender relations, and property rights.

Niehof and Price (2001a) suggested that Livelihood generation encompasses all activities undertaken by people to meet their basic needs and for the "results or outcome of those activities the term livelihood is used".

According to Niehof and Price (2001b) a livelihood is the material means whereby one lives. Livelihood as a concept for research and development thus includes what people do (given their resources and assets) and what they achieve by doing it.

According to Kumar *et al*. (2006), sustainable rural livelihood is a multifaceted concept. It refers to maintenance or enhancement of access of rural families to food and income-generating activities on a long-term basis.

Alipour *et al.* (2008) suggested that sustainable agriculture puts emphasis on the economical, ecological and rural culture balance with each other.

Scoones (2009a) suggested that Livelihoods perspectives have been central to rural development thinking and practice in the past decade and that livelihood perspectives start with how different people in different places live.

According to Scoones (2009b), a descriptive analysis of livelihood portrays a complex web of activities and interactions that emphasize the diversity of ways people make a living.

According to the United Nations Development Program (2015), the term is well recognized as humans inherently develop and implement strategies to ensure their survival. The hidden complexity behind the term comes to light when governments, civil society, and external organizations attempt to assist people whose means of making a living is threatened, damaged, or destroyed.

According to Sarkar and Sinha (2015) rural livelihoods are inadequate in terms of income and employment. However, livelihood can be improved with the use of resources available in the local environment.

According to Gaillard (2015), livelihoods refer to the means and capacities required to sustain durably people's basic needs. Basic needs are vitally linked to food, but also include shelter, clothing, cultural values, and social relationships. The ability to meet food and other basic needs depends on assets or resources (also called capitals).

Pradipta *et al.* (2015) defined livelihood as adequate stock and flows of food and cash to meet basic needs.

Nutz (2017) defined the term sustainable livelihood as the income-generating activity that results in a positive return on investments sufficient to provide an income and fund. Further, he opined that investment is necessary to continue that activity.

According to Israr *et al.* (2017) livelihood in the multidimensional point of view recognizes the suppleness and constraints with which people build their composite lives and adapt their livelihoods. Self-motivated behaviour and the diversification of assets, activities, and social support capabilities can boost livelihoods, and enlarging capabilities and opportunities.

According to Tripathy (2018), livelihood is the processes whereby people obtain the necessities of life, exactly what the necessities of life. Exactly what the necessities of life are vary from society to society, but one thing is certain: they are more than just food, clothing and shelter.

Yang *et al.* (2018) pointed out that livelihood assets are not merely things that are input into a production process but also serve as a basis of power to act and ultimately bring about changes in society.

Wang (2018) pointed out that since, rural poverty and rural development have received increasing international attention, and the concept of livelihood has provided researchers with a new perspective through which to study rural poverty alleviation, as well as the environmental protection of rural development in developing countries.

According to IFRC (2019), livelihood is a means of making a living. It encompasses peoples' capabilities, assets, income and activities required to secure the necessities of life.

2.2 Socio-economic characteristics of the farmers

David *et al.* (2000) observed that eighty one percent of households were headed by a resident male; female headed households (14% of the sample) were disproportionally drawn from the average and poor wealth groups. This study was conducted among the bush bean growers in Sub-Saharan Africa.

Alam *et al.* (2010a) conducted a study among farmers in Malaysia and reported that 93% of the total respondents were married where 3% were unmarried, 9.6 percent of the respondents were female and 90.4 percent were male. Among the women farmers, 42.1% were widows.

Alam *et al.* (2010b) reported that Most of the farmers have basic primary education (47.5%) followed by secondary education (42.9%). Only 4% of farmers have tertiary education and 3.5% have no education.

Sathyanarayan *et al.* (2010) showed that majority (96.92%) of the respondents belonged to low family income and 1.54 per cent each of the respondents belonged to medium and high family income categories.

Adesope *et al.* (2012) showed that 56.7% of the respondents had 6 to 10 years farming experience, 42.2% have been visited by extension agents, while extension agents did not visit 57.8%.

Ajah and Nmadu (2012) showed that the mean age of the farmers was 39 years with a substantial percentage (68.12%) of them having, at most, primary school education

Sibiko (2012) conducted a study on common bean farmers in eastern Uganda and indicated that the mean age of all the sampled farmers was 43 years, with the mean age for the participant and non-participant farmers being 45 and 41 years respectively.

Nouman *et al.* (2013) reported that about 60% of farmers have age above 40 years, while the rest 40% of farmers are below 40 years. Majority of the farmers (42.5%) are illiterate, 10% have primary education, 27% have secondary school education while the rest 20% farmers have a graduate level of education. Most of the farmers (87.5%) are married, 32% farmers rely only on agriculture as they do not have any other occupation, In contrast, the rest of the farmers are engaged in some other professions as well, such as business, service, labour etc.

Roy *et al.* (2013) revealed that the average age of the respondents was 42 years, and most were having medium education level (63.33%). Agriculture was the sole occupation of 25 percent farmers whereas others had subsidiary occupations like labour, shop keeping, driving etc. The majority were found having a medium level of social participation (78.34%). The average landholding was 0.40 ha, and most were having a medium herd size (66.67%). The respondents had an average farming experience of 19 years.

Umeh *et al.* (2013) revealed that the respondents were predominantly male (79.80%) between 41 – 50 years and with more than twenty years of farming experience. About 45% of them have households comprising 6-10 people and implies large family size. About 48.70% of them had only primary school education and 65.80% have dependents of between 1- 5 people. A large

proportion (44.50%) of respondents does not have off-farm income, and a majority (62.20%) was poor.

Ananthnag *et al.* (2014) reported that half of the respondents (51.67 per cent) had medium landholding. More than one-third of respondents had high school (38.33 per cent) education, nearly two third (65.00 per cent) of the respondents were having pakka house. A majority (66.67 per cent) of the respondents belonged to OBC category, the majority (95.00 per cent) of the farmers had small family (less than five members) and cent percent of the respondents were following agriculture as their primary occupation.

Neethi and Sailaja (2014) reported that 40.00 per sent and 38.33 per cent of the respondents belonged to middle age and illiterate categories respectively. They had small farm size (26.67%), medium farming experience (48.34%), medium annual income (40.83%), labour (in own land, hired) and agriculture as main and subsidiary occupation (49.17%), medium innovativeness (56.67%), medium economic orientation (48.33%), medium market orientation (45.84%), medium change proneness (49.17%), medium achievement motivation (51.67%), medium information-seeking behaviour (56.67%), with no membership in any social organization (44.17%) and medium participation in DAATTC activities (50.83%), respectively.

Julius and Chukwumah (2014) reported that majority (90.91%) of the farmers were married with mean household size, age, education, years of farming experience as 8, 44, 7 and 14 years, respectively. Majority of the farmers indicated that their main reasons for cultivating rice were to get income and for household consumption.

Anigbogu *et al.* (2015) reported that majority of the respondents (about 34.5% and 25.4% of them) fall within the age brackets of 51-60 years and 60 years, and above. Also reported that agricultural production in the state is

mainly in the hand of the aged who are at the verge of retirement from the active workforce.

Mbakwe *et al.* (2015) showed that the respondents mean age was 43.24 years and the majority (73.33%) was male. Greater proportions (71.67%) were married with an average household size of six persons. Average farm size was 0.97 ha.

Ogunmefun and Achike (2015) reported that the higher the age of the respondents the higher their experience in farming (all things being equal) and this translates to more encounter with risks among older farmers than in younger farmers.

Akoth (2016) reported in his study that 89% of the respondents were male, and 11% were female, respectively.

Cuadrado and Mantiza (2016) in their study revealed that the majority of the household heads in the Barangay are males (94.74%) and only 5.26 percent constitutes for the female household head.

Yadav (2016) conducted a study among common bean farmers of Babati district, Tanzania and reported that the majority (52.5%) of common bean farmers were aged between 40 to 60 years which indicates that common bean is a traditional crop cultivated by both young and old farmers.

Osarenren *et al.* (2016) reported that 66.70% of the cocoa farmers were within the age range of 41 – 50 years with a mean age of 46 years.

Larochelle *et al.* (2016) conducted a study among bean farmers in Rwanda and reported that the average bean-growing household head was 46 years old.

Issa and Abdulkadir (2016) revealed that most (42.5%) of the farmers were between 25 and 34 years of age, male (94.2%), married (58.3%) and had

secondary education (65.8%). About 32% of the farmers had between 20 and 29 years of farming experience.

Zamanti and Jaderka (2016) showed that about 51% of cassava producers had formal education; about 50% had more than ten years of farming experience while the average age, household size and farm size of the respondents stood at 46 years, 8 people, and 3 hectares, respectively.

Otekhile and Verter (2017) showed that the majority of farmers in their study areas are educated and married. Farmers in the regions generated more income from the farming than non‑farming activities.

Yadav *et al.* (2017) revealed that 69.33 per cent of the farm women had involved in agriculture, animal husbandry (16.33%), silk worm rearing (10.67%), and poultry (3.67%). It was also found that 21.67 per cent of the farm women had earning more than ₹ 6,032 per month followed by 45.33 per cent of them with earning between ₹ 6,032 – 12,114, and remaining, 33 per cent of them with earning less than ₹ 6,032.

Tekkara *et al.* (2017) conducted a study among bean growers in Northern Uganda and indicated that majority of the respondents (81.7%) were practicing farming and 31 per cent of them were under 31-40 years of age.

Jamanal and Sadaqath (2017) conducted a study on soybean growers and indicated that majority (54.00%) of Soybean growers belonged to middle age followed by old age (38.00%) and a small proportion of farmers (8.00%) belonged to the young age group.

Onyuka *et al.* (2017) conducted a study in Ndhiwa Sub-County, Kenya reported that the majority of the household heads of groundnut growers were found to be middle age (between 36 and 55 years). The mean age was 46 years.

Mustapha (2017) conducted a study among common bean growers in Babati district and observed that 81.0% of the SILT (Scaling up of Improved Legume Technologies) and 72.0% of non-SILT (non- Scaling up of Improved Legume Technologies) household heads were males.

Darshan *et al.* (2017) conducted a study in Karnal district of Haryana state and revealed that majority of farmers (80%) belonged to young age group (upto 35 years) who were mostly attracted by social media. Considerable numbers of farmers (40%) completed up to matriculation level of education for which using social media was easy. Around 62.50 per cent of farmers' families belonged to under medium education status (2.00-3.20) which encourage usage of modern information sources.

Taiy *et al.* (2017) indicated that most farmers have low education, mainly primary and secondary education and a majority are relatively old. Though a high proportion of the farmers are married, cases of single farmers are also common. Potato is a key crop but almost all households keep livestock reaaring, particularly cattle and chicken.

Bagenia and Chaturvedi (2018) conducted a study among cluster bean growers in Hyper Arid Zone of Rajasthan and reported that 53.48 percent of respondents were in the middle age group ranging from 36 to 55 years followed by 37.85 per cent of the farmers were in the old age group of above 55 years, while 18.67% respondents fell in the young age group up to 35 years.

Muthulakshmi and Singh (2018) revealed that majority (68.75%) of the farmers belonged to middle age group, had medium annual income (58.75%), belong to medium social cohesiveness(81.25%), had medium mass medium access (72.50%), had medium knowledge on climate change(83.75%).

Ram *et al*. (2018) revealed that majority (62.5 per cent) of the farmers were from the middle age group, were educated up to primary level, had the

nuclear type of families and agriculture and animal husbandry as the major occupation. At the same time, economic status revealed that majority of unorganized dairy farmers belonged to the low level of income (<₹ 2, 53,000) group and had a medium size of land holding. The majority (65.50%) of the farmers used media sources of information for obtaining information about dairy farming and had a medium experience.

Basyal *et al.* (2019) reported that most significant marketing channel was from i) producer to consumer (88.88% of respondents) followed by ii) from producer to wholesaler to consumer (11.67% of respondents).

2.3 Farming as a livelihood component

Chilot *et al.* (2010) reported that pulses offer natural soil maintenance benefits through nitrogen-fixing, which improves yields of cereals through crop rotation, and can also result in savings for smallholder farmers from less fertilizer use.

Dev (2011) concluded that rural households get livelihoods through agriculture, rural non-farm sector and migration. The sources of livelihoods differ from one country to another. Thus, agriculture is the primary source of livelihood in many Asia-Pacific countries, but several countries have a substantial share of the rural non-farm sector.

Singh (2013) reported that due to the inadequacy of agricultural income to meet household expenditure, the small and marginal farmers have to devise livelihood strategy for their survival.

Altenbuchner *et al.* (2014) showed that organic farming could contribute greatly to the improvement of livelihoods (through increased yields, income and higher standard of living) and increases farmers' ability to cope with challenges, mainly through knowledge transfer, access to capital and capacity building on a local level.

Darkey *et al.* (2014) revealed that the contribution of urban vegetable production to farmers' mean livelihoods was generally 'low'. However, it contributed 'moderately high' to their natural and physical capitals. The strength of association between farmers' mean livelihood subscales also showed that urban vegetable production impacted differently and significantly on their livelihoods.

Udin (2014) revealed that organic farming not only fulfills the requirement of family consumption but also give a fair amount of income and reduce the cost of cultivation with a sustainability of agro-eco-system.

Xu *et al.* (2015) conducted a study on household livelihood strategies and dependence on agriculture and reported that 56% of households exhibit a low dependence on agriculture.

Kachroo *et al.* (2015) showed that large farmers earn only 33.04 per cent of income from agriculture followed by 29.26 per cent, 25.30 per cent and 25.24 per cent by medium, small and marginal farmers, respectively. Livestock contributes highest of 11.03 per cent in case of marginal farmers followed by 10.86 per cent, 8.51 per cent and 5.63 per cent in case of small, medium and large farmers respectively.

Singh and Singh (2015) concluded that organic farming is an essential phenomenon to sustain the livelihood of human-beings because this issue is not only limited with the lives of farmers but it is a prior concern for the life of each and every aspect related with the earth.

Adebayo *et al.* (2016) concluded that agricultural research interventions that are driven by agricultural innovation system concepts have the potential to positively impact upon the livelihood outcomes of rural smallholder farmers in Nigeria.

Mulika and Routray (2016) conducted a study on farmers' livelihood assets contributing to the sustainable livelihoods of smallholder livestock farmers in the Northeast Region of Thailand. They suggested that livestock farming is a good livelihood option for smallholders.

Singh *et al.* (2016) reported that farmers in grain and oilseed production have found economic benefits from lower input costs and increased profits by including a pulse crop in their rotation.

Yamba *et al.* (2017a) indicated that farmers are resorting to alternative livelihood activities that are less capital intensive and require less skill in order to secure income and household food supply. Significant determinants of farmers' alternative livelihood are age, household size, and household food supply, which were significant at $p < .030$, $p < .019$, and $p < .012$, respectively.

Abebe and Alemu (2017) reported that agriculture, particularly crop farming, have a greater effect on both the rural and the urban poor who spend more than half of their incomes on food.

Khatiwada *et al.* (2017) reported that the majority (61%) of the households diversified their income to non-farm sources. Livelihood diversification to business/enterprise strategies had adopted by 16% of the households and considered as the most remunerative strategy. Followed by commercial farming included by 13% of the sample and was more relevant to poverty reduction. Further, land holding, education, agriculture and skill training, access to credit, and proximity to the road and market center are the major influencing factors on the adoption of higher returning livelihood strategies.

Kamwi *et al.* (2018) reported that the use of various livelihood activities and skills in different combinations have significant importance to rural

livelihoods. Only five percent of the respondents obtained income from only one source, with 95% of the respondents engaged in a combination of farming and non-farming activities.

Liu *et al.* (2018) reported that the more natural assets and material assets that farm households own, the more likely they are to choose livelihood strategies involving engaging in agricultural production.

Subakanya *et al.* (2018) revealed that while crop and non-crop agriculture plays a dominant role in the livelihoods of most rural households, off-farm activities are also important.

Mchopa and Jeckoniah (2018) showed that households of sunflower smallholder farmers' had higher levels of livelihood outcomes and they were significantly different, unlike before sunflower cultivation. The livelihood outcomes between sunflower and non-sunflower smallholder farmers' households were significantly different (t = 12.51; p =0.000). The significant differences were evidenced by the number of household assets and access to financial services. Thus, sunflower cultivation stands a better chance for improving livelihood outcomes among smallholder farmers, unlike other economic activities in the study area.

Julius (2019) conducted a study on impact of block farming on the livelihood of farmers in the Eastern Region of Ghana. He revealed that most of the block farmers were in their active age, mainly of males and depended solely on farming for their livelihood.

Immanuel *et al*. (2019) reported that out of the five livelihood capitals, the index for physical and natural capital was higher followed by the social, financial and human index. The overall rural sustainable livelihood index for paddy farmers was 62, which was higher than the cassava farmers (52). Significant differences were observed between the paddy and cassava farmers

in farming experience, farm size, annual income, participation in training and family labour involvement.

2.4 Sustainability and sustainable livelihood

Lynam and Herdt (1989) defined sustainability as the capacity of a system to maintain output at a level approximately equal to or greater than its historical average, with the approximation determined by the historical level of variability.

Brundtland (1989) defined sustainability as meeting the needs and aspirations of today without compromising the ability of future generations to meet their own needs.

Gras *et al.* (1989) reported that sustainability indicators are variables that provide information on particular aspect/dimension, those are less easily accessible. They also serve as a guide when making a decision.

Pearce and Turner (1990) defined sustainability as to maximize the net benefits of economic development, subject to maintaining the services and quality of natural resources over time.

Francis *et al.* (1990) pointed out that sustainable farming is based on three essential functions: producing goods and services, managing the landscape and playing a role in the rural world.

Fresco and Kroonenberg (1992) defined sustainability as the dynamic equilibrium between natural inputs and outputs, modified by external events such as climatic change and natural disasters.

Jones *et al.* (2002) revealed that a large proportion of the households are involved in agricultural activities, including 70% with crops and 55% with livestock. However, while the contribution of external resources (pensions and remittance) is about 50%, the contribution of agricultural activities is very low

to total household incomes, as for instance, crops and livestock have contributed 8 per cent and 6 per cent respectively. This elucidates that agriculture in the mountains is not well performing livelihood alternatives.

Zhen and Routray (2003) suggested that sustainable agriculture is a time and space specific concept. In the long term, equal emphasis will be put on economic, environmental and socio-institutional development at national, regional and local levels.

Rasul and Thapa (2004) evaluated the sustainability of two production systems in Bangladesh where indicators were determined based on biophysical and socio-economic conditions of the study area.

Pretty (2007) revealed that sustainability in agricultural systems incorporates concepts of both resilience (the capacity of systems to buffer shocks and stresses) and persistence (the capacity of systems to continue over long periods), and addresses many wider economic, social and environmental outcomes.

Lashgarara and Asadi (2008) showed that the adoption of sustainable agricultural practices among wheat farmers in Lorestan Province was at a relatively low level and there was a significant and positive correlation between education, social participation, and market access, using communication tools, participation level in courses and farmers' attitude and knowledge towards the adoption of sustainable agriculture.

Hahn *et al.* (2009) construct a composite indicator based on seven major variables to assess the vulnerability of rural communities in Mozambique to the impact of climate change. Individual variables are compiled into a single index to be used to describe the performance of a region in relation to the others.

Kuhlman and Farrington (2010) defined sustainability as maintaining well-being over a long, perhaps even an indefinite period.

Gafsi and Favreau (2010) selected indicators considering the economic situation and viability of the farming system and on the basis of sustainable agriculture principles and organic farming principles.

Lebacq *et al*. (2012) suggested that sustainable livestock systems should indeed be environmentally friendly, economically viable for farmers, and socially acceptable, notably for animal welfare.

Roy and Chan (2102) proposed a set of indicators for agricultural (crop science) sustainability assessment at the farm level in Bangladesh, which are economic indicators, social indicators and ecological indicators.

According to Markulev and Long (2013), sustainability refers to the capacity to continue an activity or process indefinitely. It can be related to any number of economic, social, or environmental activities and can have varied meanings within different disciplines.

Shiri *et al.* (2013) observed that there was a significant and positive correlation between the variables of agricultural land size, the annual income, farmers' educational level, total participation in the participating in extension training courses, using resources and communication- information channels, having knowledge on conservation practices and attitudes towards soil conservation practices and adopting soil conservation practices.

Prajapati *et al.* (2014) showed that the size of family, annual income, livestock possession and Cosmopoliteness were statistically established positive and significant association with S.L.I of tribal farmers at 0.05 level of significance while in the case of non-tribal respondents, all the independent variables, except livestock possession were important variables affecting the S.L.I. It indicates that, there is a direct influence of agricultural modernization

27

on the S.L.I. of non-tribal farmers and they have taken the advantages of agricultural modernization for improving their S.L.I.

Ryan *et al.* (2016) conducted a study on comparison of indicators across Irish farm systems. They showed that dairy farms, followed by tillage farms, tended to be the most economically and socially sustainable farm systems.

Bachev (2017) reported that the overall sustainability of Bulgarian farms is good, with superior levels for environmental and social sustainability, and inferior levels for governance and economic sustainability.

2.5 Problems associated with French bean cultivation

Wanjiru (1992) reported on problems encountered by farmers in the production and marketing of French beans. The most cited problems in the production of the beans were high prices of fertilizer and pesticides, lack of working capital, lack of knowledge about various insect pests and diseases, lack of knowledge about appropriate chemicals to control pest and high labor requirements. In marketing, the constraints most commonly mentioned were fluctuation of the beans prices, lack of a steady market due to market fluctuations and exploitation by the middlemen in terms of low prices that do not reflect the market situation.

David (1999) reported that despite the different role played by beans in the domestic economy of the farmers in Nabongo and Lugala had experienced broadly similar production constraints, including diseases and pests, shortage of seed, lack of improved varieties and other inputs (*e.g.* fertilizers). Further, all of which contribute to low production. He also opined that poor transport systems, low prices offered by middlemen and other market-related factors also inhibit production. Yet, most of these constraints can be alleviated by known technologies and interventions including improved varieties, seed

production and storage technologies, better agronomic practices and food crop "banks" to discourage immediate post-harvest sales.

Adamo (2001) conducted a study in Ethiopia for identification of constraints of bean production and observed that major production constraints prioritized by farmers were moisture stress, poor soil fertility, weeds, soil erosion, pests and diseases and shortage of cultivable land.

Monda *et al.* (2003) reported that the major constraints in French bean production were marketing (55%), transport (30%), and diseases and pests (10%).

Voor den Dag (2003) found that farmers were better off dealing directly with exporters rather than through middlemen as this channel offered them more benefits in the value chain such as higher prices, credit acquisition, a contract, ability to negotiate prices and also assurance on the place of sale.

Katungi *et al*. (2010) reported the major constraints faced by common bean traders in Ethiopia were lack of capital, lack of storage facilities, lack of transport, and access to information.

Odero *et al.* (2013) concluded that the main constraints being the high cost of inputs (labour alone constituting 42.1% of the total cost), lack of cohesion, high information asymmetry, poor infrastructure and access to credit. Support services to farmers such as credit, extension and transport remain important in improving farmers' field operations.

Luque and Creamer (2014) reported that the major constraints in bean production were diseases, pests, and market constraints. They also suggested that institutional measures are needed, such as improving formal seed production and distribution channels and the development of national and regional seed policies.

Amanuel and Girma (2018) reported that the main constraint to the adoption of improved varieties of bean was associated with limited accessibility to seed.

RESEARCH METHODOLOGY

This chapter deals with the description of the study area and the research methods adopted to complete the present investigation. The procedures and methods adopted for the study are presented under the following headings:

3.1. Locale of the study and sampling procedure

      3.1.1. Sampling Strategy of the study

      3.1.2. Selection of districts

      3.1.3. Selection of blocks and villages

      3.1.4. Selection of respondents

3.2. Research design

3.3. Formulation of hypothesis

3.4. Selection of variables and their empirical measures

3.5. Data collection tools and techniques

3.6. Statistical tools and analysis

3.1 Locale of the study and sampling procedure

French bean is more or less common in all the districts of Nagaland, but intensive cultivation is continuing in Kiphire, Tuensang, Zunheboto, Mon and part of Phek districts of Nagaland. In these districts of Nagaland French bean (which is also known as *kholar* in local dialect) is one of the major crops and plays an important role in the livelihood of people of the region. Accordingly, the present study was conducted in some selected districts of Nagaland.

3.1.1 Sampling Strategy of the study

A sample is composed of a selected number of individuals, each of which is a member of the universe. The sampling aims to obtain the maximum possible information about the whole population with the minimum possible expenditure of resources and to achieve the reliability of an estimate. For the present study, purposive sampling technique was adopted to select district, blocks, villages, and respondents. Further, selection of the district was done based on the highest area under French bean cultivation, production and productivity of French bean among the districts. Based on Government Nagaland (2017), the highest area and production were under Tuensang district and productivity is from Kiphire districts. Accordingly, these two districts were selected to conduct the present study.

3.1.2 Selection of districts

In this study, two districts of Nagaland *viz*. Kiphire and Tuensang were purposively selected. Kiphire is the newly formed district, carved out of Tuensang district, and it is also the home of Sangtam (Eastern), Yimchunger and Sema tribes. This district is bordering with Myanmar in the east; Zunheboto in the west; Phek in south and Tuensang in the north. This district is situated at an elevation of 896 metres (2,940 ft) above mean sea level. Similarly, Tuensang district, the eastern most and the largest district of Nagaland, bordering with Myanmar in the east; Mokokchung and Zunheboto in the west; Kiphire in south and Longleng and Mon districts in the north. This district is the home to Changs, Sangtams, Yimchungers and Khiamniungan tribes of Nagaland. This district has an average elevation of 1,371 meters (4,498 feet) above mean sea level. Both the districts are known for its production and productivity of French bean.
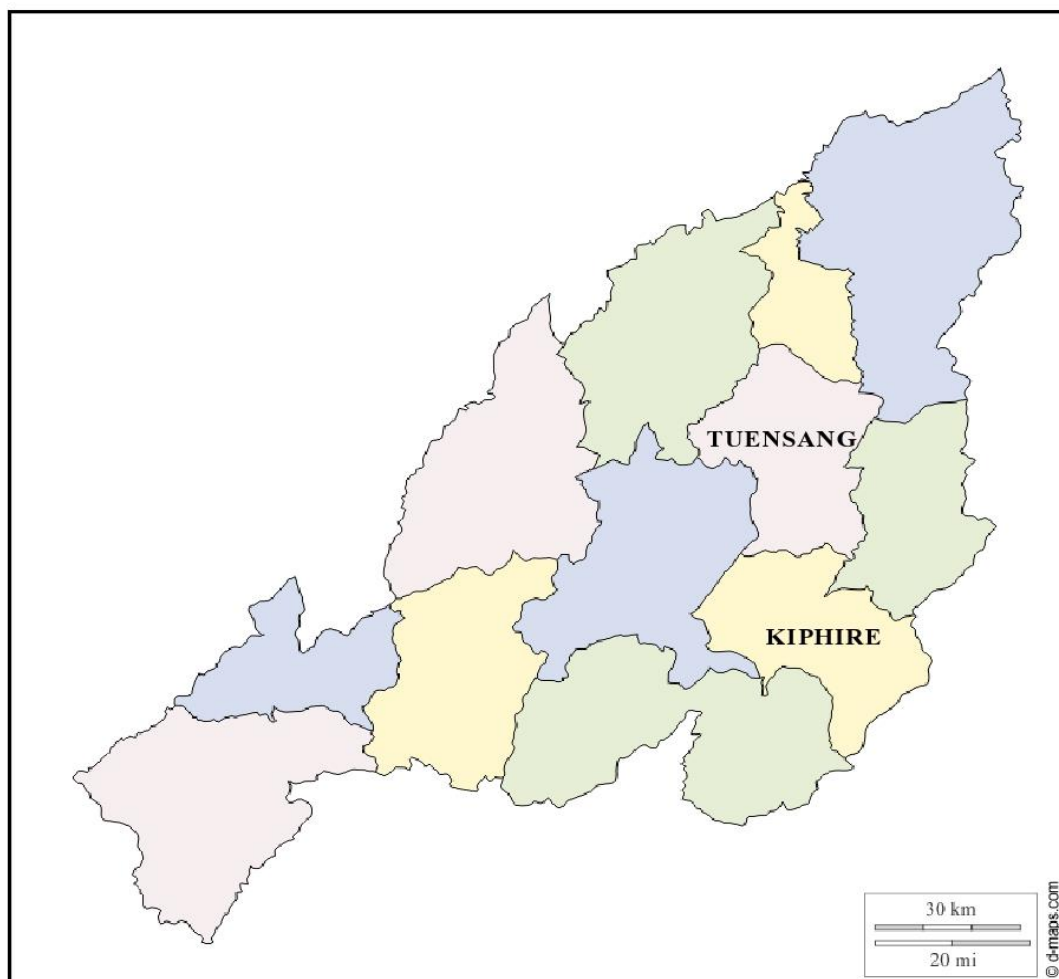
Fig 3.1 Map showing the study area

3.1.3 Selection of blocks and villages

Due to non-availability of any block/village level published data on area, production and productivity of French bean, block and district functionaries of the state department of Agriculture were consulted to know in which blocks farmers were largely growing French bean in regular manner. Based on the recommendation of those functionaries, at the first instance, two blocks from each district were purposively selected. Then, from each of those selected blocks, three such villages were again purposively selected where French bean was recommended by those functionaries to be representing the highest area, production and productivity.Thus, a total of 4 blocks and 12 villages were included for the study. The following table contains summary information about the locale of the present study.

District	Block	Village
Tuensang	Chessore	Chessore village
		Yuner (Auner) village
		Sotokur village
	Shamator	Shamator village
		Nengkonger village
		Malangeiur village
Kiphire	Pungro	Pungro village
		Zaonger village
		Phuvkiu village
	Kiphire	Phelunger village
		Kiphire village
		Inskiur village

Moreover, in order to have further clarity, a schematic depiction of the locale of research has been made through figure 3.2.

DISTRICTS	BLOCKS	VILLAGES	RESPONDENTS

DISTRICTS **BLOCKS** **VILLAGES** **RESPONDENTS**

Chessore

Chessore — Chessore — 20

Yuner — 20

Sotokur — 20

Tuensang

Purposive

Shamator

Shamator — 20

Nengkonger — 20

Malangeiur — 20

Purposive

Pungro

Pungro — 20

Zaonger — 20

Phuvkiu — 20

Kiphire

Purposive

Kiphire

Phelunger — 20

Kiphire — 20

Inskiur — 20

240
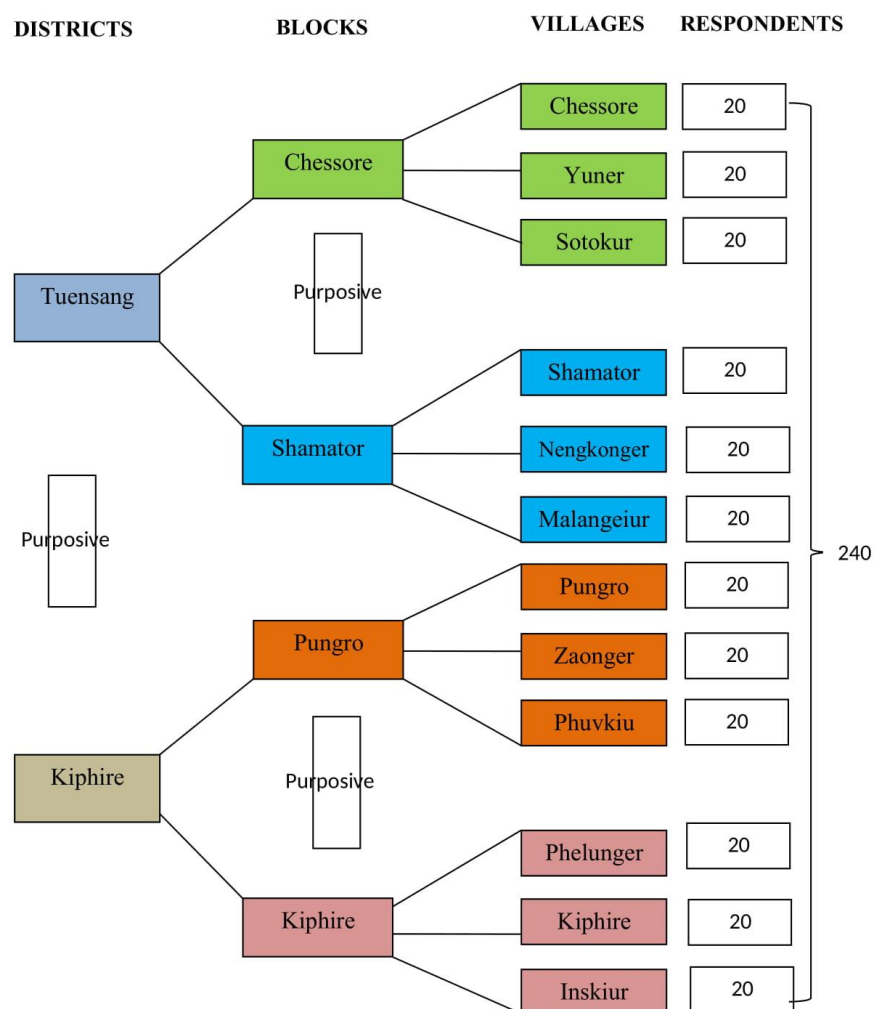
Fig 3.2 Model showing the methods for selection of villages and respondents for the present study

3.1.4 Selection of respondents

For the study, respondents were selected following the purposive sampling method, where the individuals were selected on the basis of some special characteristics. At the time of selection of respondents, due consideration was given on direct and continuous experience of French bean cultivation. Accordingly, farmers who had the experience of 3 years and above in French bean cultivation and directly involved in agriculture and allied activities were selected as respondents. Further, district and block level functionaries of the department of agriculture of respective district and block, as well as village chairman of the individual village were consulted to bring the true representative of sample and minimize the error in sampling. Based on the pre-decided criteria, 20 French bean growers from each selected village (60 growers from each block and 120 growers from each district) were included as respondents in the study. Therefore, a total of 240 French bean growers were purposively selected as respondents for the study.

3.2 Research design

A research design is a general outline for a research work which involves the collection, measurement, and analysis of data to complete the research work. It includes a comprehensive delineation of what the researcher will do. Further, a research design is a plan structure and strategy of research investigation conceived to obtain an answer to the research question and to control variance (Kerlinger, 1986). The plan is the overall scheme or programme of the research. The plan includes an outline of what the investigator will do from formulating hypotheses and their operational implications to the final analysis of data.

In the present study, the descriptive research design was adopted. Descriptive research design describes systematically and accurately the facts and characteristics of a given population or area of interest. It provides an

accurate portrayal or account of characteristics of a particular individual, situation or group; these studies are a means for discovering new meaning, describing what exists, determining the frequency with which something occurs and categorizing information.

3.3 Formulation of Hypothesis

The hypothesis is a proposition or principle which is assumed in order to draw its logical or empirical consequences, and by this method to test its accord with facts which are known or may be determined (Ray and Mondal, 2011). According to Young (1996), formulation of hypothesis gives definite point to the inquiry, aids in establishing direction in which to proceed and helps to delimit the field of enquiry by singling out the pertinent facts on which to concentrate. Keeping research ethics in consideration with references to the objectives of the present study, the following null hypotheses were formulated for due testing.

Now keeping the key measuring criteria in the form of how socio-economic features of the selected French bean growers is related to their income vis-à-vis expenditure pattern as well as what is the modality of association of various perceived explainers of sustainability with that of their socio-economic status. Following two null hypotheses were formulated for their due testing during the course of present research investigation.

H_01 = There exists no association between annual income from French bean cultivation by the respondents and their pattern of annual expenditure.

H_02: There exists no association between perceived indicators of sustainability and livelihood index of the French bean growers in the area under investigation.

3.4 Selection of variables and their empirical measures

For the present study, the selection of the variables and their empirical measures were made by consulting the experts from the different organizations, members of the advisory committee and available review of the literature. The theoretical basis for the selection of variables and their empirical measures is presenting in this section. According to Sekaran and Bougie (2010), a good conceptual framework identifies and defines the important variables in the situation that are relevant to the problem. Therefore, all variables were selected after careful consideration and presented according to the objectives of the study. The variables selected for the study are as follows:

1. Age
2. Gender
3. Marital status
4. Educational qualification
5. Occupation
6. Material possession
7. Size of land holding
8. Land under French bean cultivation
9. Annual Income
10. Type of house
11. Source of Information
12. Marketing channel
13. Migration status
14. Accessibility of villages and availability of basic amenities/ facilities
15. Experience in French bean cultivation
16. Livelihood activities
17. Income from the agricultural sector
18. Annual expenditure in French bean cultivation
19. Annual production of French bean
20. Annual income from French bean

3.4.1 Characterize the French bean growers and their socio-economic features

Various socio-economic and livelihood variables were included and analyzed to characterise the French bean growers and their socio-economic features under this objective, which presented accordingly.

3.4.1.1 Age

Age is among the most frequently collected and reported characteristic of persons in a wide variety of social, demographic and economic related statistics, and it is almost universally employed as a classification variable (United Nations, 1982).

For the present study, age referred to how old or young the respondent was at the time of the investigation. Distribution of respondents according to age was done by the mean (M) and standard deviation (SD). Depending on the age, the respondents grouped into four categories, namely, young age, lower medium age, medium age and old age farmers. Frequency, percentage, range, mean and standard deviation were adopted as empirical measures for this variable. The following table represents the details about the measurement of age.

Category	Method of categorization	Frequency	Percentage	Range
Young	<M -2SD			
Lower Medium	M-2SD to M			
Medium	>M to M+SD			
Old	>M+SD			

3.4.1.2 Gender

It is referred to as the categorization of the respondent into male and female. Frequency and percentage were used as the empirical measurements of the variable gender, which is given in the following table.

Category	Frequency	Percentage
Male		
Female		

3.4.1.3 Marital status

It is referred to the state of the relationship status of the respondents at the time of the interview, between husband and wife. Based on the marital status, the farmers were categorized into four categories *viz*. Married, never married, Widowed, Separated/divorced. The empirical measures of variable relating to marital status were frequency and percentage.

3.4.1.4 Educational qualification

Educational qualification considered as the level of formal education acquired by the respondents at the time of the investigation. Based on the level of educational qualification, the respondents were categorized into five, *viz*. 'illiterate', 'primary', 'secondary', 'graduate' and 'post-graduate and above'.

Further, weightage was assigned based on the educational qualification with the following five-point continuum, *i.e*. 0 to 4, respectively. The statistical tools, namely, frequency, percentage, mean and SD, were used as an empirical measurement of the variable. The following table shows the categorization of respondents based on educational qualification.

Sl. No.	Education	Score
1.	Illiterate	0
2.	Primary	1
3.	Secondary	2
4.	Graduate	3
5.	Post graduate and above	4

3.4.1.5 Occupation

The occupation referred to as the activity or task with which the respondent occupies oneself, specifically, the productive activity, service, trade or craft through which the respondent is regularly paid. It was classified into primary and secondary. The occupation with the main source of income was considered as a primary occupation while occupation involving other activity secondarily for income categorized as a secondary occupation. Based on the activity continued by the respondent, they had categorized accordingly. The empirical measures of the variable of occupation were done by frequency and percentage. The details about the empirical measures are given in the following table.

Sl. No.	Primary occupation	Frequency	Percentage	Secondary occupation	Frequency	Percentage
1.	Farming			Farming		
2.	Govt. job holders			Govt. job holders		
3.	Artisans			Artisans		
4.	Business			Business		
5.	Others			Others		

3.4.1.6 Material possession

It refers to the materials possessed by the respondents to use for household and agricultural purposes. It is the ownership of various assets or materials in order to aid in day to day activities of life. Material possession for the present study considered with two headings, namely, 'household assets' and 'agricultural machineries/implement'. Further, scoring for possession of each item done with a score of 1, and 0 for non-possession. The empirical measures of variables for material possession were frequency, percentage, mean and SD. The variables and measures adopted in this are given in the following three tables.

Material possession	Frequency	Percentage
Materials (household assets)		
Television		
Radio		
Refrigerator		
Bi-cycle		
Bike		
Auto-rickshaw		
Four-wheelers		
Mobile		
Sound system		

Materials (agricultural implements)	Frequency	Percentage
Machete (Dao)		
Spade		
Sprayer		
Duster		

Power tiller		
Tractor		
Pump set		
Ring well		
Godown		

A total score of each respondent also arrived from the scores obtained from each material possession and categorized with the help of mean and standard deviation (SD). The following table depicts the details about empirical measures used for categorization of respondents on material possession.

Material possession status	Method of categorization	Frequency	Percentage	Mean	SD
Low	<Mean – SD				
Medium	Mean ± SD				
High	>Mean + SD				

3.4.1.7 Size of land holding

Size of land holding referred to the total operational land under cultivation. It is expressed in hectare. Distribution of respondents based on the size of land holding was done following the procedure adopted by Reddy *et al.* (2017). Respondents with land holding less than 1 hectare were considered as marginal farmers whereas respondents with land holdings within 1 to 2 hectares considered as small farmers. Respondents with land holding size between 2.01 and 5 hectares were considered as medium farmers and respondents with land holding size more than 5 hectares were considered as

large farmers. The empirical measures for this variable were frequency, percentage, mean and SD. The following table shows the details about the categorization of respondents according to the land holding and the use of empirical measures.

Category	Criteria	Frequency	Percentage	Mean	SD
Marginal	<1 ha				
Small	1.01-2 ha				
Medium	2.01-5 ha				
Large	>5 ha				

3.4.1.8 Land under French bean cultivation

It refers to the total land under French bean cultivation of the respondent. In this study, the land under French bean was measured in a hectare. The categorization of respondents based on land under French bean cultivation done using mean ± SD. The empirical measures used for the study were frequency, percentage, mean, and standard deviation. The details of categorization of the respondents based on land under French bean are given in the following table.

Category	Method of categorization	Frequency	Percentage	Mean	SD
Small	<Mean - SD				
Medium	Mean ± SD				
Large	>Mean + SD				

3.4.1.9 Annual income

Income is one of the most important indicators of the socio economic status of an individual or a population (Jami, 2018). Annual income operationalized as the total income in rupees earned by the respondents from both agricultural and non-agricultural sector during one year. In the present study, annual income arrived by adding the income from the on-farm sector and off-farm sector. The categorization of the respondents was done by following the classification method as given by NCAER (2003). The empirical measures adopted for the study were frequency, percentage, mean and standard deviation. The details of the classification of respondents based on annual income are given in the following table.

Income category	Frequency	Percentage	Mean	SD
Low (₹ ≤35,000)				
Lower middle (₹ 35,001- ₹ 70,000)				
Middle (₹ 70,001 – ₹ 1,05,000)				
Upper middle (₹ 1,05,001 – ₹ 1,40,000)				
High (>₹ 1,40,000)				

3.4.1.10 Type of house

It is an important factor for determining the quality and status of livelihood in rural areas. Housing is a key determinant of quality of life that can be measured at the individual, household, and community levels and human rights in the cycle of human life (Campbell, Converse, and Rodgers, 1976). According to Christian (1980), the importance of housing in every life of human being and the national economy, in general, is enormous. In this study, the type or nature of the house refers to types of materials used for the construction of the house. According to the nature of the material used for the

construction of the house, type of house categorized into bamboo and thatch, bamboo and tin sheet, thatch and wood plate, wood plate and tin sheet, concrete and tin, and Reinforced Cement Concrete (RCC). Frequency and percentage used as the empirical measures of the variable which is given in the following table.

Types	Frequency	Percentage
Bamboo + thatch		
Bamboo + tin sheet		
Thatch + wood plate		
Wood plate + tin sheet		
Concrete + tin sheet		
RCC		

3.4.1.11 Sources of information

Information is an indispensable factor in the practice of farming, and it is the basis of extension delivery (Norberth *et al*., 2018). According to Camble (1992), man requires information to be able to manipulate factors of production such as land, labour and capital resources into meaningful and productive use. In this study, various sources of information were taken into consideration. Further, the degree of access to information sources for improved cultivation of French bean was quantified by following Bhagat *et al.* (2004). Weightage was assigned based on the degree of access of various information sources with the following four-point continuum, *i.e.* mostly (3), sometimes (2), rarely (1), and never (0), respectively. The total score obtained from all information sources by the individual respondent was taken into account.

Further, an individual score of all respondents against each information source was added together and considered as an overall score of particular sources of information. Based on the overall score of all information sources

ranking was drawn. The empirical measures used for the study are frequency, percentage and ranking. The method of distribution of respondents based on the source of information is given in the following table.

Information Sources	Extent of use								Score	Rank
	Mostly		Sometimes		Rarely		Never			
	Frequency	Percentage	Frequency	percentage	Frequency	Percentage	Frequency	percentage		
Contact farmers/farmers' friend										
Extension personnel										
Television										
Radio										
Agricultural university										
Farm magazines										
Newspapers										

3.4.1.12 Marketing channel

Marketing channel refers to the types of channel accessed by the respondents for selling of French bean. Marketing channel for the study was operationalized based on two parameters, namely, wholesale and retail. Frequency and percentage were used as the empirical measurement of the parameter as given in the following table.

Channel	Frequency	Percentage
Wholesale		
Retail		
Both		

3.4.1.13 Migration status

Migration is the movement of individuals or groups across symbolic or political boundaries into new residential areas and communities. Many individuals and families migrate from rural areas for economic reasons as they see no viable option for moving out of poverty within their communities (FAO, 2016). For the present study, migration status among the French bean farmers was studied, and the number of farmers or family members of respondents migrated over the years was identified by asking the respondents (with a direct binary question), and scoring also done accordingly. From the response of all the respondents, frequency and percentage arrived which is presented in the following table.

Migration status	Scoring	Frequency	Percentage
Migrated	1		
Not migrated	0		

3.4.1.14(a) Accessibility of the village

Accessibility refers to the extent of means of transportation and communication in the village. In this study, the accessibility of the village was studied with the following parameters *viz.* 'means of transportation and communication of the village', 'road condition inside the village', and 'distance of public/private transportation point'.

Based on the availability of different means of transportation and communication (public and private), a score of 0 and 1 were assigned for 'not available' and 'available' respectively in and around the village. Further, the distance of the public/private transportation and communication point from each village was recorded in kilometer, and scoring was assigned according to the distance from the transportation and communication point to the village. A score of 5 was assigned for the presence of the public/private transportation and communication point within the village. Accordingly, a score of 4 was assigned for the distance within 1 km, and distance within 2 km assigned as 3, distance within 4 km was assigned 2, distance within 5 km assigned 1, and 0 was assigned for distance within or more than 6 kilometers, respectively. Similarly, the condition of the road for transportation was also considered where a score of 1 was assigned for pucca road and a score of 0 for *kuccha* road. Finally, based on the total score obtained by each village, the accessibility of the village was categorized into poor, moderate and good using mean and standard deviation. The details about the empirical measures adopted here are presented in the following tables.

District							
Village	**Bus stand**		**Taxi stand**		**Post office**		**Road condition**	
	Score	**Distance**	**Score**	**Distance**	**Score**	**distance**	**Kucha**	**Pucca**

Category	Method of categorization	Frequency	Percentage	Mean	SD
Poor	<Mean - SD				
Moderate	Mean ± SD				
Good	>Mean + SD				

3.4.1.14(b) Availability of basic amenities/facilities

To study the availability of basic facilities/amenities in and around the village, the availability of basic facilities/amenities such as educational institution, medical facilities, bank, veterinary aid for livestock and drinking water facilities were taken into consideration. Based on the frequency of availability of facilities/amenities, scoring was assigned. A score of 1 was assigned for the availability of one facility/amenity; a score of 2 was assigned for the availability of two facilities/amenities and so on. Finally, a total score was obtained for each village and categorized all the villages into the poor, moderate and good using mean and standard deviation of the score. The details about the empirical measures adopted here are presented in the following tables.

Village	District											Bank	Veterinary aid	
	Educational institution				Medical facilities				Drinking water facilities					
	Primary school	High school	H.S. school	College	Primary health centre	Civil hospital	Private dispensary	Private hospital	Well/ pond	River or stream	Tap water		Veterinary dispensary	Diary society

Category	Method of categorization	Frequency	Percentage	Mean	SD
Poor	<Mean - SD				
Moderate	Mean ± SD				
Good	>Mean + SD				

3.4.1.15 Experience in French bean cultivation

It is starting to become widely recognized that farmers' knowledge has an important role to play in bringing about sustainable innovations in agriculture (Röling and Jiggins 1998; Chambers 1989; Hobart 1993). The agricultural knowledge system is generated by practitioners from their experience, without externally imposed criteria and agenda (Livingston, 1999). For the present study, experience refers to the years of experience in French bean cultivation by the respondent.

It is important to mention that a farmer with the experience of more than three years of French bean cultivation was considered as respondent for the present study. Further, based on the experience of the respondents, they were categorized into four categories, *viz.* 3 to 5 years, 6 to 8 years, 9 to 11 years and above 12 years, respectively. The empirical measures for this variable were frequency, percentage, mean, SD and range. The details about the measurement of experience and categorization of French bean growers are given in the following table.

Category	Frequency	Percentage	Mean	SD	Range
3 to 5 years					
6 to 8 years					
9 to 11 years					
12 years above					

3.4.1.16 Livelihood activities

Livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living (Chambers and Conway, 1991). Base on the information collected through pilot study and review of literature, all the livelihood activities in the study area were sub categorized into four broad head. Therefore, in the present study, crop-based livelihood, livestock-based livelihood, forest-based livelihood and different off-farm activities were taken into consideration. Crop-based livelihood defined as the livelihood activities involving crop cultivation and crop production as a means of living. Livestock-based livelihood is the activities which included the pooling of resources through the rearing of livestock as a means of living. Forest-based livelihood is the activity comprises both timber and non-timber forest-based activities followed by the respondents to achieve a means of subsistence. Off-farm livelihood activities are the activities continued by the respondents apart from agriculture or other forest-based activities as a source of livelihood. Different livelihood activities followed by respondents were categorized into 3 [*i.e.* Low (L), Medium (M) and High (H)] in respect of area under production, annual production, and annual income by applying mean and SD. The formula for calculation is as given below:

Category	Method of categorization
Low	<M-SD
Medium	M±SD
High	>M+SD

The following tables shows the method of categorization of respondents based on the different important crop-based, livestock-based, forest-based, and off-farm livelihood activities continued by the respondents. The empirical measures for the study were done by using frequency, percentage, mean and SD.

Sl No.	Crop	Respondents		Category (L=low, M=medium, H=high)	Distribution of respondents					
		Frequency	Percentage		Area (ha)		Annual Production (kg)		Annual Income (₹)	
					ha	Percentage of respondents	kg	Percentage of respondents	₹	Percentage of respondents
1				L						
				M						
				H						
2				L						
				M						
				H						
3				L						
				M						
				H						

| Sl No. | Livestock | Respondents | | Category (L=low, M=medium, H=high) | Distribution of respondents | | | |
| | | Frequency | Percentage | | Annual Production | | Annual Income (₹) | |
					Kg	Percentage of respondents	₹	Percentage of respondents
1				L				
				M				
				H				
2				L				
				M				
				H				
3				L				
				M				
				H				
4				L				
				M				
				H				

Sl No.	Activity	Respondents		Category (L=low, M=medium, H=high)	Distribution of respondents	
		Frequency	Percentage		Annual Income (₹)	
					₹	Percentage of respondents
1	Non-timber based					
				L		
				M		
				H		
				L		
				M		
				H		
2	Timber-based					
				L		
				M		
				H		
				L		
				M		
				H		
				L		
				M		
				H		

Sl. No.	Off-farm activities	Frequency	Percentage
1			
2			
3			
4			
5			

3.4.1.17 Distribution of respondents based on the number of livelihood activities

For the present study, the total number of livelihood activities recognized and recorded as maintained by the respondents. The livelihood activities were maintained by more than 50 per cent of the respondents were considered as major livelihood activities and remaining were considered as minor livelihood activities. Further, respondents were categorized based on the number of livelihood activities continued by them. The empirical measures for this variable were frequency, percentage, mean, and SD.

Sl. no	Details about livelihood activities				Frequency	percentage	Mean	SD
	Recognized	Major	Minor	Maintained				
1								
2								
3								

3.4.1.18 Income from the agricultural sector

For the present study, income from the agricultural sector operationalized as total income from crop production and livestock. Based on the income from the agriculture sector, respondents were categorized into a low, medium and high-income category using mean (M) and standard deviation (SD). The empirical measures adopted for this were

frequency, percentage, mean and standard deviation. The table below shows the method of distribution of respondents based on agricultural income:

Category according to income	Method of categorization	Frequency	Percentage	Mean	SD
Low	$<M - SD$				
Medium	$M \pm SD$				
High	$>M + SD$				

3.4.1.19 Annual expenditure in French bean cultivation

In this study, annual expenditure in French bean cultivation expressed as the amount of money spent by the respondents for different operations in French bean cultivation in one year. The amount of money spent on various operations was recorded based on 'Labour', 'Harvesting and post-harvest activities' and 'Seed'. Expenditures in land preparation, weeding, sowing included under labour expenditure and expenditure for harvesting, threshing, transportation and marketing included under harvesting and threshing activities. The expenditure for seed of each respondents was calculated by multiplying the quantity of seed used for sowing, and the price of seed. Frequency, percentage, range, mean and standard deviation were used to explore valid findings for different operations followed during French bean cultivation which is presented in the following table:

Area of expenditure	Expenditure (₹)	Percentage of total expenditure	Respondents spent towards different head of expenditure		Average (₹)
			Frequency	Percentage	
*Labour (land preparation, weeding, sowing)					
*Harvesting and post-harvest					

activities (harvesting, threshing, transportation and marketing)				
Seed				
Total				

Finally, the total expenditure calculated, and respondents were categorized into four. The table below shows the method of categorization and empirical measures adopted for categorization.

Category on expenditure	Frequency	Percentage	Mean	SD
Up to ₹ 3,000				
₹ 3,001-₹ 5,000				
₹5,001-₹7,000				
Above ₹ 7,000				
Total				

3.4.1.20 Annual production of French bean

For the present study, French bean production was operationalized as the total production of the bean in kg by the respondents in one year. In the developing countries, the common thing among farmers is that small farmer produced high-input-high-output and market-oriented crops (Wanjiru, 1992). French bean production plays an essential role in the livelihood of the farmers. Therefore, the production of French bean considered as an important variable for the study. The total production of the French bean was carefully analyzed and categorized into low, medium and high production using mean ±

SD. Frequency, percentage, mean and SD were the empirical measures used which is presented in the table below:

Category	Method of categorization	Frequency	Percentage	Mean	SD
Low	<Mean – SD				
Medium	Mean ± SD				
High	>Mean + SD				

3.4.1.21 Annual income from French bean

Annual income from French bean operationalized as the income generated from French bean cultivation in rupees in a year. Income generation was studied by exploring total income generated by selling the bean both as bean and green vegetables after meeting the family need for consumption. Total income from the French bean was calculated and categorized into low, medium and high income using the mean ± SD. Frequencies, percentage, mean and standard deviation used as the empirical measures, which is given in the following table.

Category	Method of categorization	Frequency	Percentage	Mean	SD
Low	<Mean – SD				
Medium	Mean ± SD				
High	>Mean + SD				

3.3.1.22 Comparative analysis of experience in French bean cultivation, size of land holdings, land under French bean cultivation, and French bean production between districts

Further, comparison of experience in French bean cultivation, size of land holding, land under French bean cultivation, and French bean production between the districts was done to understand the production factors of the two districts. The relationship among the experience in French bean cultivation, size of land holdings, land under French bean cultivation, and French bean production was done using multiple correlation analysis.

3.3.1.23 Livelihood index

A livelihood index was developed for the study. The objective of the index was to provide a model based on the quantitative measurements of livelihood. The livelihood index was developed based on the number of livelihood activities maintained by the individual and maximum numbers of livelihood activities maintained among the respondents. Respondents were asked to mention all livelihood activities maintained by them and number of activities were converted into a score by giving weightage of 1 to each livelihood activity. Further, the maximum number of livelihood activities maintained among the respondents were also calculated and converted into the score, accordingly. The calculation of livelihood index was done by total score achieved by the individual respondents divided by the maximum achievable score and multiplied by 100. The formula adopted for calculation of Livelihood index is given below:

$$\text{Livelihood index} = \frac{\text{Total score achieved by an individual for maintaining different livelihood activities}}{\text{Maximum achievable score}} \, X100$$

3.3.1.24 Distribution of respondents based on livelihood index

For the study, livelihood index was calculated for individual respondent. And based on the individual index, respondents were distributed into low, medium and high category using mean and standard deviation. The empirical measures and method of categorization are presented in the following table.

Category	Method of categorization	Frequency	Percentage	Mean	SD
Low	<Mean – SD				
Medium	Mean ± SD				
High	>Mean + SD				

3.3.1.25 Relationship between various socio-economic variables and Livelihood Index of French bean growers

In order to study the relationship between various socio-economic variables and Livelihood Index of French bean growers, multiple correlation analysis was adopted. For the study, socio-economic variables included *viz.* 'Age', 'education qualification', 'experience in French bean cultivation', 'material possession', 'source of information', 'type of house', 'land holding', 'land under French bean cultivation', 'French bean production', 'income from French bean', 'income from agricultural sector', 'annual income', 'annual expenditure'. Correlation analysis applied between the selected variables and Livelihood Index of French bean growers.

3.4.2 Explore the role of French bean as a livelihood component in the area under study

Role of French bean as a livelihood component of the farmers was tried to understand through the exploration of the issues like, Pattern of contribution to income by different crops on overall agricultural income (%), Pattern of contribution to income from different livestock on overall agricultural income (%), Pattern of contribution to income from forest-based activities, Pattern of contribution (%) of different off-farm livelihood activities on overall agricultural income, Pattern of annual income from different livelihood activities, and Annual expenditure pattern of the respondents.

3.4.2.1 Pattern of the contribution of different crops in overall agricultural income (percentage)

In the study, the pattern of contribution from different crops in total agricultural income was studied. Percentage of the contribution of different crops in total-income from crop cultivation arrived. Mean, percentage, standard deviation and range were also calculated for the study. The details about the measurement of the pattern of the contribution of different crops are presented in the following table.

Sl. No	Crop	Mean income (₹)	SD	Range (₹)	Total Income (₹)	Percentage contribution to total income from crop cultivation	Percentage contribution to total income from agriculture (including livestock)	Percentage contribution to total annual income
1								
2								
3								
4								
5								
	Total							

3.4.2.2 Pattern of the contribution of different livestock in overall agricultural income (percentage)

In the present study, the pattern of percentage income contributed by different livestock to total income from livestock as well as percentage income to total agricultural income and total annual income were calculated. Mean income, standard deviation, range and percentage were also calculated for the study. The details about measurement of pattern of contribution of different livestock is presented in the table below:

Sl.No	Livestock	Mean income (₹)	SD	Range (₹)	Total income (₹)	Percentage contribution to total income from livestock	Percentage contribution to total income from agriculture (including livestock)	Percentage contribution to total annual income
1								
2								
3								
4								
5								

3.4.2.3 Pattern of contribution of forest-based livelihood activities (percentage)

For the present study, income from different forest-based livelihood activities was studied and recorded. And, mean, SD, range and percentage of contribution in total annual income were calculated. The table below shows the method of distribution of income from different forest-based livelihood activities.

Sl. No.	Activities	Mean income	SD	Range (₹)	Total income	Percentage contribution	Percentage contribution

		(₹)			(₹)	to total income from forest activities	to total income
1							
2							
3							

3.4.2.4 Pattern of the contribution of different off-farm livelihood activities in overall agricultural income and total annual income (percentage)

For the present study, income from different off-farm livelihood activities was studied and recorded and mean income, SD, range, and percentage of contribution in total annual income was calculated. The table below shows the method of distribution of income from different off-farm livelihood activities.

Sl. No.	Activities	Total income (₹)	Mean income (₹)	SD	Range (₹)	Percentage contribution to income from off-farm livelihood activities	Percentage contribution to total income
1							
2							
3							

3.4.2.5 Contribution from different livelihood activities in total annual income

In the present study, the total income of different livelihood activities, *viz.,* crop-based livelihood, livestock-based livelihood, forest-based livelihood and off-farm livelihood activities were studied and percentage of contribution towards the total annual income was calculated. Mean, SD, the range was also calculated for each activity. The table below shows the measurement of the contribution of different livelihood activities.

Sl No	Livelihood activities	Mean income (₹)	SD	Percentage contribution to total annual income	Ranking based on percentage contribution in total annual income
1	Crop based				
2	Livestock-based				
3	Forest-based				
4	Off-farm				
5	French bean				

3.4.2.6 Annual expenditure pattern of French bean growers for their livelihood and survival

Annual expenditure pattern of the respondents for the present study was operationalized as the amount of money spent by the respondents in a year for livelihood and survival. The amount of money spent on daily life activity by the respondents was explored, and the total annual expenditure and percentage of annual expenditure for each activity carried out by the respondents were calculated. Further, the total annual expenditure was categorized into low, medium and high expenditure category using mean, percentage and standard deviation. The empirical measures of annual expenditure pattern of French bean growers are presented in the following consecutive 2 tables:

Item	Expenditure (₹)	Expenditure Percentage	Mean (₹)	SD
Food				
Clothing				
Cooking fuel				
Health				
Loan payment				
Phone				
electricity				
Transport				
House maintenance				
Fixed asset				
Social				
Religious				
Education				
Cultivation				
Total				

Expenditure	Method of categorization	Frequency	Percentage	Mean	SD
Low	<Mean – SD				
Medium	Mean ± SD				
High	>Mean + SD				

3.4.2.7 Relationship between various socio-economic variables and income from French bean cultivation

To study the relationship between various socio-economic variables and income from French bean; the correlation analysis was adopted. For the study, socio-economic variables were selected *viz.* Age, educational qualification, experience in French bean cultivation, material possession, source of information, type of house, land holding, land under French bean cultivation, French bean production, French bean income, income from agricultural sector, annual income, annual expenditure. Correlation analysis applied between the selected socio-economic variables and income from French bean.

3.4.2.7.1 Relationship between various annual expenditure pattern and income from French bean

Various expenditures incurred by the respondent and income from French bean were taken into consideration to study the relationship between various expenditure pattern and income from French bean. Further, the major area of expenditure *viz.* expenditure for food, clothing, health, education, and total annual expenditure of the respondents were selected. Correlation analysis was adopted to explore the relationship between the expenditure and income from French bean.

Further, linear regression analysis was adopted between income from French bean cultivation and selected area of expenditure to explore the cause-effect relationship.

3.4.3 Examine sustainability through French bean-based livelihood system

To explore the sustainability through French bean-based livelihood system, various documents related to sustainability research and study, namely, 'Indicators of sustainable Development: Guideline and Methodologies by (UN, 2007), sustainable Consumption and Production Indicators For The Future SDGs (UNEP, 2015), 'Sustainability Evaluation Checklist (Schroter, 2010) and Developing Methodologies for Livelihood Impact Assessment: Experience of the African Wildlife Foundation in East Africa (Ashley, and Hussein, 2000) and a livelihood study on pineapple growers in West Siang district of Arunachal Pradesh (Gamlin, 2016), were consulted. Based on the review work, different indicators and variables/parameters of sustainability were identified and

included in the study. The different indicators of sustainability, namely, economic sustainability, human sustainability, social sustainability, and environmental sustainability were taken into consideration to measure the sustainable performance of French bean. A series of parameters were prepared for each indicator and scoring were done with four-point continuum, *i.e.* most often, often, sometimes, rare and never, and scoring from 4 to zero (0) was assigned, accordingly. Respondents were asked to respond according to their degree of agreement (continuum, *i.e.* most often, often, sometimes, rare and never) with each parameter under different indicators. The empirical measures used for these variables were frequency, percentage, mean and standard deviation. The overall mean of each indicator was calculated, and the overall mean value, greater than the mid-point of assigned weightage (2) was considered as French bean-based livelihood sustainable in respect of that indicator. Further, the overall mean of all indicators was calculated and greater than or lower than the mid-point of weightage was the consideration to consider the sustainability or unsustainability of French bean-based livelihood activity.

3.4.3.1 Economic sustainability

Economic sustainability implies a system of production that satisfies present consumption levels without compromising future needs (Basiago, 1999).

Economic sustainability refers to practices that support long-term economic growth without negatively impacting the social, environmental, and cultural aspects of the community. For the present study, economic sustainability was defined in terms of whether or not French bean cultivation has created sustainable economic values for the farmers. The details about measurement and different statements/parameters of economic sustainability are given in the following table:

Sl. No.	Parameters	Most often/ strongly	Often/ Agree (3)	Some Times/ Some how	Rare/r arely agree	Never (0)

		agree (4)		agree (2)	(1)	
1	Potential for steady and standard income					
2	Cost of management is cheaper compared to other crops					
3	Income from per unit area is higher compared to other crops					
4	Income opportunity during off season					
5	Round the year price is standard					
6	Supporting better financial savings					
7	Income opportunity for women					
8	Procurement of planting material is easy					
9	Chance of crop failure is less					
10	The cost-benefit ratio is higher					
11	Higher demand in the market					
12	Post-harvest management is easier					

3.4.3.2 Human sustainability

Human sustainability for the present study was operationalized as the degree of sustainability of French bean cultivation which involves specific goals, strategies and methods implemented to preserve and improve the quality of human life. The details about measurement and different statements/parameters of human sustainability are given in the following table.

Sl. No.	Parameters	Most often/strongly agree (4)	Often /Agree (3)	Some Times/ Some how agree	Rare/ rarely agree	Never (0)

				(2)	(1)	
1	Reducing poverty					
2	Addressing food security					
3	Addressing the issues of nutrition					
4	Addressing the issues of health					
5	Addressing the issues of taste/palatability					
6	Generating employment					
7	Improving living standard					
8	Unskilled worker can perform in cultivation practices					
9	Knowledge requirement for cultivation is not important					
10	The requirement of workers for cultivation is less					
11	Level of education is not important					
12	Can be carried out by both men and women					

3.4.3.3 Social sustainability

Social sustainability for the present study was defined as the degree of sustainability of French bean cultivation involving impacts (positive and negative) on people and society as a whole. The details about the measurement of different statements/parameters of social sustainability is given in the following table:

Sl. No.	Parameters	Most often/strongly agree (4)	Often /Agree (3)	Some Times/ Some how agree (2)	Rare/ rarely agree (1)	Never (0)
1	Recognition (being engaged in something worthwhile)					
2	Up-scaling the social prestige					
3	Maintaining happiness of the family					

4	Compatible with landless/small farmer					
5	Gender discrimination is absent					
6	Upscale the current standard of living					
7	Compatible with food habit					
8	Compatible with social norms and values					
9	Good source of income for social groups like SHGs/FIGs					
10	Crops can be grown traditionally					
11	Its cultivation is easily taken up by the development sector for economic development of the weaker section					
12	Cultivation is familiar with all the members of the family					

3.4.3.4 Environmental sustainability

For the present study, environmental sustainability was operationalized as the degree of sustainability of French bean cultivation towards a healthy environment, climate and ecosystems, as well as various vital goods and services provided to humans and other organisms. The details about the measurement of different statements/parameters of environmental sustainability is given in the following table:

Sl. No.	Parameters	Most often/strongly agree (4)	Often/ Agree (3)	Some Times/ Some how agree (2)	Rare/ rarely agree (1)	Never (0)
1	Restore ecological balance and biodiversity					
2	Not undermining/deteriorating the natural resources					
3	Favorable for organic cultivation and without chemical inputs					
4	Production/yield is consistent					

5	Maintain soil fertility					
6	Control soil erosion					
7	Suitable in mixed cropping and jhum field					
8	Can grow in climatic stress condition					
9	Can grow in less fertile soil					
10	Restore soil moisture					
11	Crop residues can be used as fodders for animals					
12	The crop is climate-resilient					

3.4.3.5 Sustainability index

A sustainability index was developed for the study. The objective of developing the index was to provide a model to measure the sustainability from an economic, human, social and environmental perspective. The calculation of sustainability index was done by total score achieved by the individual respondents (in respect of 48 statements/parameters) divided by the total achievable score and multiplied by 100.

$$\text{Sustainability Index} = \frac{\begin{array}{c}\text{Total score achieved in}\\\text{sustainability statement/parameters}\end{array}}{\text{Maximum achievable score}} X100$$

3.4.3.5.1 Relationship between sustainability parameters and livelihood index

A relationship study between various sustainability parameters, namely, economic sustainability, social sustainability, human sustainability, environmental sustainability along with overall sustainability and livelihood index were taken into consideration. Correlation analysis was adopted to explore the relationship between the sustainability parameters and livelihood index.

3.4.4 Identification of the problems associated with French bean, a cultivated species and to suggest the mitigation measures, if any

Constraint analysis is becoming one of the important components of extension research. Without analyzing the constraints, it is impossible to disseminate the technologies among the farming community (Suganthkumar and Philip, 2017). The problems or obstacle faced by the farmers in every part of the country are mainly socio-economical, psychological and agro-ecological in nature. For the present study, following major aspects of cultivation, *viz.* site selection, land preparation, planting material collection, field management, labour, irrigation, transportation, harvesting, processing and value addition, storage, marketing, grading and sorting, and non-availability of suitable inputs were included in problems identification. Frequency and percentage were the empirical measures used for this objective.

Further, to mitigate the problems, respondents were asked to suggest suitable measures as provided by the respondents, all measures were documented and analyzed to explore and propose suitable mitigation measures. The theoretical orientations of the variables are presented as follows.

3.4.4.1 Site selection

The site selection for the study was operationalized as the activity involved in the selection of the area/plot for the cultivation of French bean.

3.4.4.2 Land preparation

Land preparation for the study was operationalized as the activities involved in the transformation of land for French bean cultivation.

3.4.4.3 Planting material collection

It refers as the collection of seeds for French bean cultivation.

3.4.4.4 Field management

It refers to the constraints faced by the farmers during different activities practiced for managing the field with standing crop.

3.4.4.5 Crop protection

It referes to the activity involved in pest and disease management of the crop.

3.4.4.6 Labour

It referes as the availability of manpower for work on the cultivation of French bean on a hire basis.

3.4.4.7 Irrigation

It referes to the application of water by different methods in the field for crop cultivation.

3.4.4.8 Transportation

It refers to the act of procurement of inputs from the market place, transportation and carrying inputs/implements to crop field and back to earlier place. As well as sending their produce to the market place.

3.4.4.9 Harvesting

It refers to the constraints faced by the farmers during the process of harvesting/gathering a ripe/mature crop from the fields.

3.4.4.10 Processing and value addition

It refers to the activities, namely, proper cleaning and drying of harvested product to minimize the post-harvest loss, and to maximize the storage life as well as to maximize the market value.

3.4.4.11 Storage

It refers to the action of preserving or storing the product after harvesting to restrict the deterioration of the quality of the product for future use.

3.4.4.12 Marketing

Marketing is the activity of selling. The problems faced by the farmers during the sale of farm products explored under this heading.

3.4.4.13 Grading and sorting

Sorting and grading are the activities for differentiation of harvest in to good and ugly as well as grouping according to class. The constraints involved during inspection, assessment and sorting of products regarding quality, freshness, legal conformity and market value were studied under this heading.

3.4.4.14 Non-availability of suitable inputs

It is defined as the difficulties faced by the farmers in availing essential inputs like seeds, agricultural implements and credits.

3.5 Data collection tools and techniques

The data collected for the study based on primary and secondary data. The primary data were collected from the respondents with the help of a properly designed and pre-tested interview schedule using personal interview method. The primary data were collected during the year 2016 to 2018. The secondary data were collected from various offices and allied departments, and various published and unpublished sources.

3.6 Statistical tools and analysis

The data collected from the respondents were scored, tabulated and analyzed using suitable methods. The statistical techniques and methods used in the present study are frequency, percentage, mean, standard deviation, correlation and regression.

Frequency

Frequency is the number of times it occurs in a given series of observation.

Percentage

Percentages used for making simple comparisons. For calculating percentage, the frequency of a particular cell was divided by the total number of the respondents in that specific category and multiplied by 100.

Range

The range is the difference between the smallest and largest of the observation.

Ranking

The ranking is an expression of people's priority about their thought and feelings. The method of analysis for ranking of items depends on the frequency of responses on a particular statement, *e.g.* rank- 1 is given to the item or statement that has got the highest frequency.

Mean

It refers to the average value of the distribution which is arrived at by dividing the sum of scores in the distribution by number of observation and formula presented below

$$\bar{x} = \frac{\Sigma_1^N x}{N}$$

Where, $\bar{x}$ = mean of the scores

$$\Sigma = \text{sum of individual score}$$

$$N = \text{number of observation}$$

Standard deviation

Standard deviation is a square root of the arithmetic mean divided by the number of observation and presented below:

$$S = \sqrt{\frac{(x-\bar{x})^2}{n-1}}$$

Where, S = standard deviation of the sample

x = individual score

N = number of observations

Correlation

When an increase or decrease in one variant is accompanied by an increase or decrease in the other variate, the two are said to be correlated, and the phenomenon is known as correlation.

$$\gamma = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{N\Sigma X^2 - (\Sigma X^2)][N\Sigma Y^{2-}\Sigma Y)^2]}}$$

Where X and Y = original scores in variables X and

N = number of paired scores

ΣXY =each X multiplied by corresponding Y, then   summed

ΣX = sum of X scores

ΣX^2 = each X squared, then summed

$(\sum X)^2 =$ sum of X scores, squared

$\sum Y =$ sum of Y scores

$\sum Y^2 =$ each Y squared, then summed

$(\sum Y)^2 =$ sum of Y scores, squared

Regression

The underlying relation between *y* and *x* in a bivariate population can be expressed in the form of a mathematical equation known as regression equation and is said to represent the regression of the variate *y* on the variate *x* (Panse and Sukhatme, 1967).

If *y* is the dependent variable and *x* is the independent variable, then the linear regression equation can be written as

y = *a* + *bx*

The values of *a* and *b* can be obtained by the method of least squares which consists of minimizing the expression

$\sum (y_i - a - bx_i)^2$ with respect to a and b.

The values of a and b are

$a = \bar{y} - b\bar{x}$

$$b = \frac{\sum XY - (\sum X)(\sum Y)}{\sqrt{N\sum X^2 - (\sum X^2)}[N\sum Y^{2-}\sum Y)^2]}$$

The regression equation can be written as

y = $\bar{y}$ − b$\bar{x}$ + bx or y − $\bar{y}$ = b (x − $\bar{x}$)

where b is the regression coefficient.

RESULTS AND DISCUSSION

The findings of the investigation are presented and discussed in this chapter with the help of relevant statistical tools. After careful observations, the findings of the study are presented according to the objectives of the study.

4.1 Characterize the French bean growers and their socio-economic features

The purpose of this objective was to study the status of French bean growers with respect to different socio-economic features. Accordingly, various socio-economic features were carefully analyzed and discussed under this objective.

4.1.1 Age

Table 4.1 shows the distribution of respondents according to their age. Around 48 per cent of the respondents (47.92%) belonged to lower medium age group followed by medium age group (32.92%) and old age group (17.91%) respectively. Only 1.25 per cent of the respondents belonged to the young age group. The table further shows the average age of the respondents was 52 years with a standard deviation value of 8.86 and range was 30-83 years.

It can be concluded that around 50 per cent of the respondents were from the age group of 35 to 51 years as well as the population under young age group was negligible.

4.1.2 Gender

Table 4.2 shows the distribution of respondents based on gender. Table shows that 96.25 per cent of the respondents were male, and 3.75 per cent of the respondents belonged to the female gender.

From the table, it can be concluded that male-gender plays a major role in French bean cultivation in the study area.

4.1.3 Marital status

Table 4.3 shows the distribution of respondents based on marital status. The study reveals that 95 per cent of the respondents were married, 2.50 per cent were widowed, and 1.67 per cent were divorced and only 0.83 per cent of the respondents were found to be never married.

The reason for the majority of the respondents was found to be married may be because all respondents were above 30 years old (table 4.1).

4.1.4 Educational qualification

Table 4.4 shows the distribution of respondents based on their educational qualification. The table reveals that 63.33 per cent of the respondents from Tuensang district had primary level of educational qualification whereas 72.50 per cent of the respondents from Kiphire district had primary level of educational qualification. Again, under Tuensang district, 18.33 per cent of the respondents had secondary level of educational qualification and 16.66 per cent of the respondents from Kiphire district had a secondary level of education. The remaining 18.33 and 10.83 per cent of the respondents under Tuensang and Kiphire district respectively were found to be illiterate. The table also reveals that none of the respondents attended graduate

Table 4.1 Distribution of respondents according to their age   N=240

Sl. No	Category	Frequency	Percentage	Mean	SD	Range
1	Young (<35)	3	1.25			
2	Lower Medium (35-51)	115	47.92	51.98	8.86	30 - 83
3	Medium (52-60)	79	32.92			
4	Old (>60)	43	17.91			
	Total	**240**	**100.00**			

Table 4.2 Distribution of respondents based on gender   N=240

Category	Frequency	Percentage
Male	231	96.25
Female	9	3.75
Total	**240**	**100.00**

Table 4.3 Distribution of respondents based on marital status   N=240

Category	Frequency	Percentage
Married	228	95.00
Never married	2	0.83
Widowed	6	2.50
Divorce	4	1.67
Total	**240**	**100.00**

or post-graduate level of education. The mean education level was 1.02 with a standard deviation value of 0.60 in respect of Tuensang district. In the case of Kiphire district, the mean education level was 1.05 with a standard deviation value of 0.52. The educational qualification ranges from illiterate to secondary. The table further reveals that from the two districts, *i.e*. Tuensang and Kiphire, 67.91 per cent of the respondents had educational qualification up to primary level, 17.50 per cent of the respondents had secondary level of education and the remaining 14.58 per cent of the respondents were illiterate. The overall mean education level was 1.02 with a standard deviation value of 0.56.

From the table, it can be concluded that 82.50 per cent of the respondents were either illiterate or completed up to the primary level of education and educational status in the study area was in a pitiful state. The study conducted by Shahi (1994) also revealed that a greater number of farmers attended up to primary levels of education which supports the current findings.

4.1.5 Occupation

Table 4.5 shows the distribution of respondents based on occupation. The table shows that 98.33 per cent of the respondents were engaged in farming as their primary occupation. Remaining, 1.66 per cent of the respondents had a government job as their primary occupation. The table also shows that 1.66 per cent of the respondents were keeping farming as their secondary occupation, 13.33 per cent as artisans, and 2.50 per cent were involved in the business.

The study reveals that almost all the respondents were engaged in farming as primary occupation, and only a few percent of the respondents were continuing with some other activities along with farming.

Table 4.4 Distribution of respondents based on their educational qualification

N=240

Sl. No	Category	Tuensang				Kiphire				Pooled			
		F	%	M	SD	F	%	M	SD	F	%	Mean	SD
1	Illiterate	22	18.33			13	10.83			35	14.58		
2	Primary	76	63.33			87	72.50			163	67.91		
3	Secondary	22	18.33	1.02	0.60	20	16.66	1.05	0.52	42	17.50	1.02	0.56
4	Graduate	0	0			0	0			0	0		
5	Post graduate	0	0			0	0			0	0		
	Total	**120**	**100.00**			**120**	**100.00**			**240**	**100.00**		

4.1.6 Distribution of respondents based on possession of household assets

The table 4.6 shows that 97.08 per cent of the respondents used mobile phone, 49.16 per cent had television, 1.25 per cent had accessed to the radio, 1.66 per cent had a sound system and only 0.41 percent had a refrigerator.

From the above findings, it can be concluded that majority of the respondents had accessed to mobile phones which may be due to the fact that communication is vitally important to the farmers. It also helps the farmers to keep in touch with the change agent system.

4.1.6.1 Distribution of respondents based on the possession of agricultural implements

Table 4.7 reveals that cent per cent of the respondents possessed machete (*Dao*) and spade. On the other hand, 78.75 per cent had godown, and only 0.41 per cent of the respondents had a ring well. Farmers had used machete (*Dao*) and spade since time immemorial and it is still in use as the primary tools for farming. Therefore, the finding shows that cent per cent (100.00%) of respondents possessed *Dao* and spade, and farm mechanization was not taken place. Majority of the farmers used the indigenous bamboo structure as godown, which was the only means for safely storing crop products. Since the river is considered as a major natural water source in rural areas, only negligible portion of the respondents were found to use ring well as a water source.

4.1.6.2 Distribution of respondents based on the material possession

Table 4.8 showing the distribution of respondents based on material possession. The table reveals that 80.83 per cent of the respondents had medium material possession, 16.25 per cent had a low level of material possession and only 2.91 per cent of the respondents had a high level of material possession with a mean value of 4.28 and standard deviation value of 0.79.

The fact that a large number of the respondents had a medium level of material possession may be due to poor economic condition, the backwardness of the area and simple living style of the farmers. Luxury is something which farmers cannot afford with limited income (Table 4.11). Moreover, because of hilly topography of the region farmers could use only a few agricultural implements. Findings of this study have an agreement with the study of Prasad *et al.* (2017).

Table 4.5 Distribution of respondents based on occupation   N=240

Sl. No.	Primary occupation	Frequency	Percentage	Secondary occupation	Frequency	Percentage
1.	Farming	236	98.33	Farming	4	1.66
2.	Govt. job holders	4	1.66	Govt. job holders	0	0.00
3.	Artisans	0	0.00	Artisans	32	13.33
4.	Business	0	0.00	Business	6	2.50

Table 4.6 Distribution of respondents based on possession of household assets   N=240

Materials (household assets)	Frequency	Percentage
Television	118	49.16
Radio	3	1.25
Refrigerator	1	0.41
Mobile	233	97.08
Sound system	4	1.66

Table 4.7 Distribution of respondents based on the possession of agricultural implements **N=240**

Materials (agricultural implements)	Frequency	Percentage
Machete (Dao)	240	100.00
Spade	240	100.00
Ring well	1	0.41
Godown	189	78.75

Table 4.8 Distribution of respondents based on the material possession

N=240

Material possession	Frequency	Percentage	Mean	SD
Low	39	16.25		
Medium	194	80.83	4.28	0.79
High	7	2.91		
Total	**240**	**100.00**		

4.1.7 Size of land holding

Table 4.9 shows the distribution of respondents based on the size of land holding. The table reveals that 65.00 per cent of the respondents in Tuensang district and 51.66 per cent of the respondents in Kiphire district had medium size of land holding, 30.83 per cent and16.66 per cent under Tuensang and Kiphire district respectively had large land holding. Again, 3.33per cent under Tuensang district and 24.16 per cent under Kiphire district had small land holding and only 0.83 per cent of the respondents under Tuensang district and 7.50 per cent of the respondents under Kiphire district had marginal land holding. The average size of landholding across the study area was 3.73 ha with a standard deviation value of 1.96.

From the study, it can be concluded that the majority of the French bean growers were medium farmers followed by large farmers, small farmers and marginal farmers respectively. Roy *et al.* (2013) also reported that the majority of the hill farmers from Almora District in Uttarakhand were having a medium size of land holding.

4.1.8 Land under French bean cultivation

Table 4.10 shows the distribution of respondents based on land under French bean cultivation. Under Tuensang district79.16 per cent of the respondents had medium land for French bean cultivation whereas, under Kiphire district, 86.66 per cent of the respondents had medium land for French bean cultivation. Another,17.50 per cent of the respondents from Tuensang district had large land holdings in terms of land under French bean cultivation whereas under Kiphire district only 8.33 per cent of the farmers had large land holdings, and the remaining 3.33 per cent and 5.00 per cent from Tuensang and Kiphire district respectively were placed under the small category. The table further reveals that majority of the respondents (82.91%) across the study area had medium land holdings (0.38-3.33 ha) under French bean cultivation, 12.91

per cent of the respondents had large landholding (>3.33 ha) and 4.16 per cent of the respondents had small landholding (<0.38 ha) under French bean cultivation. The average land size under French bean cultivation was 1.86 ha with a standard deviation value of 1.47.

The study clearly shows that the majority of the French bean growers in the study area allocated land 0.38 ha to 3.33 ha or more for French bean cultivation. The reason behind the allocation of more land under French bean cultivation may be due to its high remunerative performance without much care, as well as the immense situational (climatic condition of the study area) and cultural compatibility of the crop.

4.1.9 Annual income

The table 4.11 reveals that 46.66 per cent of the respondents from Tuensang district and 59.16 per cent of the respondents from Kiphire district had income range from ₹35,001 to ₹ 70,000.Again, 34.16 per cent and 22.50 per cent of the respondents had income range from ₹ 70,001 to ₹ 105,000, another 8.33 per cent and 2.50 per cent of the respondents from Tuensang and Kiphire district respectively had income range from ₹ 105,001to ₹ 140,000. Further, 6.66 per cent and 11.66 per cent of the respondents from Tuensang and Kiphire district respectively had income below ₹ 35,000 and respondents having income more than ₹ 140,000 were only 4.16 per cent each of the respondents from both the districts. The table also reveals that the majority of the respondents (52.91%) across the study area had an income range from ₹ 35,001 to 70,000 per annum, and they were categorized as a lower-middle-income group. Another 28.33 per cent of the respondents had an income range from ₹ 70,001 to 105,000 and categorized them under the middle-income group, 9.19 per cent of the respondents were categorized under low-income group with income range below ₹ 35,000. Again, 5.41 per cent of the

respondents were placed under the upper-middle-income group with income range from ₹ 105,001 to ₹ 140,000. Remaining, 4.16 per cent of the respondents were categorized under the high-income group with an income range of more than ₹ 140,000. The mean income of the respondents was ₹70,542.13with a standard deviation value of36131.04.

It can be concluded from the table that majority of the French bean growers (62%) in the study area had limited or low annual income, and the remaining (38%) of them had average or higher annual income.

Table 4.9 Distribution of respondents based on the size of land holding (ha) N=240

Category	Size of land holding (ha)	Tuensang		Kiphire		Pooled			
		F	%	F	%	F	%	Mean	SD
Marginal	<1	1	0.83	9	7.50	10	4.16		
Small	1.01-2	4	3.33	29	24.16	33	13.75	3.73	1.96
Medium	2.01-5	78	65.00	62	51.66	140	58.33		
Large	>5	37	30.83	20	16.66	57	23.75		
Total		**120**	**100.00**	**120**	**100.00**	**240**	**100.00**		

Table 4.10 Distribution of respondents based on land under French bean cultivation (ha) N=240

Category	Tuensang		Kiphire		Pooled			
	F	%	F	%	F	%	Mean	SD
Small (<0.38 ha)	4	3.33	6	5.00	10	4.16		
Medium (0.38-3.33 ha)	95	79.16	104	86.66	199	82.91	1.86	1.47
Large (>3.33 ha)	21	17.50	10	8.33	31	12.91		
Total	**120**	**100.00**	**120**	**100.00**	**240**	**100.00**		
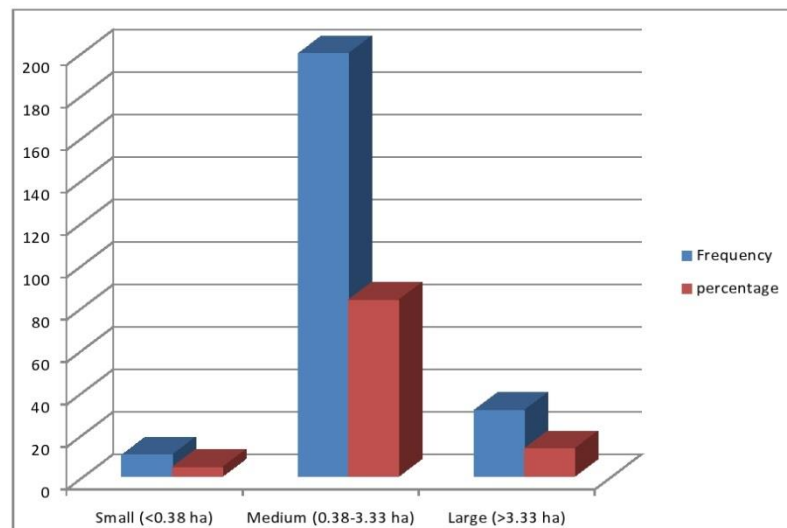
Fig 4.1 Distribution of respondents based on land under French bean cultivation

Table 4.11 Distribution of respondents based on annual income (₹) N=240

Income	Tuensang		Kiphire		Pooled			
	F	**%**	**F**	**%**	**F**	**%**	**Mean**	**SD**
Low (≤35,000)	8	6.66	14	11.66	22	9.16	70,542.13	36131.04
Lower middle (35,001-70,000)	56	46.66	71	59.16	127	52.91		
Middle (70,001 – 105,000)	41	34.16	27	22.50	68	28.33		
Upper middle (105,001 – 140,000)	10	8.33	3	2.50	13	5.41		
High (>140,000)	5	4.16	5	4.16	10	4.16		
Total	**120**	**100.00**	**120**	**100.00**	**240**	**100.00**		

4.1.10 Type of house

The table 4.12 reveals that 67.5 per cent of the respondents had house made from 'bamboo and tin sheet', 18.33 per cent of the respondents with 'thatch and wood plate', 12.08 per cent with 'wood plate and tin sheet' whereas only 2.08 per cent of the respondents had house made from bamboo and thatch. The majority of the respondent's house made of bamboo and tin sheet (67.5%) may be due to abundance in the availability of bamboo in the villages and surroundings. It reveals the richness in natural resources in the region and also the house being constructed with light material like bamboo and tin sheet represents a quintessential rural area. This finding is in line with the study conducted by Cuadrado and Mantiza (2016).

4.1.11 Source of information

The table 4.13 shows the distribution of respondents according to the source of information. The table reveals that 27.90 per cent of the farmers mostly make use of the contact farmers/farmers friend, 7.50 per cent of the respondents sometimes make use of contact farmers/farmers friend, 7.50 per cent rarely used contact farmers/farmers friend and majority of the respondents *i.e.*57.08 per cent never kept in touch with contact farmers/farmers friend. The table also reveals that 1.25 per cent of the respondents were sometimes contacting with extension personnel, 7.08 per cent of the respondents rarely contacted extension personnel and 91.66 per cent of the respondents never contacted with extension personnel for information. The table further reveals that 5.00 per cent of the respondents rarely and 95.00 per cent never used television for information in respect of farming and livelihood. The table also shows that 1.25 per cent rarely and 98.75 per cent never used radio as a source of information. None of the respondents subscribed to newspaper or farm magazines which may be because of locally non-availability of those.

Table 4.12 Distribution of respondents based on types of house   N=240

Types	Frequency	Percentage
Bamboo + thatch	5	2.08
Bamboo + tin sheet	162	67.50
Thatch + wood plate	44	18.33
Wood plate + tin sheet	29	12.08
Total	**240**	**100.00**

Table 4.13 Distribution of respondents according to access of sources of information   N=240

Information sources	Extent of use								Score	Rank
	Mostly		Sometimes		Rarely		Never			
	F	%	F	%	F	%	F	%		
Contact farmers/farmers' friend	67	27.90	18	7.50	18	7.50	137	57.08	255	I
Extension personnel	0	0.00	3	1.25	17	7.08	220	91.66	26	II
Television	0	0.00	0	0.00	12	5.00	228	95.00	24	III
Radio	0	0.00	0	0.00	3	1.25	237	98.75	3	IV

As shown further in table 4.13, farmers at the greatest extent preferred to contact with contact-farmers/farmers friend for information related to farming and farm activities which is ranked first among the sources of information. Farmers were also accessing extension personnel, television and radio as a source of information for farming and farm activities with a ranking of II, III and IV respectively. The present finding conforms with the results of a study conducted by Bhagat e*t al.* (2004).

4.1.12 Marketing channel

Table 4.14 shows the distribution of respondents based on the use of marketing channel to sell their product. The table indicates that 18.33 per cent of the respondents marketed their products through wholesale, whereas 10.00 per cent of the respondents sell their products in retail and local areas. But the majority of the respondents (71.66%) marketed their product by using both (wholesale and retail).

4.1.13 Migration status

Table 4.15 shows the distribution of respondents based on migration status. The table indicates that 92.91 per cent of the respondents or respondents' family members had never migrated from their village whereas only 7.08 per cent of the respondents or their family members had migrated to other places for the job opportunity, education and/or better livelihood.

It can be concluded from the table that majority of the farmers were non-migrants and only a few farmers had migrated to other places for a job opportunity, education and/or better livelihood.

Table 4.14 Distribution of respondents according to different marketing channels use for selling French bean N=240

Channel	Frequency	Percentage
Wholesale	44	18.33
Retail	24	10.00
Both	172	71.66
Total	**240**	**100.00**

Table 4.15 Distribution of respondents according to migration status

N=240

Migration status	Frequency	Percentage
Migrated	17	7.08
Not migrated	223	92.91
Total	**240**	**100.00**

4.1.14(a) Accessibility of the village

Accessibility of the villages was measured for both the districts separately. The tables for the measurement of the accessibility of the villages are presented by using the following four tables (table 4.16, 4.17, 4.18, and 4.19).

The table 4.16 and 4.17 are showing the measurement and distribution of villages under Tuensang district based on the accessibility. The table 4.16 reveals that majority of the villages (83.33%) had moderate accessibility. The remaining 16.67 per cent of the villages were found to have poor accessibility whereas none of the villages had good accessibility. The table further reveals that the mean score of accessibility was 9.33 with a standard deviation value of 3.93.

Table 4.18 and 4.19 are showing the measurement and distribution of villages under Kiphire district based on their accessibility. The table 4.18 reveals that majority of the villages (50.00%) had moderate accessibility, 33.33 per cent of the villages were found to have poor accessibility and the remaining 16.67 per cent of the villages had good accessibility. The table further reveals that the mean score of accessibility was 11.17 with a standard deviation value of 6.74.

4.1.14(b) Availability of basic amenities/ facilities

The table 4.20 and 4.21 are showing the measurement and distribution of villages under Tuensang district based on the availability of basic facilities/amenities (educational institution, medical facilities, drinking water facilities, bank, and veterinary aid). It reveals that 88.33 per cent of the villages had moderate availability of basic facilities/amenities and the remaining 16.66 per cent of the villages had good availability of basic facilities/amenities. The mean score was found to be 5 with a standard deviation value of 3.31.

The table 4.22 and 4.23 showing the distribution and measurement of villages under Kiphire district based on the availability of basic facilities/amenities (educational institution, medical facilities, drinking water facilities, bank, and veterinary aid). It reveals that 66.66 per cent of the villages had moderate availability and the remaining 33.33 per cent of the villages had good availability of basic facilities/amenities.

4.1.15 Experience in French bean cultivation

Table 4.24 shows that majority of the respondents from Tuensang district (61.66%) and Kiphire district (85.83%) had more than nine years of experience in French bean cultivation.

The table also reveals that from across the study area 38.33 per cent of the respondents had more than 12 years of experience, 35.41 per cent of the respondents had the experience of 9 to 11 years, and 21.25 per cent had 6 to 8 years of experience whereas only 5.00 per cent of the respondents had the experience of 3 to 5 years. The mean years of experience in French bean cultivation were 10.49 years with a standard deviation value of 3.08 and ranged from 3 to 20 years.

It can be concluded that majority of the respondents (95.00%) had more than six years of experience in French bean cultivation which denotes the farmers were highly experienced in French bean cultivation.

Table 4.16 Measurement of accessibility of villages under Tuensang district   N=6

| Village | Bus stand | | Taxi stand | | Post office | | Road condition |
	Score	Distance (score)	Score	Distance (score)	Score	Distance (score)	
Chessore	1	0	1	5	1	5	0
Yuner	1	0	1	4	1	4	0
Sotokur	1	0	1	1	1	5	0
Shamator	1	0	1	4	1	4	1
Nengkonger	0	0	1	0	1	0	0
Malangeiur	0	0	1	3	1	4	0

The header row above spans "Tuensang" across the entire table.

Table 4.17 Distribution of villages based on their accessibility under Tuensang district   N=6

Category	Frequency	Percentage	Mean	SD
Poor	1	16.67		
Moderate	5	83.33	9.33	3.93
Good	0	0.00		
Total	**6**	**100.00**		

Table 4.18 Measurement of the accessibility of villages under Kiphire district   N=6

| Village | Kiphire | | | | | | Road condition |
| | Bus stand | | Taxi stand | | Post office | | |
	Score	Distance (score)	Score	Distance (score)	Score	Distance (score)	
Pungro	1	3	1	5	1	3	1
Zaonger	1	0	0	0	1	0	0
Phuvkiu	1	2	1	5	1	2	0
Phelunger	1	1	0	0	1	1	0
Kiphire	1	5	1	5	1	5	1
Inskiur	1	4	1	4	1	4	0

Table 4.19 Distribution of villages based on their accessibility under Kiphire district   N=6

Category	Frequency	Percentage	Mean	SD
Poor	2	33.33		
Moderate	3	50.00	11.17	6.74
Good	1	16.67		
Total	**6**	**100.00**		

Table 4.20 Measurement of availability of basic facilities/amenities under Tuensang district   **N=6**

| Village | Tuensang | | | | | | | | | | Bank (f) | | |
| | Educational institution | | | Medical facilities | | | | Drinking water facilities | | | | Veterinary aid | |
	Primary school (F)	High school (F)	College (F)	Primary health center (F)	Civil hospital (F)	Private dispensary (F)	Private hospital (F)	Well/ pond (F)	River or stream (F)	Tap water (F)		Veterinary dispensary (F)	Diary society (F)
Chessore	2	0	0	1	0	0	0	1	2	0	1	1	0
Yuner	1	0	0	1	0	0	0	0	1	0	0	0	0
Sotokur	1	0	0	1	0	0	0	0	1	0	0	0	0
Shamator	2	0	0	2	0	1	0	1	2	1	1	1	0
Nengkonger	1	0	0	1	0	0	0	0	0	0	0	0	0
Malangeiur	1	0	0	1	0	0	0	0	1	0	0	0	0

Table 4.21 Distribution of villages based on the availability of basic facilities/amenities under Tuensang district   **N=6**

Category	Frequency	Percentage	Mean	SD
Poor	0	0.00		
Moderate	5	83.33	5	3.31
Good	1	16.66		
Total	**6**	**100.00**		

Table 4.22 Distribution of villages based on the availability of basic facilities/amenities under Kiphire district   **N=6**

Category	Frequency	Percentage	Mean	SD
Poor	0	0.00		
Moderate	4	66.66	7.33	5.57
Good	2	33.33		
Total	**6**	**100.00**		

Table 4.23 Measurement of availability of basic facilities/amenities under Kiphire district　　　　　N=6

Village	Educational institution			Medical facilities				Drinking water facilities			Bank	Veterinary aid	
	Primary school	High school	College	Primary health center	Civil hospital	Private dispensary	Private hospital	Well/ pond	River or stream	Tap water		Veterinary dispensary	Diary society
Pungro	3	1	0	2	1	2	0	1	2	1	1	1	0
Zaonger	1	0	0	1	0	0	0	0	1	0	0	0	0
Phuvkiu	1	0	0	1	0	0	0	0	2	0	0	0	0
Phelunger	1	0	0	1	0	0	0	0	1	1	0	0	0
Kiphire	2	1	0	1	1	3	0	1	2	1	2	0	0
Inskiur	1	0	0	1	0	0	0	0	2	0	0	0	0

Table 4.24 Distribution of respondents according to experience in French bean cultivation (years)

N=240

Category	Tuensang		Kiphire		Pooled		Mean	SD	Range of experience
	F	%	F	%	F	%			
3 to 5 years	12	10.00	0	0.00	12	5.00			
6 to 8 years	34	28.33	17	14.16	51	21.25			
9 to 11 years	37	30.83	48	40.00	85	35.41	10.49	3.08	3 to 20
12 years above	37	30.83	55	45.83	92	38.33			
Total	**120**	**100.00**	**120**	**100.00**	**240**	**100.00**			

. **4.1.16 Livelihood activities**

For the present study, crop-based livelihood, livestock-based livelihood, forest-based livelihood and off-farm livelihood activities were taken into consideration. Distribution of respondents was done based on the different livelihood activities continued by the respondents.

4.1.16.1 Distribution of respondents according to crop-based livelihood activities

Table 4.25 shows the distribution of respondents according to crop-based livelihood activities. The table reveals that all of the respondents were growing French bean where the majority of the respondents, *i.e*. 82.91 per cent were under medium French bean grower, 67.91 per cent had medium French bean production and 74.16 per cent had medium annual income from French bean. Again 67.91 per cent of the respondents were found to grow rice out of which 55.00 per cent were under the category of medium farmers 48.33 per cent had a medium level of rice production and 99.16 per cent had low income from rice cultivation. Again, 97.08 per cent of the respondents were also growing maize; out of which 55.83 per cent were under average maize growers' category, 65.83 per cent had medium annual production with 45.00 per cent were having medium annual income from maize. The table further reveals that 21.25 per cent of the respondents were growing potato and 37.91 per cent were growing other vegetables such as, mustard, taro, pumpkin, pea, soybean, and chilli which were grown in small quantity for family consumption purpose.

It can be concluded from the table that French bean, maize and rice were the major crops grown in the study area, which contributed the major income in crop-based livelihood. Crops like potato, mustard, taro, pumpkin, pea, soybean and chilli were also growing in small scale by few respondents

for their family consumption and which did not contribute much in terms of financial income.

4.1.16.2 Distribution of respondents according to livestock-based livelihood activities

Table 4.26 shows the distribution of respondents according to livestock-based livelihood activities. The table shows that 90.41 per cent of the respondents were rearing chicken out of which 52.91 per cent had low annual production, 22.50 per cent had medium annual production and 24.58 per cent had high annual production. Majority of the respondents *i.e.* 53.75 per cent had low annual income from chicken, 34.16 per cent had medium annual income and only 12.08 per cent had high annual income from enterprise. Again, 88.75 per cent of the respondents were found to rear pigs where the majority of them *i.e.* 70.83 per cent had medium annual production and 75.00 per cent had medium annual income from rearing pigs. Also, 9.16 per cent of the respondents were practicing beekeeping as a source of income from honey. Majority of the respondents *i.e.* 90.83 per cent had low honey production, 4.58 per cent, had medium production and 4.58 per cent had high honey production. Majority of the respondents *i.e.* 90.83 per cent had low income from beekeeping and only 5.00 per cent and 4.16 per cent had medium and high income, respectively from beekeeping. Again, 7.08 per cent of the respondents were also found to rear Mithun where only 5.00 per cent of them were found to have medium annual production and 95.00 per cent had low annual production in terms of meat. Only a few proportions of the respondents (2.91%) were found to maintain cattle.

It can be concluded from the table that chicken and pig rearing were the two important and major livestock-based livelihood activities as maintained by the French bean growers in the study area. But in terms of production and

income piggery was found to be the most important livestock-based livelihood activity.

4.1.16.3 Distribution of respondents according to forest-based livelihood activities

Table 4.27 shows the distribution of respondents according to forest-based livelihood activities. The table reveals that under timber-based, forest activities, cent per cent of the respondents were collecting firewood, out of which 88.75 per cent had low income and 11.25 per cent had a medium income per annum, respectively. Another 4.58 per cent of the respondents were involved in wood timber collection out of which 97.08 per cent had low income and 2.91 per cent of them had medium income. The table also reveals that 1.25 per cent of the respondents were involved in bamboo timber collection where 98.75 per cent of them had low income and 1.25 per cent had medium income. Around 2.50 per cent of the respondents were also found to maintain plantation.

The respondents were also found to engage in non-timber forest-based livelihood activities. The table further shows that 2.91 per cent of the respondents were collecting forest honey. Out of them, 97.08 per cent had low income and 2.91 per cent had medium-income from forest honey collection. Again, 16.66 per cent of the respondents were also found to engage in other non-timber forest-based activities such as fishing, hunting and foraging but without any income.

It can be concluded from the table that majority of the respondents were involved in timber-based forest activities where the collection of firewood for fuel was the major activity carried out by them, followed by timber (wood and bamboo) collection. Respondents were also found to remain engaged in non-timber forest-based livelihood activities, such as fishing, hunting, forest honey

collection and foraging. Though these were directly not contributing in terms of income but playing an important role in terms of nutrition and food security.

4.1.16.4 Distribution of respondents according to different off-farm livelihood activities

Table 4.28 shows the distribution of respondents according to different off-farm livelihood activities. The table indicates that 10.41 per cent of the respondents were found to practice weaving which was done by the women folk in the rural areas as a tradition. Again, 1.66, 2.91, 2.08 and 0.41 per cent of the respondents were engaged in government jobs, carpentry, business, and driving, respectively. It can be concluded that 17.47 per cent of the respondents were continuing off-farm livelihood activities.

Table 4.25 Distribution of respondents according to crop-based livelihood activities   **N=240***

Sl No.	Crop	Respondents		Category (L=low, M=medium, H=high)	Distribution of respondents					
		Frequency	Percentage		based on Area (ha)		Annual Production (kg)		Annual Income (₹)	
					ha	Percentage of respondents	kg	Percentage of respondents	₹	Percentage of respondents
1	French bean	240	100.00	L	<0.38	4.16	<500.54	13.75	<10,318.38	8.33
				M	0.38-3.33	82.91	500.54-2,031.94	67.91	10,318.38-50,425.79	74.16
				H	>3.33	12.91	>2,031.94	18.33	>50,425.79	17.50
2	Rice	163	67.91	L	<0.004	32.08	<47.62	32.50	<690.57	32.50
				M	0.004-1.41	55.00	47.62-716.69	48.33	690.57-10,392.02	48.33
				H	>1.41	12.91	>716.69	19.16	>10,392.02	19.17
3	Maize	233	97.08	L	<0.56	21.25	<799.87	15.41	>883.64	33.75
				M	0.56-1.74	55.83	799.87-2,055.49	65.83	883.64-11,033.18	45.00
				H	>1.74	24.58	>2,055.49	18.75	>11,033.18	21.25
4	Potato	51	21.25	L	-	-	-	-	-	-
5	Vegetables	91	37.91	L	-	-	-	-	-	-

*multiple responses were obtained
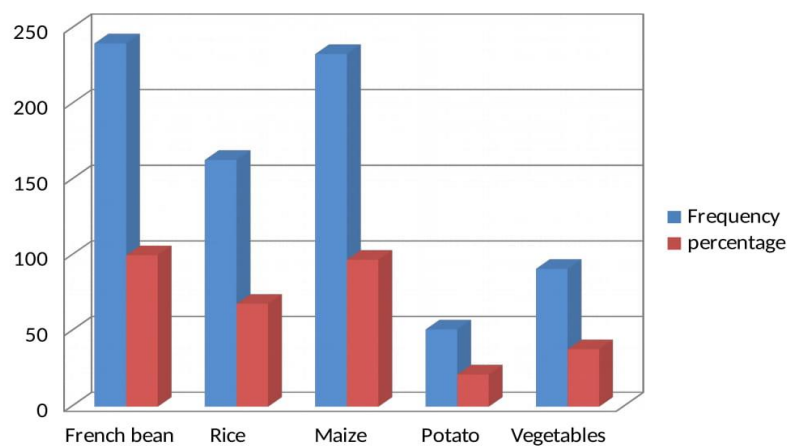
Fig 4.2 Distribution of respondents according to crop-based livelihood activities
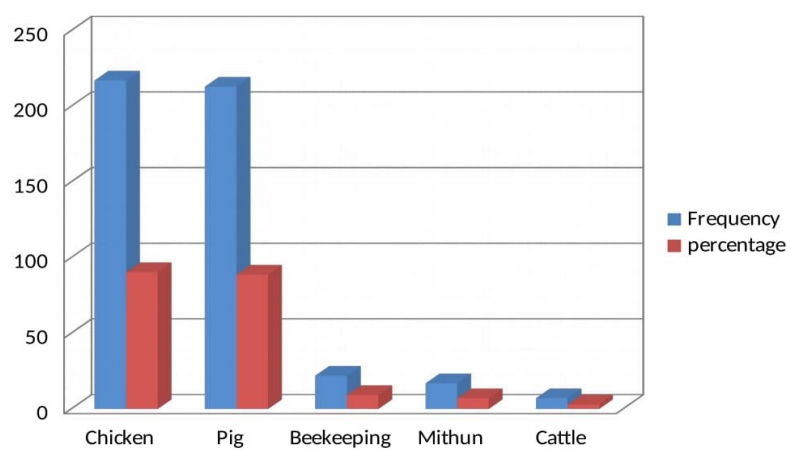
Fig 4.3 Distribution of respondents according to livestock-based livelihood activities

Table 4.26 Distribution of respondents according to livestock-based livelihood activities   **N=240***

Sl No.	Livestock	Respondents		Category (L=low, M=medium, H=high)	Distribution of respondents			
		Frequency	Percentage		Annual Production		Annual Income (₹)	
					Kg	Percentage of respondents	₹	Percentage of respondents
1	Chicken	217	90.41	L	<1.57	52.91	<901.78	53.75
				M	1.57-10.37	22.50	901,78-3,774	34.16
				H	>10.37	24.58	>3,774	12.08
2	Pig	213	88.75	L	<36.78	12.91	<5,925.66	13.33
				M	36.78-187.87	70.83	5,925.66-33,715.59	75.00
				H	>187.87	16.25	>33,715.59	11.66
3	Beekeeping	22	9.16	L	<4.92	90.83	<2,099.85	90.83
				M	4.92-10.25	4.58	2,099.85-5,131.96	5.00
				H	>10.25	4.58	>5,131.96	4.16
4	Mithun	17	7.08	L	<351.72	95.00	>45,604.89	95.41
				M	>351.72-473.27	5.00	45,604-94,249.65	4.58
5	Cattle	7	2.91	L	-	-	-	-

*multiple responses were obtained

Table 4.27 Distribution of respondents according to forest-based livelihood activities   **N=240**

Sl No.	Activity	Respondents		Category (L=low, M=medium, H=high)	Distribution of respondents	
		Frequency	Percentage		Annual Income (₹)	
					₹	Percentage of respondents
1	**Non-timber based**					
	i)Forest honey	7	2.91	L	<1,755.98	97.08
				M	1,755.98-2,910.68	2.91
	ii)Miscellaneous (Fishing, hunting, fodder collection)	40	16.66	L	-	100.00
2	**Timber-based**					
	i)Wood	11	4.58	L	<10,432.97	97.08
				M	10,432.97-36,709.89	2.91
	ii) Bamboo	3	1.25	L	<2,585.00	98.75
				M	2,585.00-6,748.33	1.25
	iii) Firewood	240	100.00	L	<6,955.73	88.75
				M	6,955.73-17,377.60	11.25
	iv) Plantation	6	2.50	L		100.00
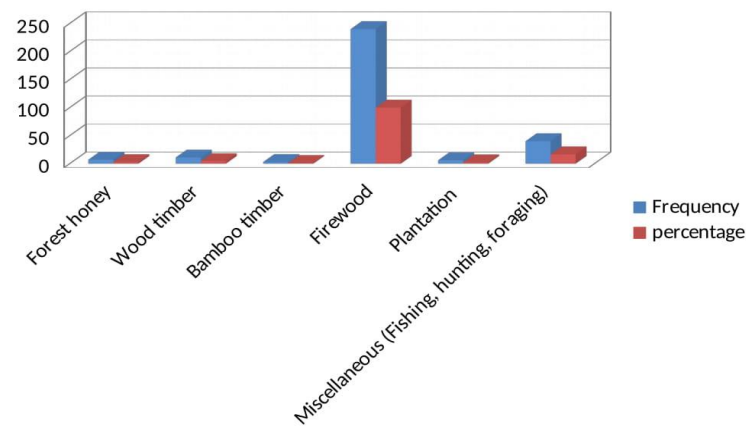
Fig 4.4 Distribution of respondents according to forest-based livelihood activities
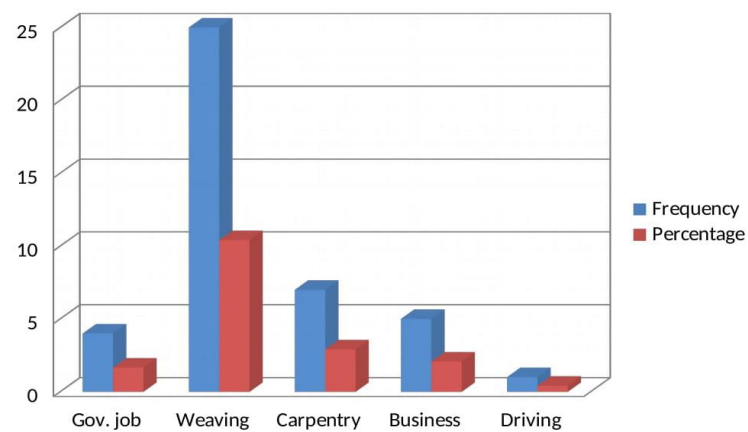
Fig 4.5 Distribution of respondents according to different off-farm livelihood activities

Table 4.28 Distribution of respondents according to different off-farm livelihood activities   N=240

Sl. No.	Off-farm activities	Frequency	Percentage
1	Gov. job	4	1.66
2	Weaving	25	10.41
3	Carpentry	7	2.91
4	Business	5	2.08
5	Driving	1	0.41
6	Without off-farm activity	198	82.50
	Total	**240**	**100.00**

4.1.17 Distribution of respondents based on the number of livelihood activities

Table 4.29 shows the distribution of respondents based on the number of livelihood activities. Majority of the respondents *i.e.* 71.00 per cent maintained 6 to 8 livelihood activities and around 19.00 per cent of the respondent maintained 3 to 5 livelihood activities. Again, little over 9.00 per cent of the respondents maintained 9 to 10 livelihood activities. The average number of livelihood activities maintained by the respondents was 8.45, with a standard deviation value of 1.37 and ranged from 3 to 10 livelihood activities. Altogether, 25 livelihood activities had recognized in the study area. Out of that 8 activities were considered as major ones as they were playing major role in the livelihood and more than 50.00 per cent of the French bean growers were maintaining those. Another,17 livelihood activities were considered minor as less than 50.00 per cent to only a negligible number of respondents were continuing those.

4.1.18 Annual income from agricultural sector

The table 4.30 reveals that majority of the respondents in both Tuensang and Kiphire district (*i.e.* 74.16 per cent and 75.83 per cent respectively) had medium income (₹ 31,543 to ₹89,265) per annum from the agricultural sector. Again, 8.33 per cent of the respondents from Tuensang district had low income from the agricultural sector (<₹ 31,543) whereas under Kiphire district 12.50 per cent of the respondents had low agricultural income. Another, 17.50 per cent and 11.66 per cent of the respondents from Tuensang and Kiphire district had high agricultural income (>₹89,265).The table also reveals that 75.00 per cent of the respondents across the two districts had medium income from agriculture, 14.58 per cent had high income and 10.41 per cent had low agricultural income. The mean income was ₹65,593.80 with a standard deviation value of 29578.79.

Table 4.29 Distribution of respondents based on the number of livelihood activities   **N=240**

Sl. no	Details about livelihood activities				Frequency	percentage	Mean	SD
	Recognized	Major	Minor	Maintained				
1				3	2	0.83		
2				4	9	3.75		
3				5	36	15.00		
4	25	8	17	6	61	25.42	8.45	1.37
5				7	71	29.58		
6				8	39	16.25		
7				9	16	6.67		
8				10	6	2.50		

Table 4.30 Distribution of the respondents based on annual income from agricultural activities (₹)   **N=240**

Category according to income	Tuensang		Kiphire		Pooled			
	F	%	F	%	F	%	Mean	SD
Low (< ₹ 31,543)	10	8.33	15	12.50	25	10.41		
Medium (₹ 31,543 - ₹ 89,265)	89	74.16	91	75.83	180	75.00	65,593.80	29,578.79
High (>₹ 89,265)	21	17.50	14	11.66	35	14.58		
Total	120	100.00	120	100.00	240	100.00		

It is clear from the earlier discussion that the majority of the farmers were found to be medium farmers with medium land holding (Table 4.9) which may be the reason for medium agricultural income. This finding is in line with the study conducted by Singh (2013).

4.1.19 Annual expenditure in French bean cultivation

The table 4.31 shows the expenditure pattern in the cultivation of French bean. The major area of expenditure for French bean cultivation was for 'seed cost 'and which was incurred by all the respondents. Around 81.25 per cent of the respondents were spending on 'hiring labour', mainly for land preparation, weeding and sowing. Another 8.33 per cent of the respondents were spent on 'harvesting and post-harvest activities'. The table also shows that about 76.97% of the expenditure was spent towards 'seed cost', 20.46% on payment of labour wage and remaining 2.57% for harvesting and post-harvesting activities. Further, table shows the respondents averagely spent ₹3,907.75, ₹1,038.75 and ₹130.42 for 'seed cost', 'hiring labour' and 'harvesting and post-harvesting activities', respectively. The total annual expenditure for French bean cultivation was ₹12, 18,460 with a total average expenditure of ₹5,076.91.

Therefore, it can be concluded that all the respondents had expenditure for French bean cultivation. Further, expenditure for seed and labour wage were the major areas of expenditure.

4.1.19.1 Distribution of respondents based on annual expenditure in French bean cultivation

The table 4.32 shows the distribution of respondents based on total expenditure in French bean cultivation. It is clear that 31.67 per cent of the respondents had expenditure upto ₹3,000 in French bean cultivation, 21.67 per cent had expenditure ranged between ₹3,001 to ₹5,000. Another, 23.75 per

Table 4.31 Annual expenditure pattern in French bean cultivation (₹)

N=240

Head of expenditure	Expenditure (₹)	Percentage of total expenditure	Respondents spent towards different head of expenditure		Average (₹)
			Frequency	Percentage	
*Labour (land preparation, weeding, sowing)	2,49,300	20.46	195	81.25	1,038.75
*Harvesting and post-harvest activities (harvesting, threshing, transportation and marketing)	31,300	2.57	20	8.33	130.42
Seed	9,37,860	76.97	240	100.00	3,907.75
Total	**12,18,460**	**100.00**	**240**	**100.00**	**5,076.91**

*Only expenditure incurred for hiring labour and household contribution not included.

Table 4.32 Distribution of respondents based on the annual expenditure in French bean cultivation

N=240

Expenditure	Frequency	Percentage	Mean	SD
Up to ₹ 3,000	76	31.67		
₹ 3,001-₹ 5,000	52	21.67		
₹5,001-₹7,000	57	23.75	**5,076.91**	**3501.60**
Above ₹ 7,000	55	22.91		
Total	**240**	**100.00**		

116

cent had expenditure ranged from ₹ 5,001 to ₹ 7,000 and remaining 22.91 per cent of the respondents had expenditure above ₹7,000. The average expenditure was found to be ₹5,076.91 with a standard deviation value of 3501.60.

4.1.20 Annual production of French bean

Table 4.33 shows the distribution of respondents based on annual production of French bean. The table reveals that 70.00 per cent of the respondents under Tuensang district and 65.83 per cent of the respondents under Kiphire district had medium level of production of French bean (498 to 2,032 kg), 21.66 per cent of the respondents under Tuensang district and 15.00 per cent of the respondents under Kiphire district had high French bean production (>2,032 kg). Again, 8.33 per cent of the respondents under Tuensang district and 19.16 per cent of the respondents under Kiphire district had a low level of French bean production (<498 kg).

The table also reveals that 67.91 per cent of the total respondents had medium (498 – 2,032 kg) level of production of French bean, 18.33 per cent had high level of production (> 2,032 kg) of French bean and remaining 13.75 per cent of the respondents had low level of production (< 498 kg) of French bean. The average French bean production was 1,265.32 kg with a standard deviation value of 767.08.Therefore, it can be concluded that the majority of the French bean growers in the study area had a medium level of French bean production.

4.1.21 Annual income from French bean

Table 4.34 shows the distribution of respondents based on income from French bean cultivation. The table indicates that 72.50 per cent of the respondents under Tuensang district and 79.16 per cent of the respondents

Table 4.33 Distribution of respondents based on annual production of French bean (Kg)   N=240

Category	Tuensang		Kiphire		Pooled			
	F	%	F	%	Frequency	Percentage	Mean	SD
Low (< 498 kg)	10	8.33	23	19.16	33	13.75		
Medium (498 – 2,032 kg)	84	70.00	79	65.83	163	67.91	1,265.32	767.08
High (> 2,032 kg)	26	21.66	18	15.00	44	18.33		
Total	120	100.00	120	100.00	240	100.00		

Table 4.34 Distribution of respondents based on income from French bean cultivation (₹)   N=240

Category	Tuensang		Kiphire		Pooled			
	F	%	F	%	Frequency	Percentage	Mean	SD
Low (< (₹ 10,906)	13	10.83	7	5.83	20	8.33		
Medium (₹ 10,906 – ₹ 52,159)	87	72.50	95	79.16	182	75.83	30,372.08	20011.88
High (> ₹ 52,159)	20	16.66	18	15.00	38	15.83		
Total	120	100.00	120	100.00	240	100.00		
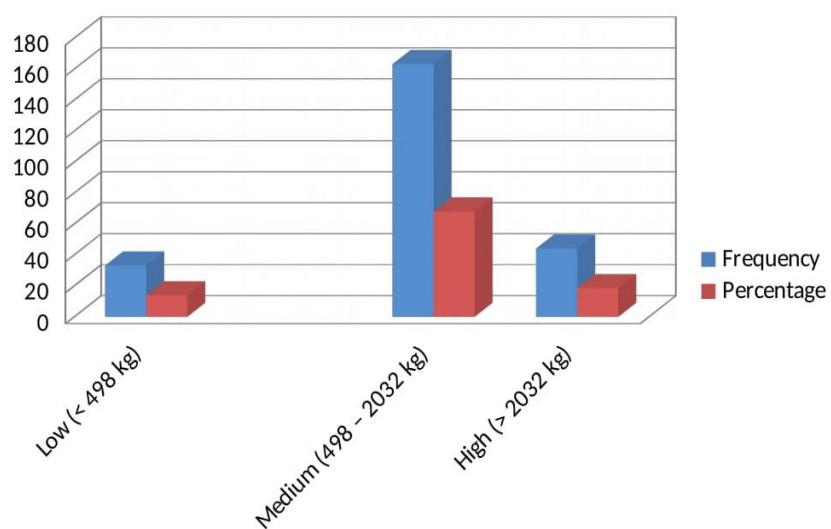
Figure 4.6 Distribution of respondents based on production of French bean
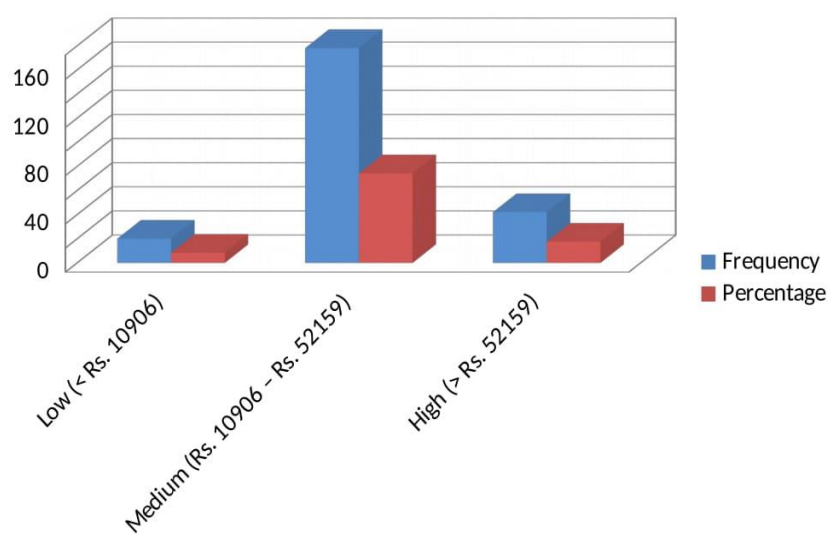
Figure 4.7 Distribution of respondents based on income from French bean

under Kiphire district had medium income (₹ 10,906 to ₹ 52,159) from French bean. Another, 16.66 per cent of the respondents under Tuensang district and 15.00 per cent of the respondents under Kiphire district had high income (>₹ 52,159) from French bean production. Again, 10.83 per cent of the respondents under Tuensang district and 5.83 per cent of the respondents under Kiphire district had low income (<₹ 10,906) from French bean production.

The table further indicates that 75.83 per cent of the respondents were found to have medium income from French bean (₹ 10,906 – ₹ 52,159), 15.83 per cent were having the high income (>₹ 52,159) and only 8.33 per cent were having the low income (<₹. 10,906). The table also reveals that the average income from French bean for all the respondents was ₹ 30,372.08 with a standard deviation value of 20011.88.

It can be concluded that majority of the respondents having medium income from French bean may be due to the fact that the majority of the respondents were found to possess medium land holding under French bean cultivation. Another reason may be due to the hilly topography of the study area, farmers could not use any agricultural machinery, and the cultivation solely depends on the agricultural labourer. Hence, the farmers had average production with average income.

4.1.22 Comparative analysis of experience in French bean cultivation, size of land holding, land under French bean cultivation, and French bean production between the districts

Here an attempt was made to comprehend the relative differences of experience in French bean cultivation, size of land holding, land allocation under French bean cultivation and French bean production between the districts under study.

Table 4.35 shows that the 'average size of land holding', 'average size of land under French bean' and 'French bean production' is higher for French bean growers from Tuensang district but the average experience of French bean growers from Kiphire district was higher. Therefore, it can be assumed that due to larger size of land holding and more land allocation under French bean cultivation, farmers from Tuensang district had higher French bean production in spite of their lesser years of experience in French bean cultivation.

4.1.22.1 Relationship among important socio-economic aspects of respondent *viz.*French bean production, experience in French bean cultivation, size of land holding, and land under French bean cultivation

Table 4.36 contains information about the relationship among important socio-economic aspects of respondents *viz.,*'French bean production', 'experience in French bean cultivation', 'size of land holding', and 'land under French bean cultivation'. The table reveals that the 'size of land holding' had a positive and significant relationship with both 'land under French bean cultivation', and 'French bean production'. And thus signifies that the size of land holding and land allocation under French bean cultivation played the major role in terms of French bean production in the two districts *i.e.* Tuensang and Kiphire.

Table 4.35 Comparative analysis of experience in French bean cultivation, size of land holding, and land under French bean cultivation and French bean production between the districts N=240

Districts and *Blocks*	Average of Experience in French bean cultivation	Average size of Landholding in ha	Average size of Land under French bean in ha	Average of French bean production in Kg
Kiphire	**11.12**	**3.11**	**1.55**	**1122.91**
Kiphire	12.08	3.69	1.98	1352.40
Pungro	10.16	2.53	1.13	893.43
Tuensang	**9.86**	**4.34**	**2.16**	**1409.56**
Chessore	8.13	4.71	2.11	1290.93
Shamator	11.60	3.98	2.21	1528.20
Grand Total	**10.49**	**3.73**	**1.86**	**1266.24**

Table 4.36 Relationship among important socio-economic aspects of respondents *viz.,* French bean production, experience in French bean cultivation, size of land holding, and land under French bean cultivation

N=240

Category	'r' value
Between experience and land holding	-0.05 NS
Between experience and land under French bean cultivation	-0.01 NS
Between experience and French bean production	0.03 NS
Between size of land holdings and land under French bean cultivation	0.90[**]
Between size of land holdings and French bean production	0.86[**]
Between land under French bean and French bean production	0.95[**]

* Significant at 5 per cent, table value: 0.127; ** Significant at 1 per cent level, table value: 0.166; NS- Not Significant

4.1.23 Distribution of respondents based on livelihood index

The table 4.37 shows the distribution of respondents based on livelihood index. The table reveals that 71.25 per cent of the respondents had medium livelihood index, 19.58 per cent had low livelihood index and 9.16 per cent had high livelihood index. The average livelihood index was 39.24, with a standard deviation value of 8.06. It is important to mention that the respondents with large number of livelihood activities were acquired higher livelihood index score.

4.1.24 Relationship between various socio-economic variables and livelihood index

Here an attempt was made to correlate various socio-economic variables and livelihood index. Table 4.38 reveals that 'age' had a significant but negative correlation with livelihood index. On the contrary, 'material possession', 'Educational qualification', 'type of house', 'size of land holding', 'annual income', and 'annual expenditure' had a significant and positive correlation with livelihood index.

'Age' was found to have a significant but negative correlation with livelihood index with a correlation value of -0.185.

'Educational qualification' was found to have a strong and positive correlation with a correlation value of 0.184.

The positive and strong correlation was found between 'material possession' and livelihood index with a correlation value of 0.327.

'Type of house' and livelihood index had a positive and significant correlation with a correlation value of 0.146.

The correlation value between the 'size of land holding' and livelihood index was 0.158, which shows a significant and positive correlation.

122

The correlation value between 'annual income' and livelihood index was 0.194, which shows a significant and positive correlation.

The correlation value between 'Annual expenditure' and livelihood index was 0.176, which shows a significant and positive correlation.

'Annual income' and livelihood index had established a significant and positive correlation with a correlation value of 0.193.

'Annual expenditure' and livelihood index had produced a significant and positive correlation with a correlation value of 0.176.

Table 4.37 Distribution of respondents based on livelihood index   N=240

Sl. no	Livelihood index	Frequency	Percentage	Mean	SD
1	Low (<31.18)	47	19.59		
2	Medium (31.18-47.30)	171	71.25		
3	High (>47.30)	22	9.16	39.24	8.06
	Total	**240**	**100.00**		

Table 4.38 Relationship between various socio-economic variables and livelihood index

SL. No	Socio-economic variables	Value of 'r'
1	Age	-0.185**
2	Material possession	0.327**
3	Educational qualification	0.184**
4	Source of information	-0.106NS
5	Type of house	0.146*
6	Size of land holding	0.158*
7	Annual income	0.194**
8	Annual expenditure	0.176**

* Significant at 5 per cent, table value: 0.127; ** Significant at 1 per cent level, table value: 0.166; NS- Not Significant

4.2 Explore the role of French bean as a livelihood component in the area under study

This objective aimed to explore the role and importance of French bean in the livelihood of the French bean growers. Accordingly, the following parameters, namely, the pattern of contribution in income from different crops, livestock, forest, and different off-farm livelihood activities on overall agricultural income were studied in terms of percentage shares of each of those. Further, the contribution of French bean and those identified livelihood activities on total annual income, and annual expenditure pattern of the respondents were also analyzed and discussed in this section.

4.2.1 Pattern of contribution of crop-based livelihood on overall annual income (percentage)

Table 4.39 shows the pattern of contribution of different crops on overall agricultural income (percentage). It is clear from the table that French bean contributed 46.30 per cent of total agricultural income, 73.82 per cent of income from total crop production and 43.05 per cent in total annual income which was largest among all the other crops considered. The average income from French bean was ₹30,372 with a standard deviation value of 20,053.70. The table further shows that the total income of French bean was ₹72, 89,300 with an income range of ₹ 1,800-1, 12,000. Major crops like rice, maize, soybean and chilli were also found to contribute 8.44, 7.94, 0.01 and 0.02 per cent, respectively in respect of total agricultural income;13.46, 12.66, 0.02 and 0.03 per cent respectively, in respect of total income from crop production; and 7.85, 7.38, 0.01, 0.02 per cent respectively, in respect of total annual income. The average income from rice, maize, soybean and chilli cultivation was₹ 5,541.30, ₹5,209.17, ₹10.42, and ₹12.50 with a standard deviation value of 4,850.72, 5256.37, 161.37 and 193.65, respectively. Crops like potato, mustard, taro, pumpkin, pea and other vegetables were found to have no contribution to the

total agricultural income. The average income from crop production was ₹ 41,145.47.

It is clear from the table 4.39 that French bean has been contributing around 46.30 per cent of total agricultural income, and the largest proportion (i.e. 43.05%) to total annual income. Therefore, it can be concluded that French bean has been playing the most formidable role as a livelihood component in the area under study.

Table 4.39 Pattern of contribution of different crops on overall agricultural income (percentage)   N=240

Sl. No	Crop	Mean income (₹)	SD	Range (₹)	Total Income (₹)	Percentage contribution to total income from crop production	Percentage contribution to total income from agriculture (including livestock)	Percentage contribution to the total annual income
1	French bean	30,372.08	20,053.7	1,800-1,12,000	72,89,300	73.82	46.30	43.05
2	Rice	5,541.30	4,850.72	2,610-17,400	13,29,911	13.46	8.44	7.85
3	Maize	5,209.17	5,256.37	320-22,800	12,50,200	12.66	7.94	7.38
4	Soybean	10.42	161.37	-	2,500	0.02	0.01	0.01
5	Chili	12.50	193.65	-	3,000	0.03	0.02	0.01
	Total	**41,145.47**			**9,874,911**			

4.2.2 Pattern of the contribution of livestock-based livelihood activities towards overall agricultural income (percentage)

The table 4.40 shows the details about livestock rearing and pattern of the contribution of the livestock sector in the livelihood of respondents. In the study area, respondents were maintaining/rearing chicken, pig, Mithun, and beehives for their livelihood. Pig rearing contributed the highest *i.e.* 81.07 per cent of total income from the livestock sector; 30.21 per cent of total agricultural income, and 28.09 per cent in total annual income. The total income from pig rearing was ₹ 47, 56,950, with the average income of ₹ 19,820 and standard deviation value of 13,894.96. The range of income from pig rearing was ₹ 8,000-72,000. Other livestock rearing practices, like poultry, apiary, and Mithun rearing had a very negligible contribution towards total agricultural income and total annual income. The average income from overall livestock production was ₹ 24,448.33.

Among the livestock, Pig rearing was contributing the highest in total agricultural income which may be due to the reason that pork is a delicacy among the farmers in the study area and the high market demand of meat. Besides the market demand, pig rearing is considered as a tradition among the farmers where every farming household rear pigs for consumption as well as for selling of meat.

Table 4.40 Pattern of contribution in income from different livestock towards overall agricultural income (percentage)

N=240

Sl. No	Livestock	Mean income (₹)	SD	Range (₹)	Total income (₹)	Percentage contribution to total income from livestock	Percentage contribution to total income from agriculture (including livestock)	Percentage contribution to total annual income
1	Chicken	1,091.25	1524.85	500-7,500	2,61,900	4.46	1.67	1.54
2	Pig	19,820.63	13894.96	8,000-72,000	4,756,950	81.07	30.21	28.09
3	Beekeeping	331.46	1138.05	450-7,500	79,550	1.35	0.50	0.47
4	Mithun	3,205.00	15475.52	7,200-90,000	7,69,200	13.10	4.88	4.54
	Total	**24,448.33**			**58,67,600**			

4.2.3 Pattern of contribution in income from forest-based livelihood activities

The table 4.41 reveals that firewood contributed 63.85 per cent in total income from forest-based livelihood activities and 1.94 per cent in total annual income where the mean income was ₹ 1,368.75 with an income range of ₹6,000-24,000 and standard deviation value of 4218.47. Timber collection contributed 32.07 per cent in total income from forest-based activities and 0.97 per cent in total annual income. The mean income was found to be ₹ 687.50 with an income range of ₹10,000-50,000 and a standard deviation value of 4486.88. Forest honey and bamboo collection were also found to contribute to the total income with 1.36 per cent and 2.72 per cent respectively towards income from forest-based livelihood activities and 0.04 and 0.08 per cent in annual income. The average income from overall forest-based livelihood activities was ₹2,143.75.

Therefore, firewood collection and timber collection were found to be the major income-generating activities under forest-based livelihood activities in the study area.

4.2.4 Pattern of contribution in income from different off-farm livelihood activities

Table 4.42 contains the pattern of contribution in income from different off-farm livelihood activities. The table shows that mean income from government job was ₹20,750 with an income range of ₹10,000-30,000 and a standard deviation value of 1, 37,621.20. It contributed about 0.49 per cent in the total annual income and 12.33 per cent in total income from off-farm livelihood activities. Weaving was found to contribute 1.31 per cent in the total annual income and 33.15 per cent in total income from off-farm livelihood activities with an income range of ₹3,000-22,000and a mean income of ₹ 8,924 with a standard deviation value of 4538.66. Carpentry and business had a mean

income of ₹ 5,714.29 and ₹62,400with an income range of ₹4,000-8,000 and₹2,000-2, 40,000 and a standard deviation value of 1380.131, and 99793.79, respectively. They were found to contribute 0.23 and 1.84 per cent respectively in the total annual income and 5.94 and 46.35 per cent respectively in total income from off-farm livelihood activities. Respondents were also found to engage in driving with an average income of ₹ 15,000. The average income from overall off farm-based livelihood activities was ₹2,804.58.

From the table, it was also evident that off-farm livelihood activities contributed 4.31 per cent in the total annual income of the French bean growers.

4.2.5 Contribution from different livelihood activities in total annual income and livelihood

Table 4.43 shows the income and contribution from different livelihood activities to total annual income and livelihood. French bean-based livelihood activities were found to contribute 43.05 per cent and ranked as first in respect of contribution to the total annual income. The average income from French bean was ₹ 30,372.08, with SD value of 20053.70. Livestock based livelihood was found to contribute 34.65 per cent and ranked as second in respect of contribution to the total annual income. The average income from the livestock sector was ₹ 24,448.33 with SD value of 19962.84. Crop-based livelihood activities were found to contribute 15.27 per cent and ranked as third in respect of contribution to the total annual income with an average income of ₹10,773.38, with SD value of 6116.66. Off-farm activities and Forest-based activities were found to contribute 3.97 and 3.03 per cent to the total annual income and also ranked as fourth and fifth, respectively. The average income from forest-based and Off-farm activity was ₹ 2,143.75 and ₹ 2,804.58 and SD value of 6105.16 and 16147.28, respectively. The table also

Table 4.41 Pattern of contribution of forest-based livelihood activities

Sl No	Activities	Mean income (₹)	SD	Range (₹)	Total income (₹)	Percentage contribution to total income from forest-based livelihood activities	Percentage contribution to total annual income
1	Firewood	1,368.75	4218.47	6,000 - 24,000	3,28,500	63.85	1.94
2	Timber collection	687.50	4486.88	10,000 - 50,000	1,65,000	32.07	0.97
3	Forest honey	29.17	265.09	2,000 - 3,000	7,000	1.36	0.04
4	Bamboo	58.33	553.36	3,000 - 7,000	14,000	2.72	0.08
	Total	**2,143.75**			**5,14,500**		

Table 4.42 Pattern of income from off-farm livelihood activities   N=240

Sl. No.	Activities	Total income (₹)	Mean income (₹)	SD	Range (₹)	Percentage contribution to income from off-farm livelihood activities	Percentage contribution to total annual income
1	Gov. job	83,000	20,750	137621.20	10,000-30,000	12.33	0.49
2	Weaving	2,23,100	8,924	4538.66	3,000-22,000	33.15	1.31
3	Carpentry	40,000	5,714.29	1380.13	4,000-8,000	5.94	0.23
4	Business	3,12,000	62,400	99793.79	2,000-2,40,000	46.35	1.84
5	Driving	15,000	15,000	-	-	2.22	0.09
	Total	**6,73,100**	**2,804.58**				

Table 4.43 Contribution from different livelihood activities in total annual income   **N=240**

Sl No	Livelihood activities	Mean income (₹)	SD	Percentage contribution to total annual income	Ranking based on percentage contribution in total annual income
1	Crop based (excluding French bean)	10,773.38	6116.66	15.27	III
2	Livestock based	24,448.33	19962.84	34.65	II
3	Forest based	2,143.75	6105.94	3.03	V
4	Off farm	2,804.58	16147.28	3.97	IV
5	French bean	30,372.08	20053.70	43.05	I
	Total	**70,542.12**			

reveals that the average income from overall different livelihood activities was ₹ 70,542.12.

It can be concluded that French bean had immensely played the major role in the livelihood of the farmers in the study area which was found to contribute the highest in terms of income followed by livestock-based, crop-based, off-farm and forest-based activity.

4.2.6 Annual expenditure pattern of the respondents for their livelihood and survival

Table 4.44 shows the major areas of expenditure for daily livelihood. The table shows that 38.72 per cent of expenditure was on food with the mean expenditure of ₹ 16,120 and a standard deviation value of 7916.23, followed by 31.84 per cent of the expenditure on education with an average expenditure of ₹13,259.17and a standard deviation value of 13330.92. Around 7.01 per cent of the expenditure was spent on phone bill with an average expenditure of ₹2,921 and a standard deviation value of 1193.45. Another, 4.23 per cent of the expenditure was on electricity with an average expenditure of ₹1,761.25 and a standard deviation value of251.36. Again, 2.58 per cent of the expenditure was on cooking fuel with an average expenditure of ₹1,077.08 and a standard deviation value of 3256.21 and 1.78 per cent of the expenditure was on clothing with an average expenditure of ₹744.41 and a standard deviation value of 1132.35. Again, 12.19 per cent of the expenditure was on cultivation with and average expenditure of ₹ 5,076.91 and a standard deviation value of 3501.60.The table also reveals that respondents had spent a small amount on health, transport, house-maintenance, social and religious activities, respectively.

Table 4.45 shows the distribution of respondents according to the total expenditure. The table indicates that 69.17 per cent of the respondents had medium expenditure; 15.00 per cent of the respondents had low expenditure and the remaining

15.83 per cent of them had high expenditure. The average expenditure of the respondents was ₹41,630.25 with a standard deviation value of 19868.52.

Thus, it can be concluded from the table that majority of the farmers in the study area had medium level of annual expenditure, where major expenditure was found to be incurred for food, followed by educational expenditure, cultivation, phone bill, electricity bill, cooking fuel, clothing and other miscellaneous purposes.

4.2.7 Relationship between various socio-economic variables and income from French bean cultivation

Here an attempt has been made to study the relationship between the income from French bean as a livelihood component and various perceived socio-economic explaining variables. Table 4.46 shows the correlation between income from French bean and various socio-economic variables.

Table 4.46 shows that out of twelve socio-economic variables studied, nine variables, namely, 'material possession', 'educational qualification', 'source of information', 'size of land holding', 'land under French bean cultivation', 'French bean production', 'annual income', 'income from agricultural sector', 'annual expenditure' had a significant and positive relationship with income from French bean.

The correlation value between 'material possession' and income from French bean was 0.21 to establish existence of highly significant and positive relationship between 'material possession' and income from French bean. Therefore, farmers with higher income from French bean may have more financial stability in enabling them to possess more luxurious material.

Table 4.44 Annual expenditure pattern of the respondents (₹)   N=240

Item	Expenditure (₹)	Expenditure	Mean (₹)	SD

		Percentage		
Food	38,68,800	38.72	16,120	7916.23
Clothing	1,78,660	1.78	744.41	1132.35
Cooking fuel	2,58,500	2.58	1,077.08	3256.21
Health	76,600	0.76	319.16	568.97
Phone bill	7,01,040	7.01	2,921	1193.45
Electricity bill	4,22,700	4.23	1,761.25	251.36
Transport	35,500	0.35	147.91	1067.78
House maintenance	4,000	0.04	16.66	203.86
Social	26,000	0.26	108.33	272.00
Religious	18,800	0.18	78.66	258.80
Education	31,82,200	31.84	13,259.17	13330.92
Cultivation	12,18,460	12.19	5,076.91	3501.60
Total	9,991,260	**100.00**		

Table 4.45 Distribution of respondents based on the total expenditure

N=240

Expenditure	Frequency	Percentage	Mean	SD
Low (<₹ 21,761.73)	36	15.00		
Medium (₹ 21,761.73 – ₹61,498.77)	166	69.17	41,630.25	19868.52
High (>₹ 61,498.77)	38	15.83		
Total	**240**	**100.00**		

'Educational qualification' was found to have a significant relationship with income from French bean with a correlation value of 0.134. Farmers with higher education had influenced in wise decision making on different activities under the

farming of French bean. Education enables the farmers to greater degree of access to market information through wisely and widely use of proper market channel to achieve remunerative price for their produce.

'Source of information' and income from French bean was found to be significantly related with a correlation value being 0.127. With the proper source of information, farmers could get pertinent information for improved cultivation practices as well as the appropriate marketing channel. Size of landholding was found to have highly significant and positive relationship with income from French bean with a correlation value of 0.691 to indicate that larger landholding size gives farmers more opportunity to have larger size of farms and thus higher income.

The correlation value for 'land under French bean' and income from French bean was 0.821, which established that there was a highly significant relationship between 'land under French bean' and income from French bean. Therefore, large French bean farmers may have a better scope to earn more.

The relationship between 'French bean production' and income from French bean was strong and positively significant with a correlation value of 0.807. So, the higher the French bean production gives a better scope of higher income.

'Annual income' and income from French bean were found to have a highly significant and positive relationship with a correlation value of 0.45. It is clear from the correlation that higher the income from French bean would it greater influence in acquiring higher annual income.

'Income from agricultural sector' was found to have a highly significant and positive relationship with income from French bean with a correlation value of 0.70. This may be due to the reason that French bean contributes the highest percentage share to income when compared to all other agricultural crops in the study area. Therefore, higher the income from French bean higher would be the agricultural income.

'Annual expenditure' and income from French bean had a strong and positive correlation with a correlation value of 0.369. This could be due to the reason that respondents having higher income from French bean would be in a better position to spend more as marks of their higher lifestyle.

4.2.8 Relationship between various annual expenditure pattern and income from French bean cultivation

Table 4.47 shows the relationship between various annual expenditure patterns of the respondents and income from French bean cultivation. Out of four different expenditure patterns, two i.e. 'food expenditure', and 'education expenditure 'showed positive and significant correlation with income from French bean.

The correlation value between 'food expenditure' and 'income from French' bean was 0.282, which to denote existence of a strong and positively significant correlation between them.

The correlation value between 'education expenditure' and 'income from French bean' was 0.324 to indicate the existence of a strong and positively significant correlation between those.

Though the table 4.47 has failed to exhibit any significant relationship between the two other selected parameters of annual expenditure i.e. 'expenditure on health' and 'expenditure on clothing' with that of their annual income from French bean, the 'overall annual expenditure' combining all the four parameters of expenditure patterns, nevertheless, appeared to have exhibited very strong and positive relationship with that of the annual income from French bean of the respondents under investigation with corresponding correlation value being 0.369.

Table 4.48 shows the simple regression analysis between income from French bean cultivation (x) and five other socio-economic issues (y) with reference to expenditure pattern of respondents, *viz*. total annual expenditure, expenditure for food, education, health, and clothing. From these five simple regression equations, it can be

concluded that French bean income as an independent predictor has a significant and positive role on the pattern of expenditure and livelihood, *viz.* total annual spending, expenditure on food and education. No significant but positive impact of income from French bean was found on expenditure on health and clothing.

The reflection from simple regression analysis, as has found a place in table 4.48, it once again gets transpired that although there appeared somewhat skewed pattern of causal relationship between the annual income from French bean cultivation as independent predictor variable with those of various explaining variables of livelihood expenditure, overall annual expenditure, however, exhibited a high degree of positive and significant interdependence.

Based upon this revelation arising out of the perusal of tables 4.47 and 4.48, the null hypothesis $H_0 1$ which states there exists no association between annual income from French bean cultivation by the respondents and their pattern of annual expenditure is hereby rejected.

Table 4.46 Relationship between socio-economic variables and income from French bean   **N=240**

SL. No.	Socio-economic variables	Value of 'r'
1	Age	-0.075NS
2	Experience in French bean cultivation	0.079NS
3	Material possession	0.210**
4	Educational qualification	0.134*
5	Source of information	0.127*

6	Type of house	-0.111NS
7	Size of land holding	0.661**
8	Land under French bean cultivation	0.792**
9	French bean production	0.807**
10	Annual income	0.459**
11	Income from agricultural sector	0.709**
12	Annual expenditure	0.369**

* Significant at 5 per cent, table value: 0.127; ** Significant at 1 per cent level, table value: 0.166; NS-Not Significant

Table 4.47 Relationship between various annual expenditure pattern and their income from French bean cultivation

Sl. No	Expenditures	Value of 'r'
1	Food	0.282**
2	Clothing	0.039NS
3	Health	0.114NS
4	Education	0.324**
5	Total Expenditure	0.369**

* Significant at 5 per cent, table value: 0.127; ** Significant at 1 per cent level, table value: 0.166; NS-Not Significant

Table 4.48 Linear regression analysis between income from French bean cultivation and expenditure pattern of respondents

variables	Intercept	β	SE	T val of β
Fooding	12,735	0.111	0.02	4.54*
Education	6,702.31	0.215	0.04	5.29*
Health	220.468	0.003	1.77	0.076
Clothing	675.598	0.002	0.003	0.610*
Total expenditure	26,298.8	0.337	0.055	6.132*

4.3 Sustainability through French bean-based livelihood system

This objective aims to examine sustainability through French bean based livelihood system in the study area. Therefore, various indicators of sustainability, namely, 'economic sustainability', 'human sustainability', 'social sustainability' and 'environmental sustainability 'were taken into consideration to justify the present objective.

4.3.1 Economic sustainability through French bean based livelihood system

Table 4.49 shows the performance of French bean as a livelihood component in terms of economic sustainability. Altogether, 12 parameters were included under economic sustainability with a maximum achievable score of 4 and a midpoint value of 2. The table reveals that incase of 'potential for steady and standard income', the mean score was 2.98 with a standard deviation value of 0.67. The mean score is higher than the midpoint score *i.e.* 2.00.

Similarly, the mean score in respect of 'Cost of management is cheaper compared to other crops' was 3.12, which was greater than the midpoint score with a standard deviation value of 0.52. In respect of 'income per unit area is higher compared to other crops', the mean score was 3.13 with a standard deviation value of 0.56. The mean score for 'income opportunity during off-season' was 2.64 and the standard deviation value was 0.70. In respect of 'round the year price is standard', the mean score was 2.90 with standard deviation value of 0.56.

Similarly, in respect of 'Better savings', 'Income opportunity for women', 'Procurement of planting material is easy', 'Chance of crop failure is less', 'Cost-benefit ratio is higher' and 'Higher demand in the market', the mean score was 2.92, 2.50, 3.46, 3.06, 3.15, 3.22 and 3.50with standard deviation value of 0.67, 0.71, 0.51, 0.55, 0.41, 0.49, 0.51 respectively.

With reference to all the parameters, the mean score was found to be higher than the midpoint score. The overall mean with respect to economic sustainability was 3.05, which signify that the performance of French bean as a livelihood component towards economic sustainability was highly satisfactory.

Table 4.49 Economic sustainability through French bean-based livelihood system N=240

Sl No.	Parameters	Maximum achievable score	Mean	SD
1	Potential for steady and standard income	4.00	2.98	0.68
2	Cost of management is cheaper compared to other crops	4.00	3.12	0.52

3	Income per unit area is higher compared to other crops	4.00	3.13	0.56
4	Income opportunity during off season	4.00	2.64	0.71
5	Round the year price is standard	4.00	2.90	0.56
6	Better savings	4.00	2.92	0.67
7	Income opportunity for women	4.00	2.50	0.71
8	Procurement of planting material is easy	4.00	3.46	0.51
9	Chance of crop failure is less	4.00	3.06	0.55
10	Cost-benefit ratio is higher	4.00	3.15	0.41
11	Higher demand in the market	4.00	3.22	0.49
12	Post-harvest management is easier	4.00	3.50	0.51
Over all mean		3.05		

4.3.2 Human sustainability through French bean-based livelihood system

Table 4.50 shows the performance of French bean-based livelihood system with respect to human sustainability. Altogether, 12 parameters were included under human sustainability with a maximum achievable score of 4 and a midpoint value of 2. From the above table, we can see that the in respect of 'reducing poverty, the mean score was 2.48 with a standard deviation value of 0.55, In terms of 'addressing food security' the mean

score was of 2.38 with a standard deviation value of 0.44 and for 'addressing issues of nutrition', the mean score was 2.97 with a standard deviation value of 0.44.

Similarly, for the parameter 'Addressing issues of health', the mean score was 2.90 with a standard deviation value of 0.49. 'Addressing issues of taste/palatability', the mean score was 3.23 with a standard deviation value of 0.47 and for 'Generating employment', the mean score was 1.70 with a standard deviation value of 0.67.

Likewise, for parameters 'Improving living standard', 'Unskilled worker are able to perform in cultivation practices', 'Requirement of physical capability is not important', 'Knowledge requirement is not important', 'Requirement of workers for cultivation is low', 'level of education for cultivation is not important', 'Can be carried out by both men or women', the mean score was 2.68, 2.81, 3.16, 2.90, 3.38, 3.65, respectively, with a standard deviation value of 0.56, 0.57, 0.44, 0.50, 0.49, 0.48, respectively. For all the parameters, the mean score was found to be higher than the midpoint scoring, *i.e*. 2.00.

Table 4.50 Human sustainability through French bean based-livelihood system N=240

Sl No	Parameters	Maximum achievable score	Mean	SD
1	Reducing poverty	4.00	2.48	0.55
2	Addressing food security	4.00	2.83	0.44
3	Addressing issues of nutrition	4.00	2.97	0.44
4	Addressing issues of health	4.00	2.90	0.49
5	Addressing issues of taste/palatability	4.00	3.23	0.47
6	Generating employment	4.00	1.70	0.67

7	Improving living standard	4.00	2.68	0.56
8	Unskilled worker are able to perform in cultivation practices	4.00	2.81	0.57
9	Knowledge requirement is not important	4.00	3.16	0.44
10	Requirement of workers for cultivation is less	4.00	2.90	0.50
11	level of education is not important	4.00	3.38	0.49
12	Can be carried out by both men or women	4.00	3.65	0.48
Overall mean		2.89		

But for the parameter 'generating employment', the mean score was below the midpoint score.

The overall mean score with respect to human sustainability was 2.89, which is higher than the midpoint score. Therefore, it is evident from the table that the performance of French bean-based livelihood system towards human sustainability was satisfactory.

4.3.3 Social sustainability through French bean-based livelihood system

Table 4.51 shows the performance of French bean based livelihood system with respect to social sustainability. Altogether, 12 parameters were included under social

sustainability with a maximum achievable score of 4 and a midpoint value of 2. The table reveals that the parameter 'Recognition' achieved a mean score of 2.60 with a standard deviation value of 0.56. The parameter 'Upscaling the social prestige', the mean score was 2.70 with a standard deviation value of 0.51.

Similarly, for parameters, 'Maintaining happiness of the family', 'Compatible with landless/small farmer', 'Gender discrimination is absent', 'Enhance current standard of living', 'Compatible with food habit', 'Compatible with social norms and values', 'Good source of income for social groups like SHGs', 'Crops can be grown traditionally', 'Its cultivation is easily taken up by development sector', 'Its cultivation is familiar with all the members of the family', the mean score was 3.46, 2.99, 2.82, 3.75, 2.74, 3.30, 3.50, 2.48, 3.65, 2.51, 3.46 with a standard deviation value of0.56, 0.51, 0.35, 0.54, 0.43, 0.61, 0.48, 0.53, 0.59, 0.49, 0.59, 0.51, respectively. The table reveals that the mean score for all the parameters was higher than the midpoint score *i.e*. 2.00.

The table further reveals that the overall mean score was 3.04, which was higher than the midpoint score, which suggests that the performance of

Table 4.51 Social sustainability through French bean based livelihood system N=240

Sl No	Parameters	Maximum achievable score	Mean	SD
1	Recognition	4.00	2.60	0.56
2	Up scaling the social prestige	4.00	2.70	0.51
3	Maintaining happiness of the family	4.00	2.99	0.35
4	Compatible with landless/small farmer	4.00	2.82	0.54
5	Gender discrimination is absent	4.00	3.75	0.43
6	Enhance current standard of living	4.00	2.74	0.61
7	Compatible with food habit	4.00	3.30	0.48

8	Compatible with social norms and values	4.00	3.50	0.53
9	Good source of income for social groups like SHGs/FIGs	4.00	2.48	0.59
10	Crop can be grown traditionally	4.00	3.65	0.49
11	Cultivation is easily taken up by development sector for economic development of weaker section	4.00	2.51	0.59
12	Cultivation is familiar with all the members of the family	4.00	3.46	0.51
	Overall mean	**3.04**		

French bean-based livelihood system towards social sustainability was satisfactory.

4.3.4 Environmental sustainability through French bean-based livelihood system

Table 4.52 shows the performance of French bean-based livelihood system with respect to environmental sustainability. Altogether, 12 parameters were also included under environmental sustainability with a maximum achievable score of 4 and a midpoint value of 2. The table shows that incase of 'Restore ecological balance and biodiversity', 'Not undermining the natural resources', 'Favorable for organic cultivation and without chemical inputs', 'Production is consistent', 'Maintain soil fertility', 'Control soil erosion', 'Suitable in mixed cropping and jhum fields', 'Can grow in climatic stress condition', 'Can grow in less fertile soil', 'Restore soil moisture', 'Crop residues can be used as fodders for animals', and 'Crop is climate-resilient', the mean scores were 2.44,

2.85, 3.10, 2.66, 2.30, 2.90, 2.41, 2.55, 2.73, 2.91, 2.13, 2.29 which were higher than the midpoint score *i.e.* 2.00 with a standard deviation value of 0.96, 0.68, 0.40, 0.52, 1.51, 0.52, 0.66, 0.82, 0.49, 0.57, 0.57, 0.59, respectively.

The table also reveals that the overall mean score was 2.65, which is above the midpoint score. Therefore, it is evident from the table that the performance of French bean-based livelihood system towards environmental sustainability was satisfactory.

Table 4.52 Environmental sustainability through French bean based livelihood system   **N=240**

Sl No	Parameters	Maximum achievable score	Mean	SD
1	Restore ecological balance and biodiversity	4.00	2.44	0.96
2	Not undermining the natural resources	4.00	2.85	0.68
3	Favorable for organic cultivation and without chemical inputs	4.00	3.10	0.40
4	Production is consistent	4.00	2.66	0.52
5	Maintain soil fertility	4.00	2.30	1.51
6	Control soil erosion	4.00	2.90	0.52
7	Suitable in mixed cropping and jhum fields	4.00	2.41	0.66
8	Can grow in climatic stress condition	4.00	2.55	0.82

9	Can grow in less fertile soil	4.00	2.73	0.49
10	Restore soil moisture	4.00	2.91	0.57
11	Crop residues can be used as fodders for animals	4.00	2.13	0.57
12	Crop is climate resilient	4.00	2.29	0.59
Overall mean		2.65		

4.3.5 Relationship between sustainability parameters and livelihood index

Here an attempt was made to study the relationship between the 'livelihood index' and four components of sustainability index (*i.e.* economic sustainability, human sustainability, social sustainability, and environmental sustainability) along with overall sustainability index.

Table 4.53 shows the relationship between various sustainability parameters along with the overall sustainability index and livelihood index.

The correlation value between 'economic sustainability' and 'livelihood index' was 0.09, which to denote there exist no significant but positive correlation between them.

The correlation value between 'human sustainability' and 'livelihood index' was 0.16 to indicate the existence of a positively significant correlation between them.

The correlation value between 'social sustainability' and 'livelihood index' was 0.06, which shows that there exists no significant but positive correlation between them.

The correlation value between 'environmental sustainability' and 'livelihood index' was 0.14, which indicates the existence of a positively significant correlation between them.

Though the table 4.55 has failed to exhibit any significant relationship between the two other selected parameters of sustainability i.e., 'economic sustainability' and 'social sustainability' with that of 'livelihood index', the 'overall sustainability' combining all the four parameters of sustainability, nevertheless, appeared to have exhibited a positive relationship with that of 'livelihood index' with a corresponding correlation value of 0.17.

Based upon the findings (table 4.55), the null hypothesis $H_0 2$ which states 'there exists no association between perceived indicators of sustainability and livelihood index of the French bean growers in the area under investigation' is hereby rejected.

4.53 Relationship between sustainability index and livelihood index

SL. No.	Parameters	Value of 'r'
1	Economic sustainability	0.09 NS
2	Human sustainability	0.16*
3	Social sustainability	0.06 NS
4	Environmental sustainability	0.14*
5	Overall sustainability	0.17**

* Significant at 5 per cent, table value: 0.127; ** Significant at 1 per cent level, table value: 0.166; NS- Not Significant

4.4 Identification of the problems associated with French bean, a cultivated species and to suggest the mitigation measures, if any

The purpose of this objective was to study the various problems associated with French bean cultivation faced by the farmers. Taking into consideration the response given by the respondents, various constraints faced by the farmers were analyzed and prioritized by ranking.

4.4.1 Prioritization of problems associated with French bean cultivation

Table 4.54 shows that 89.58 per cent of the respondents expressed the problem of 'transportation' which was ranked first among various problems. This may be due to the poor road condition in the study area affecting marketing. 'Marketing' was ranked the second most expressed problem in the study which was found to be represented by 82.08 per cent of the respondents. A fair percentage of respondents *i.e.* 51.25 per cent were found to have problem with 'field management' which may be because majority of the farmers in the study area practiced jhum cultivation which requires more men power and is laborious. Therefore, field management was ranked third among various problems faced by the farmers. 'Storage', 'harvesting', 'non-availability of inputs', were other

major problems expressed by 36.66, 20.00 and 18.33 per cent of the respondents, respectively and ranked fourth, fifth and sixth, respectively. Again, few percentages of the respondents *i.e*. 3.33, 2.08, 1.25 per cent expressed other problems such as 'crop protection', 'site selection' and 'labour' which were ranked seventh, eighth, and ninth, respectively.

Table 4.54 Prioritization of problems associated with French bean cultivation N=240

Sl. No.	Constrains	Frequency	Percentage	Rank
1	Transportation	215	89.58	I
2	Marketing	197	82.08	II
3	Field management	123	51.25	III
4	Storage	88	36.66	IV
5	Harvesting	48	20.00	V
6	Non-availability of inputs	44	18.33	VI
7	Crop protection	8	3.33	VII
8	Site selection	5	2.08	VIII
9	Labour	3	1.25	IX

*multiple responses obtained

4.4.2 Mitigation measures as suggested by the respondents

For the study, various mitigation measures proposed by the respondents were carefully recorded and included to aid in the future policy planning development for the study area. The various mitigation measures as indicated by the respondents are presented as follows:

The major problem associated with French bean cultivation was transportation upon which the respondents expressed the urgent need for intervention of government organizations. The road connectivity from villages to town in the study area was in a pitiable condition which was a hindrance for the transportation of agricultural products from village to market. There was no proper approach road to the field and farmers transport their products from field to godown physically, which requires huge workforce. Therefore, the need for intervention of government organizations in providing proper road connectivity in the study area was the major mitigation measures suggested by the respondents.

There was no regulated market in the study area due to which farmers used to exploit by the middle man. Also, due to the lack of awareness of proper marketing channels, farmers could not get the optimum return from their products. Therefore, respondents were concerned about the marketing process and expressed the need for awareness programmes with respect to marketing systems and marketing channels.

Farmers in the study area grow/cultivate French bean traditionally, which does not involve any advanced cultivation practices. Field management practices such as sowing, weeding, disease and pest management, harvesting, post-processing were done following age-old traditions. Therefore, respondents were keen on learning new ways of growing French bean and conveyed that concern organizations and authorities should bring about changes in the ways of cultivation by organizing training, demonstrations, awareness programmes *etc*.

Non-availability of inputs, such as improved seed varieties, suitable agricultural machineries, monetary inputs, *etc.,* was another issue highlighted by the respondents. Respondents expressed that extension functionaries should take up initiatives in implementing various rural development programmes in the study area.

Crop protection was another problem highlighted by the respondents in the study area. Major pest involved in French bean cultivation in the study area was rodents. The respondents expressed the need for training on crop protection and ways to control rodents in particular. Therefore, the respondents suggested that various pest management training and awareness programmes should be carried out.

SUMMARY AND CONCLUSIONS

The concept of livelihood and sustainable livelihoods goes hand in hand, which plays the most important role in the context of rural development. The term livelihood refers to the daily life activities maintained to achieve a means of living whereas sustainable livelihood refers to the activities maintained to secure a means of living without hampering the future needs and interests. In the development scenario, improving the livelihood status of the people without compromising the issues of sustainability to save the next generation should be the priority of the highest order of every development sector. Livelihood can be sustainable only by understanding and exploring the existing natural resources and its judicious utilisation. Therefore, a good insight into the existing livelihood and its association with the environment requires the utmost attention of every policymaker.

Surprisingly, attention of the development sector at the global and national level, since earlier and in the recent was mainly confined to the improvement of livelihood status of the people by the implementation of some external means of livelihood. The sustainability of existing as well as introduced livelihood system was relatively less emphasised. And it was not an exception in respect of Nagaland (the study area).

The majority of the population in Nagaland lived in rural areas and was dependent on agriculture. The present study was conducted to highlight the rural livelihood strategy as maintained by the French bean farmers in particular. The study was conducted to explore the various livelihood activities continued by the French bean growers and the performance of French bean based livelihood and other livelihood activities maintained by the French bean growers as well as the rural people of the State.

Therefore, the study would provide valuable information to the academicians, planners, policymakers and extension workers about existing livelihood pattern, livelihood strategies, potentiality, prospect and prominent contribution of the crop to the livelihood of the traditional people of Nagaland, the documentation and database development about which is immensely lacking. Therefore, keeping these in view, a study was conducted entitled, "A Livelihood Study on French Bean (*Phaseolus vulgaris L.*) Growers of Nagaland" with the following objectives:

- To characterise the French bean growers and their socio-economic features,
- To explore the role of French bean as a livelihood component in the area under study,
- To examine the sustainability through French bean based livelihood system, and
- To identify the problems associated with French bean, a cultivated species and to suggest the mitigation measures, if any.

RESEARCH METHODOLOGY

The study was conducted in two districts of Nagaland *viz.* Kiphire and Tuensang which were purposively selected. Further, two blocks from each district, namely, Chessore, Shamator, Pungro, and Kiphire blocks were also purposively included. Again, twelve villages were selected by taking three villages from each block and finally, 20 French bean growers from each selected village (60 growers from each block and 120 growers from each district) had chosen as respondents for the study. Therefore, altogether, 240 French bean growers were purposively selected as respondents for the study. The data were collected by individual interview method using a structured interview schedule.

In respect of socio-economic characterization of French bean growers, 20 variables were included and inferences were made by using appropriate statistical tools. In this study, two indexes were developed on livelihood and sustainability. Income from various livelihood activities was explored and compared with income from French bean cultivation to find out the role of French bean as a livelihood component. To examine the sustainability of French bean based livelihood system, various sustainability indicators *viz.* environmental, social, human and economic sustainability were taken into consideration. Various problems or constraints associated with French bean cultivation and its mitigation measures, as suggested by the respondents were also recorded for the study. Different statistical tools used for the analysis were frequency, mean, percentage, standard deviation, correlation, and regression.

Findings of the study

Following are the summary of the results of the study according to the objective:

Characterize the French bean growers and their socio-economic features

It is evident from the research that majority of the respondents (47.92%) belonged to lower medium age group followed by medium age group (32.92%) and old age group (17.91%) respectively. Only 1.25% of the respondents belonged to the young age group. The study further showed that the average age of the respondents was 52 years.

The study showed that 96.25 per cent of the respondents were male and 3.75% of the respondents belonged to the female gender. The study showed that the educational condition in the study area was in a pitiable state, and 82.5% of the respondents were either illiterate or completed up to the primary level of education.

In respect of occupation, farming was the only and primary occupation, which continued by 98.33% of the respondents. Remaining, 1.66% of the respondents were keeping agriculture as their secondary occupation. Simultaneously, 13.33% and 2.50% were continuing artisan and business as an occupation.

The study showed that 97.08% and 49.16% of the respondents had possession of mobile phone and television, respectively. The study further revealed that cent per cent of the respondents possessed machete (dao) and spade, and 78.75 % had godown for crop cultivation and storage.

The study also concluded that 80.83% of the respondents had medium material possession, 16.25% had a low level of material possession, and only 2.91% of the respondents had a high level of material possession with a mean and standard deviation value of 4.28, and 0.79, respectively.

The study revealed that 65.00%, 51.66% and 58.33% of the respondents from Tuensang district, Kiphire district and State, respectively had the medium size of landholding. On the other hand, 30.83%, 16.66% and 23.75% under Tuensang and Kiphire district, and state respectively had large landholding. Again, 3.33% under Tuensang district, and 24.16% under Kiphire district, and 13.75% of the state, respectively had small landholding. The average size of landholding across the study area was 3.73 ha, with a standard deviation value of 1.96.

The study also revealed that 79.16%, 86.66% and 82.91% of the respondents from Tuensang district, Kiphire district and state, respectively had the medium size of landholding under French bean cultivation. On the other hand, 17.50%, 8.33% and 12.91% of respondents from Tuensang and Kiphire district, and state respectively had vast land holding under French bean cultivation. Again, 3.33% from Tuensang district, and 5.00% from Kiphire district, and 4.16% from state, respectively had small land holding under

French bean cultivation. The average size of land holding under French bean cultivation across the study area was 1.86 ha with a standard deviation value of 1.47. Further, the majority of the French bean growers in the study area allocated land of 0.38 ha to 3.33 ha or more for French bean cultivation.

The study showed that adoption of tin-sheet for roof shedding was gradually increasing and the majority of the respondents (67.50%) had house made from 'bamboo and tin sheet'. But the use of wood plate (*takta*) as wall and leaves from forest plant as thatch were also persisting (32.50%) in the study area.

The study showed that farmers preferred to take support from contact farmers/farmers' friend to the greatest extent for information which ranked first among the sources of information, followed by extension personnel, television and radio with a decreasing degree of access, respectively.

The study revealed that majority of the respondents (71.66%) marketed their product through wholesale as well as through the retail channel of the market. But, only 18.33% of the respondents entirely marketed their product through wholesale and 10.00% of the respondents completely sold their product in retail.

Migration status

The study showed that 92.91% of the respondents or respondents' family members had never migrated from their village. In contrast, only 7.08% of the respondents' family member(s) had migrated to other places for job, education and better livelihood options.

Accessibility of the village and availability of basic amenities/ facilities

The study showed that the majority of the communities (83.33%) under Tuensang district had moderate accessibility. The remaining 16.67% of the

villages were found to have poor accessibility whereas none of the villages had good accessibility. Majority of the villages (50.00%) under Kiphire district had moderate availability, 33.33% of the villages were found to have poor accessibility, and the remaining 16.67% of the villages had good availability.

Again, under Tuensang district, 88.33% of the villages had moderate availability of necessary facilities, and the remaining 16.66% of the villages had good availability of basic facilities. Whereas, under Kiphire district, 66.66% of the villages had moderate availability and the remaining 33.33% of the villages had good availability of basic facilities.

Experience in French bean cultivation

The study showed that the majority of the total respondents (95%) had more than six years of experience in French bean cultivation. But, 85.83% and 61.66% from Kiphire and Tuensang district, respectively had more than nine years of experience in French bean cultivation. The mean years of experience in French bean cultivation were 10.49 years with a standard deviation value of 3.08 and ranged from 3 to 20 years.

Livelihood activities

The respondents were categorized based on different livelihood activities followed, namely, crop-based, livestock-based, forest-based and off-farm livelihood.

Crop-based livelihood activities

The study revealed that all of the respondents were growing French bean, where the majority of the respondents (*i.e.* 83.33%) were under medium French bean grower, 67.91% had medium French bean production, and 74.16% had medium annual income from French bean cultivation. Again, 67.91% of the respondents were growing rice out of which 55.00% of the

respondents were under the category of medium farmers in terms of area under rice cultivation. Further, 48.33% of the respondents had medium rice production and a medium annual income from rice cultivation.

Again, 97.08% of the respondents were also growing maize, out of which 55.83% of the respondents were under average maize growers' category. Around, 66.00% of the respondents had medium annual production, and 45.00% of the respondents had medium annual income from maize. Further, 21.25% of the respondents were growing potato, and 37.91% of the respondents were growing other vegetables.

Livestock-based livelihood activities

Further, 90.41% of the respondents were rearing chicken. Around, 53.00% 22.50% and 24.58% of chicken growers had low, medium and high annual production, respectively. Majority of the chicken- rearing respondents (54.00%) had low annual income from chicken rearing.

On the other hand, 88.75% of the respondents were found to rear pigs, where the majority of the respondents (70.83%) with pig rearing had medium annual production and 75.00% of the respondents had medium annual income. Also, 9.16% of the respondents were practicing beekeeping as a source of income from honey production. Majority of them had low production and income from honey production. A few of the respondents (7.08%) were also rearing - Mithun, where only 5.00% of them had medium annual meat production.

Forest-based livelihood activities

The study further revealed that all of the respondents were collecting firewood, and 88.75% had low income from this. A negligible portion of respondents (4.60%) were involved in timber collection.

The respondents were also found to engage in non-timber forest-based livelihood activities. The study showed that only 2.91% of the respondents were collecting forest honey and earning less income. Around 16.66% of the respondents were also engaged in other activities, like, hunting, fishing and fodder collection.

Off-farm livelihood activities

The study also showed that 10.41% of the respondents were found to practice weaving which was done by the womenfolk in the rural areas as a tradition. Again, 1.66, 2.91, 2.08 and 0.41% of the respondents were engaged in government jobs, carpentry, business, and driving, respectively.

In respect of livelihood activities, the study explored and recognized 25 livelihood activities as maintained by the respondents. As yet, 8 activities were categorized as major and remaining as minor. Further, majority of the respondents (55.00%) were maintained within 6 to 7 numbers of livelihood activities. About 25.42% and remaining, 19.58% were maintaining above 8, and up to five livelihood activities, respectively. The average number of livelihood activities continued by the respondents was 8.45 and ranged from 3 to 10, with a standard deviation value of 1.37.

Annual Income

The study revealed that the majority of the respondents (52.91%) across the study area had income ranged from ₹ 35,001 to 70,000 per annum, which were categorised as a lower-middle-income group. The mean income of the respondents was ₹70,542.13 with a standard deviation value of 36131.04.

Income from the agricultural sector

The study revealed that 74.16%, 75.83% and 75.00% of the respondents from Tuensang district, Kiphire district and state, respectively had medium

income from agriculture. On the other hand, 17.50%, 11.66% and 14.58% of the respondents under Tuensang and Kiphire district, and state, respectively had high income from agriculture. Again, 8.33% of the respondents under Tuensang district, and 12.50% of the respondents under Kiphire district, and 10.41% of the respondents of the state, respectively had low income from agriculture. The average income from agriculture across the study area was ₹ 65,593.80 with a standard deviation value of 29578.79.

Annual expenditure in French bean cultivation

The study showed that the major area of expenditure under French bean cultivaion was seed cost. The respondents also had expenditure on labour hiring and even in harvesting and post-harvest activities. The table further revealed that 76.97 per cent of the expenditure was incurred on seed cost, 20.46 per cent on labour hiring and 2.57 per cent in harvesting and post-harvest activities. The table also showed that 31.67 per cent of the respondents had expenditure upto ₹ 3,000, 21.67 per cent had between ₹ 3,001-₹ 5,000, 23.75 per cent had expenditure between ₹5,001-₹7,000 and 22.91 per cent had expenditure above ₹ 7,000. The average expenditure in French bean cultivation was ₹5,076.91 with a standard deviation value of 3501.60.

Annual production of French bean

The study revealed that 70.00%, 65.83% and 67.91% of the respondents from Tuensang district, Kiphire district and state, respectively had medium French bean production (498 – 2,032 kg). On the other hand, 21.66%, 15.00% and 18.33% from Tuensang and Kiphire district, and state, respectively had high French bean production (> 2,032 kg). Again, 8.33% under Tuensang district, and 19.16% under Kiphire district, and 13.75% of the state, respectively had low French bean production (< 498 kg). The average French

bean production of the respondents of the state was 1,265.32 kg with a standard deviation value of 767.08.

Annual income from French bean production

Around 72.50% and 79.16% and 74.16% of the respondents from Tuensang district, Kiphire district and state, respectively had medium income from French bean production. On the other hand, 16.66%, 15.00% and 17.50% under Tuensang and Kiphire district, and state respectively had high income from French bean. Again, 10.83% under Tuensang, and 5.83% Kiphire district, and 8.33% of the state, respectively had low income from French bean. The average income from French bean cultivation under the study area was ₹ 30,372.08 with a standard deviation value of 20011.88.

Comparative analysis of experience in French bean cultivation, size of land holdings, land under French bean cultivation, and French bean production between the districts

The study showed that the average size of landholding, the average size of land under French bean and French bean production is higher for French bean growers from Tuensang district, but the average experience of French bean growers from Kiphire district was higher.

The study also showed that the size of landholding and the land under French bean cultivation had a positive and significant relationship with French bean production. Size of landholding also had a significant relationship with land under French bean cultivation.

Relationship between various socio-economic variables and livelihood index

The study revealed that age had a significant but negative correlation with livelihood index. But, material possession, educational qualification, type

of house, size of landholding, annual income, and annual expenditure had a significant and positive correlation with livelihood index.

The study also revealed that majority of the respondents had medium livelihood index with an average index of 39.24 with a standard deviation value of 8.06.

Role of French bean as a livelihood component in the area under study

Pattern of the contribution of crop-based livelihood on overall annual income (percentage)

It is evident from the study that French bean contributed the highest, (*i.e*. 46.30%) in total agricultural income (crop and livestock), 73.82% of income from total crop production and 43.05% in total annual income. The average income from French bean was ₹ 30,372.08 with a standard deviation value of 20011.88. Major crops like maize, rice, chilli and soybean were also found to contribute in respect of total agricultural income, total income from crop production and total annual income.

Pattern of the contribution in income from different livestock towards overall agricultural income (percentage)

Pig rearing contributed the highest in income, *i.e*. 30.21% of total agricultural income, 81.07% of total income from the livestock sector and 28.09% in total annual income. The total income from pig rearing was ₹ 47, 56,950, with the average income of ₹ 19,820 and standard deviation value of 13,894.96. The range of income from pig rearing was ₹ 8,000 to ₹ 72,000. Other livestock, like chicken, beekeeping and mithun had a very negligible contribution in total income from livestock, total agricultural income and total annual income respectively.

Pattern of contribution in income from forest-based livelihood activities

The study revealed that firewood contributed 63.85% in the total income from forest-based livelihood activities and 1.94% in total annual income where the mean income was ₹ 1,368.75 with income ranging from ₹6,000 to ₹ 24,000 and with a standard deviation value of 4,218.47. Timber collection contributed 32.07% in total income from forest-based activities and 0.97% in total annual income. The mean income was found to be ₹ 687.50 with a salary ranging from ₹ 10,000 to ₹ 50,000 with a standard deviation value of 4486.88. Firewood collection and timber collection were found to be the major income-generating activities under forest-based livelihood activities in the study area. Forest honey and bamboo collection were also found to negligibly contribute to the total income.

Pattern of contribution in income from different off-farm livelihood activities

The study revealed that the mean income from government job was ₹ 20,750 with an income range of ₹10, 000 to ₹ 30,000 and a standard deviation value of 137621.20. It contributed 0.49% of the total annual income and 12.33% in total income from off-farm livelihood activities. Weaving was found to add 1.31% in the total annual income, and 33.15% in total income from off-farm livelihood activities with a mean income of ₹ 8,924 and income ranged from ₹3,000 to ₹ 22,000 and with a standard deviation value of 4538.66. Carpentry and business had a mean income of ₹ 5,714.29 and ₹ 62,400 respectively with income ranged from ₹ 4,000 to ₹ 8,000 and ₹ 2,000 to ₹ 2,40,000 and with a standard deviation value of 1380.13, 99793.79, respectively. They were found to contribute 0.23% and 1.84% respectively in the total annual income and 5.94% and 46.35% in total income from off-farm livelihood activities. Respondents were also found to engage in driving with an average income of ₹ 15,000.

Contribution from different livelihood activities in total annual income

French bean-based livelihood activities found to contribute 43.05 % and ranked as I in respect of contribution to the total yearly income with an average income of ₹ 30,372.08, with SD value of 20011.88. Livestock based livelihood was found to contribute 34.65% and ranked as II in respect of contribution to the total annual income. The average income from the livestock sector was ₹ 24,448.33 with SD value of 19962.84. Crop-based livelihood activities were found to contribute 15.27% and ranked as III in respect of contribution to the total annual income with an average income of ₹ 10,773.38 and SD value of 6116.66. Off-farm and Forest-based activities were found to contribute 3.97% and 3.03 % and also ranked as IV and V in respect of contribution to the total annual income, respectively. The average income of forest-based and off-farm activity was ₹ 2,143.75 and ₹ 2,804.58 and with SD value of 6105.94 and 16147.28, respectively.

Annual expenditure pattern of the respondents for their livelihood and survival

The study showed that the major area of expenditure by the respondents was on food with a mean expenditure of ₹ 16,120, followed by spending on education with average spending of ₹ 13,259.17.

The study also showed that 69.17% of the respondents had average expenditure, 15.00% of the respondents had low expenditure, and the remaining 15.83% of the respondents had high spending. The average spending of the respondents was ₹ 41,630.25.

Relationship between various socio-economic variables and income from French bean

The study showed that out of 12 socio-economic variables studied, material possession (r=0.210), educational qualification (0.134), source of

information (r=0.127), size of land holding (r=0.661), land under French bean cultivation (r=0.792), French bean production (r=0.807), annual income (r=0.459), income from agricultural sector (r=0.709), annual expenditure (r=0.369) had a significant and positive relationship with income from French bean. Therefore, it is evident from the study that the French bean plays a vital role in the livelihood of the farmers.

Relationship between various annual expenditure and income from French bean

The study showed that out of five different expenditures, food expenditure (r=0.282), education expenditure (r=0.324) and total investment (r=0.369) showed positive and significant correlation with income from French bean.

The study showed the relationship by simple regression analysis between income from French bean cultivation (x) and five other socio-economic issues (y) with reference to expenditure pattern of respondents, *viz.* total annual expenditure, expenditure for food, education, health, and clothing.

Further, it can be concluded that French bean income as an independent predictor had a significant and positive role in expenditure, *viz.* total annual expenditure, expenditure on food and education. No significant but positive impact of income from French bean was found on expenditure on health and clothing.

Sustainability through French bean-based livelihood system

Economic sustainability through French bean-based livelihood system

Out of 12 parameters studied *viz.* potential for steady and standard income, Cost of management is cheaper compared to other crops; Income per unit area is higher compared to other crops, Income opportunity during

offseason, Round the year price is standard, Better savings, Income opportunity for women, Procurement of planting material is easy, Chance of crop failure is low, Cost-benefit ratio is higher, Higher demand in the market, Post-harvest management is more natural, in all the parameters the mean score was found to be higher than the midpoint score.

The overall mean concerning economic sustainability was 3.05, which signify that the performance of French bean as a livelihood component towards economic sustainability was satisfactory.

Human sustainability through French bean-based livelihood system

For the study, 12 parameters were studied *viz.* Reducing poverty, Addressing food security, Addressing issues of nutrition, Addressing issues of health, Addressing issues of taste/palatability, Generating employment, Improving living standard, Unskilled worker cap performing in cultivation practices, Knowledge requirement is not essential, Requirement of workers for cultivation is low, level of education is not essential, Can be carried out by both men or women. For all the parameters, the mean score was found to be higher than the midpoint scoring *i.e*. 2.00. But for the parameter 'generating employment', the mean score was below the midpoint score.

The overall mean score concerning human sustainability was 2.89, which is higher than the midpoint score (2.00). Therefore, it is evident from the table that the performance of French bean as a livelihood component towards human sustainability was satisfactory.

Social sustainability through French bean-based livelihood system

For the study, 12 parameters were studied *viz.* Recognition, Upscaling the social prestige, Maintaining happiness of the family, Compatible with landless/small farmer, Gender discrimination is absent, Enhance the current standard of living, Compatible with food habit, Compatible with social norms

and values, Good source of income for social groups like SHGs, Crops can be grown traditionally, Its cultivation is readily taken up by development sector, Its cultivation is familiar with all the members of the family. The study revealed that the mean score for all the parameters was higher than the midpoint scores, *i.e.* 2.00.

The study further revealed that the overall mean score was 3.04, which was higher than the midpoint score, which suggests that the performance of French bean based livelihood system towards social sustainability was satisfactory.

Environmental sustainability through French bean-based livelihood system

For the study, 12 parameters were studied *viz.* Restore ecological balance and biodiversity, Not undermining the natural resources, Favorable for organic cultivation and without chemical inputs, Production is consistent, Maintain soil fertility, control soil erosion, Suitable in mixed cropping and jhum fields, Can grow in climatic stress condition, Can grow in less fertile soil, Restore soil moisture, Crop residues can be used as fodders for animals, crop is climate resilient. All the parameters had a mean score above the midpoint score.

The study also revealed that the overall mean score was 2.65, which was above the midpoint score. Therefore, it is evident from the research that the performance of French bean-based livelihood system towards environmental sustainability was satisfactory.

Relationship between sustainability parameters and livelihood index

It was found that out of four components of sustainability, 'human sustainability'(r=0.16) and 'environmental sustainability' (r=0.14) were established significant and positive association with livelihood index.

Remaining two components of sustainability, namely, economic and social sustainability were established a positive relationship with livelihood index. Further, overall sustainability index (r=0.17) was also established a positive and significant relationship with livelihood index. Therefore, the performance of French bean as a livelihood component was sustainable.

In the study on the sustainable performance of French bean as a livelihood component, altogether, 48 parameters under four components of sustainability were taken into consideration. It was found that in respect of 47 parameters, the performance of French bean was satisfactory as well as performance was also very much satisfactory in terms of economic, social, human, and environmental sustainability. Further, the study established a positive and significant relationship between livelihood index and perceived sustainability index. Therefore, French bean based livelihood is immensely sustainable.

Identification of the problems associated with French bean, a cultivated species and to suggest the mitigation measures, if any

All together nine problems were identified based on the responses from the study community. Around 90% of the respondents expressed the problem of 'transportation', which was ranked Ist among various issues. This may be due to the poor road condition in the study area affecting marketing. Accordingly, 'marketing' was idendified as the second most important problem. Simultaneously, 'field management', 'storage', 'harvesting', 'Non-availability of inputs', 'crop protection', 'site selection', and 'non-availability labour' were highlighted by respondents as significant problems in the study area, respectively.

CONCLUSIONS

From the present study conducted in the two districts namely, Kiphire, Tuensang in Nagaland, majority of the farmers were middle-aged farmers where the majority of the farmers were male, indicating male-gender playing a major role in French bean cultivation. Educational status in the study area was also in a pitiable state. The reason for the majority of the respondents was found to be married may be because all respondents were above 30 years old. All the respondents were engaged in farming, and only a few portions of the respondents were continuing some other activities along with farming. Majority of the farmers had a medium level of material possession which may be due to simple living style of the farmers. Despite being highly experienced in French bean cultivation, most of the farmers had medium income from French bean production which may be due to the reason that farmers were not exposed to advance cultivation practices as such only a few portions of the farmers consulted extension personnel. It is clear from the study that majority of the respondents had low and medium mass media contact and the majority of the respondents (71.66%) marketed their product by using both the marketing channel (wholesale and retail). Most of the farmers never migrated to other places for livelihood, and the majority of the farmers were highly experienced French bean growers.

Among the crops grown, French bean, maize and rice were the major crops, and chicken and piggery were major livestock maintained in the study area. Among the different livelihood activities, French bean was the most important crop in crop-based livelihood, piggery in livestock based, firewood collection in the - forest-based and weaving in off-farm activities. Majority of the farmers were found to be under the medium farmers' category with medium land holdings.

French bean is an essential crop in the region. It contributed the highest to crop-based income (73.82%), agricultural (including livestock) income (46.30%) and in total annual income (43.59%). Therefore, it can be concluded that the French bean plays a major role in the livelihood of the farmers in the study area.

Sustainability of French bean based livelihood system in respect to economic sustainability, human sustainability, social sustainability and environmental sustainability was found to be highly sustainable.

Transportation, Marketing, Field management, Storage, Harvesting, Non-availability of inputs, crop protection, site selection and non-availability of labour were the problems associated with French bean cultivation as expressed by the farmers. Where transportation, marketing and field management were the most severe problems associated with French bean cultivation.

Recommendations

➢ Despite French bean being the major crop of the farmers, most of the farmers had average production, which could not meet the demand of the market. Therefore, more emphasis should be given to increase the productivity of the farmers.

➢ Most of the French bean growers were practicing the traditional method of French bean cultivation. Therefore, farmers should be made aware of the new package of practices of French bean cultivation to maximize the production through the use of improved seed, varieties and techniques.

➢ More focus should be given on the sustainable French bean production as income from French bean cultivation was the major source of livelihood for the French bean growers.

➢ In the study area, French bean is cultivated in jhum fields which involve slash and burn of the forest area, thereby, affecting flora and fauna of

the forest. Therefore, extensive research should be done to find an alternative for jhum cultivation method. Also, farmers should be made aware of the advantages of maintaining optimum jhum cycle through awareness programmes.

➢ Due to the hilly topography of the study area, farmers could not use any farm machinery and were solely dependent on the workforce for intercultural operations, land preparation, sowing, weeding, harvesting etc. And also, labour hiring emerged as major head of direct expenditure in French bean cultivation. Therefore, future research should focus on the development of technologies for hill agriculture, thereby reducing the spending on labour hiring and maximizing productivity.

➢ In the study, it was observed that vast majority of the French bean growers do not have contact with extension agents which could be the reason why the majority of the French bean growers were ignorant of the modern cultivation practices. Therefore, more emphasis should be given on establishing a good relationship between farmers and extension agents by organizing awareness programmes and other extension activities.

➢ In the study area, farmers grow French bean without the use of chemical fertilizers or nutrients with immense success owing to the high fertility of the soil. As such, there is excellent scope for organic production of French bean, which can have a substantial massive impact in the national market. Therefore, emphasis should be given to help the farmers to certify their product through the right certifying agency, thereby improving their marketing opportunity.

➢ It can be observed from the study that livestock also played a major role in the livelihood of the French bean growers. Therefore, due consideration should also be given towards the improvement of livestock rearing. Farmers should be made aware of the improved

178

livestock rearing techniques through training and exposures through the activities of ATMA and KVKs.

➢ It was observed from the study that the major problem faced by the French bean growers was transportation. The road condition in the study area was in the pitiable state, thereby hindering in the transportation of products from field to storage and from storage to market places. Therefore, the focus should be given towards improving the condition of the road and developing the area as a whole.

➢ In the study area, French bean is sold both as retailed as well as wholesale. There was no regulated market for the farmers as such farmers get exploited by the middle man. Therefore, measures should be taken by the government to establish a regulated market for the French bean growers for better and remunerative price of their products.

➢ The study showed that the French bean based livelihood system was highly sustainable, and the performance of French bean cultivation was also highly remunerative. But its cultivation and production were profoundly lacking in the state and could not meet the demands. Therefore, through this study, the importance of French bean cultivation can be appraised to other farmers.

➢ It can be concluded that more and up to date intervention is needed from all the concerned to up-scale the income from French bean by more production and productivity to bring all-round development of the region.

Prospect for future research:

➢ The present study was conducted with limited resources in two districts of Nagaland. Therefore, a similar type of research may also be conducted in other French bean growing districts of the State, other parts of the country and other countries.

➢ From the study, it can be suggested that an indepth market research study for French bean production and other crop production as a whole should be conducted as there was no proper marketing channel in the study area. The French bean produced by the farmers were sold only in local markets with low price. Future market research would help farmers to get the remunerative return from their product.

➢ Farmers in the study area grow French bean traditionally, which includes the use of local varieties, indigenous cultural practices, which are outdated and farmers could not compete with other progressive farmers in national and international markets. Therefore, proper agronomic research should be conducted pertaining to the climatic and soil conditions of the area which would help to suggest farmers on the improved cultivation practices in respect to French bean cultivation as well as other crop cultivation.

➢ French bean being a leguminous and immensely sustainable crop, there is high scope for future research in terms of climate-resilient agriculture. This type of research findings can be helpful in creating awareness among policy makers and most importantly, among farmers in the study area as well as state as a whole.

➢ French bean growers also actively participate in livestock production especially piggery and poultry production. Therefore, there is an immense scope for research interms of animal husbandry in the study area.

REFERENCES

Abebe, G., Amanuel Alemu. 2017. Role of improved seeds towards improving livelihood and food security at Ethiopia. *Index Copernicus Value*. **5**(2).

Adamo, K. 2001. Participatory Agricultural Research Processes in Ea stern and Central Ethiopia: Using Farmers' Social Networks as Entry Points for PR Activities. Network on Research in Africa, Occasional Publications Series, No. 33, CIAT, Kampala, Uganda.

Adebayo, O., Olagunju, K. and Ogundipe, A. 2016. Impact of Agricultural Innovation on Improved Livelihood and Productivity Outcomes among Smallholder Farmers in Rural Nigeria. Retrieved from https://ssrn.com/abstract=2847537. Accessed on 11 December 2019.

Adesope, O.M., Matthews-Njoku, E.C., Oguzor, N.S. and Ugwuja, V.C. 2012. Effect of Socio-Economic Characteristics of Farmers on Their Adoption of Organic Farming Practices, Crop Production Technologies, Peeyush Sharma and Vikas Abrol, IntechOpen, DOI: 10.5772/30712. https://www.intechopen. com/books/crop-production-technologies/effect-of-socio-economic-characteristics-of-farmers-on-their-adoption-of-organic-farming-practices. Accessed on 9 December 2019.

Agropedia, 2019. Area, production and productivity of major pulses. http://agropedia.iitk.ac.in/content/area-production-and-productivity-major-pulses. Accessed on 11 December 2019.

Ajah, J., Job, N., and Nmadu. 2012. Socio-economic factors influencing the output of small-scale maize farmers in Abuja, Nigeria. *Kasetsart J. (Soc. Sci).* **33**: 333 – 341.

Akoth, O. B. 2016. Socio-economic impacts of sugarcane farming on livelihoods and the biophysical environment in Transmara sub-county, Kenya. Master of Environmental Studies and Community Development, School of Environmental Studies of Kenyatta University.

Alam, M., Siwar, C., Md. Wahid Murad, Rafiqul Islam Molla, and Mohd Ekhwan bin Toriman. 2010a. Socioeconomic profile of farmer in Malaysia: Study on integrated agricultural development area in north-west Selangor. *Agricultural Economics and Rural Development. New series.* **VII** (2): 249–265.

Alam, M., Siwar, C., Md. Wahid Murad, Rafiqul Islam Molla, and Mohd Ekhwan bin Toriman. 2010b. Socioeconomic profile of farmer in Malaysia: Study on integrated agricultural development area in north-west Selangor. *Agricultural Economics and Rural Development. New series.* **VII** (2): 249–265.

Alipour, H., Fallah, R., and Moghadas Farimani, N. 2008. Researchers' knowledge and tendency in extension, education and agricultural research organization towards sustainable agriculture. *Research and Development*. **81**: 110-119.

Altenbuchner, C., Larcher, M. and Vogel, S. 2014. The impact of organic cotton cultivation on the livelihood of smallholder farmers in Meatu district, Tanzania. *Renewable Agriculture and Food Systems*. **31** (1): 22-36.

Amanuel, A. and Girma, A. 2018. Production Status, Adoption of Improved Common Bean (Phaseolus vulgaris L.) Varieties and Associated Agronomic Practices in Ethiopia. *Journal of Plant Science & Research.* **5** (1).

Ananthnag. K., Mahatab Ali K.M., and Vinaya Kumar, H. M. 2104. A Study on Socio - economic status of farmers practicing organic farming in Eastern Dry Zone of Karnataka. *Online Journal of Bio-Sciences and Informatics*. **1** (2).

Anigbogu, T. U., Agbasi, O. E., and Okoli, I. M. 2015. Socioeconomic factors influencing agricultural production among cooperative farmers in Anambra State, Nigeria. *International Journal of Academic Research in Economics and Management Sciences,* **4** (3).

Arenas, R., O., Damián Huato, M.A., Rivera Tapia, J.A., Báez Simón A., Huerta Lara M., and Cabrera Huerta, E. 2013. The Nutritional value of Beans (*Phaseolus vulgaris* L.) and its importance for Feeding of Rural communities in Puebla-Mexico. *International Research Journal of Biological Sciences*. **2** (8): 59-65.

Ashley, C and Hussein, K. 2000. Developing Methodologies for Livelihood Impact Assessment: Experience of the African Wildlife Foundation in East Africa. Overseas Development Institute Portland House Stag Place London SW1E 5DP UK. https://www.researchgate.net/publication/237433406_Developing_Methodologies_for_Livelihood_Impact_Assessment_Experience_of_the_African_Wildlife_Foundation_in_East_Africa. Accessed on 11 December 2019.

Bachev, H. 2017. Sustainability level of Bulgarian farms. *Bulg. J. Agric. Sci*. **23** (1): 1–13.

Bagenia, P. S., and Chaturvedi, D. 2018. Knowledge status of cluster bean (*Cyamopsis tetragonoloba*) growers in Hyper Arid Zone of Rajasthan, India. *Int.J.Curr.Microbiol.App.Sci,* **7** (1): 264-272.

Basiago, A. D. 1999. Economic, social, and environmental sustainability in development theory and urban planning practice. *The Environmentalist* (19): 145-161.

Basyal, K., Khanal, K. and Dhakal, S. 2019. Socio-Economic Study of Tomato Producing Farmers in Lamahi, Dang. *Biomed J Sci & Tech Res*. **20** (5).

Bhagat, G. R., Nain, M. S., and Narda, R. 2004. Information sources for agriculture technology. *Indian Journal of Extension Education*. **40** (1)(2).

Brown, B., Hanson, M., Liverman, D., and Merideth, R. 1987. Global sustainability: toward definition. *Environmental Management*. **11** (6): 713-719.

Brundtland, G.H. 1989. "Protecting the Global Commons," *Earth Ethics*, Fall, 12.

Camble, E. 1992. Access to and Utilization of Quality Information in Rural Development Programmes in Bama Zone of Borno State. Ph.D Thesis, Department of Library, Archival, and Information Studies, University of Ibadan.

Campbell, A., Converse, P., and Rodgers, W. 1976. Quality of American Life, The: Perceptions, Evaluations, and Satisfactions. Russell Sage Foundation. http://www.jstor.org/stable/10.7758/9781610441032. Access on 11 November 2020.

Carney, D. (ed.). 1998. Sustainable rural livelihoods: what contribution can we make?, **In**: Proceedings of the Department for International Development's Natural Resources Advisers' Conference, pp.vii + 213.

Celmeli, T., Sari, H., Canci, H., Sari, D., Adak, A., Eker, T and Toker, C. 2018. The Nutritional Content of Common Bean (*Phaseolus vulgaris L.*) Landraces in Comparison to Modern Varieties. *Agronomy*. **8**: 166.

Chambers, R. 1989. Farmer First, farmer innovation and agricultural research. London, Intermediate Technology Productions.

Chambers, R., and Conway, G. 1991. Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. *IDS Discussion paper 296*.

Chambers, R., and Conway, G.R. 1992. 'Sustainable Rural Livelihoods: Practical Concepts for the 21st Century'. *Discussion Paper*. **296**.

Chandra, S., and Ali, M. (1986). TechnicarBulletin No.1. Directorate of Pulses Research, Kanpur, 14-15.

Chilot, Y., Rashid, S., Befekadu, B., and Solomon, L. 2010. Pulses Value Chain Potential in Ethiopia; Constraints and opportunities for enhancing exports. *International Food Policy Research Institute*, 1-50.

Christian, J.W. 1980. Housing Finance for Developing Countries. *Illinois, Chicago*

Cuadrado, J. T., and Mantiza, H. B. 2016. Socio-economic status of barangay saguma: basis for needs assessment in identifying specific project for extension program. *International Journal of Humanities & Social Science Studies* **2** (5): 348-361.

Darkey, S.K., Dzoemku, B.M., Okorley, E.L., Gyimah, F.A., and Bluwey N.A. 2014. Contribution of urban vegetable production to farmers' livelihood: A case of the Kumasi Metropolis of Ashanti region of Ghana. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development. **14** (1).

Darshan, N.P., Meena, B.S., and Meena, H.R. 2017. Influence of Socio-economic Characteristics of Farmers on their Use of Social Media in Haryana, India. *Int.J.Curr.Microbiol.App.Sci*. **6** (10): 14-18.

David, S. 1999. Beans in the farming system and domestic economy of Uganda: A tale of two parishes. Network on Bean Research in Africa, Occasional Publications Series, No. 28, CIAT, Kampala, Uganda.

David, S., Kirkby, R., and Kasozi, S. 2000. Assessing the Impact of Bush Bean Varieties on Poverty Reduction in Sub-Saharan Africa: Evidence from Uganda. *Network on Bean Research in Africa, Occasional Publications Series*, No. 31, CIAT, Kampala, Uganda.

Dev, S.M. 2011. Climate Change, Rural Livelihoods and Agriculture (focus on Food Security) in Asia-Pacific Region. Indira Gandhi Institute of Development Research, Mumbai. http://www.igidr.ac.in/pdf/publication/WP-2011-014.pdf. Accessed on 11 December 2019.

Ellis, F. 2000. The determinants of rural livelihood diversification in developing countries, *Journal of Agricultural Economics*, **51** (2): 289–302.

Engberg, L. E. 1996. Finding a livelihood alternative: An example of family resource management in action, in L. E. Engberg; J. Varjonen and H. Steinmuller (eds) Family Resource Management Issues, Paris, International Federation for Home Economics.

FAO. 2011. Countries by commodity – FAOSTAT. http://www.fao.org/faostat/en/#rankings/countries_by_commodity. Accessed on 2 December 13, 2019.

FAO. 2014. Statistical year book: Asia and the Pacific Food and Agriculture. http://www.fao.org/3/a-i3590e.pdf. Accessed on 2 December 13, 2019.

FAO. 2016. Migration, agriculture and rural development: Addressing the root causes of migration and harnessing its potential for development. http://www.fao.org/3/a-i6064e.pdf. Accessed on 5 November 2019.

Francis, C.A., Butler, Flora, C., and King, L.D. 1990. Sustainable agriculture in temperate zones. New-York, Chichester, JohnWiley & Sons, 487 pp.

Fresco, L. O., and Kroonenberg, S. B. 1992. Time and spatial scales in ecological sustainability. *Land Use Policy*. **9**: 155–168.

Gafsi, M., and Favreau, J.L. 2010. Appropriate method to assess the sustainability of organic farming systems. *9th European IFSA Symposium*, Vienna (Austria).

Gaillard, J.C. 2015. Vulnerability and Livelihoods. *In: People's Response to Disasters in the Philippines*. Disaster Studies. Palgrave Macmillan, New York.

Gamlin. 2016. A livelihood study on pineapple growers in West Siang district of Arunachal Pradesh. Mcs (Ag) thesis.

Gerita. 2015. Facts and benefits of French Beans. www.slurrpy.com. Accessed on 25/9/2017.

Government of India, 2019. State-wise Production of Pulses from 2012-13 to 2014-15. Ministry of Agriculture and Farmers Welfare, Government of India. Available at https://data.gov.in/resources/state-wise-production-pulses-2012-13-2014-15-ministry-agriculture-and-farmers-welfare. Accessed on 5 October 2019.

Government of Nagaland. 2006. Integrated Watershed Management Programme (IWMP): State Perspective And Strategic Plan (SPSP) Of Nagaland. https://dolr.gov.in/sites/default/files/Nagaland_SPSP.pdf. Accessed on 5 October 2019.

Government of Nagaland. 2009. Livelihood and employment opportunities in Nagaland - sectoral issues: A Thematic Report. *Government of Nagaland, Department of Planning and Coordination,* pp 16-17.

Government of Nagaland. 2012. Nagaland State Action Plan on Climate Change: Achieving a Low Carbon Development Trajectory. http://moef.gov.in/wp-content/uploads/2017/09/Nagaland.pdf. Accessed on 5 October 2019.

Government of Nagaland. 2014. Statistical handbook of Nagaland. http://14.139.60.153/bitstream/123456789/11357/1/Statistical%20Handbook%20of%20Nagaland%202014.pdf. Accessed on 12 November 2019.

Government of Nagaland. 2017. Statistical handbook of Nagaland. https://dimapur.nic.in/document/statistical-handbook-2017/. Accessed on 12 November 2019.

Gras, R.., Benoit, M., Deffontaines, J.P., Duru, M., Lafarge, M., Langlet, A., and Osty, P.L. 1989. Le fait technique en agronomie - Activité agricole, concepts et méthodes d'étude. INRA – Ed. L'Harmattan. Paris, 184 p.

Hahn, M.B., Anne M., Riederer, Stanley O., and Foster. 2009. The Livelihood Vulnerability Index: A pragmatic approach to assessing risks from climate variability and change—A case study in Mozambique. *Global Environmental Change*, **19**, 74–88.

Harris, David R. and Fuller, D.Q. 2014. Agriculture: Definition and Overview. In *Encyclopedia of Global Archaeology* (Claire Smith, Ed.). Springer, New York. pp 104-113.

Hobart, M. 1993. An anthropological critique on development, the growth of ignorance. London*, Routledge*: 235. http://www.fao.org/faostat/en/#rankings/countries_by_commodity.Accessed on 12 November 2019.

Hussein, K., and Nelson, J. 1998. Sustainable livelihoods and livelihood diversification. *IDS working paper 69.*

IFRC. 2019. *What is a livelihood? – IFRC.* https://www.ifrc.org/en/what-we-do/disaster-management/from-crisis-to-recovery/what-is-a-livelihood/. Accessed on 5 October 2019.

Immanuel, S., Jaganathan, D., Sivakumar, P.S., Muthuraj, R., and Prakash, P. 2019. Livelihood Assessment of Cassava and Paddy Growing Farmers in Tamil Nadu: A Comparative Analysis. Ind. J. Pure App. Biosci. **7**(4): 90-98.

Israr, M., Yaseen, A., and Ahmad, S. 2017. Sustainable rural development and livelihood sources of the rural households in mountainous pakistan. *American Journal of Rural Development*, **5**(4): 97-102.

Issa, K, and Abdulkadir. 2016. Analysis of socio-economic factors influencing farmers' adoption of improved maize production practices in Ikara local government area of Kaduna state, Nigeria. *Agrosearch* **16**(2): 15-24.

Jamanal, S. K., and Sadaqath, S. 2017. Socio-economic characteristics of soybean growers. *Journal of Pharmacognosy and Phytochemistry* **6**(5): 2766-2768

Jami, J. 2018. The Dilemma of Classification of Income Levels in Social Research. *The NEHU Journal* **16**(1): 19-30.

Jamir and Naromongla. 2012. Participation of Naga women in electoral politics: a case study of Kohima town. http://hdl.handle.net/10603/66131. Accessed on 5 October 2019.

Jones, A.L. 1999. Phaseolus bean: Post-harvest Operations. Phaseolus bean: Post-harvest Operations. Centro Internacional de Agricultura Tropical (CIAT). http://www.fao.org/3/a-av015e.pdf. Accessed on 10 December 2019.

Jones, J.E., Tripathi, B.P., Joshi, K.R., and Pant, B.B. 2002. 'Results from Household Survey with Emphasis on Rural Livelihoods and Soil fertility Management Undertaken in the Mid- hills of Nepal'. SRI/UK-ARS Lumle/NARC Collaborative Project Report. Pokhara/Kaski: RARS Lumle.

Julius, A., and Chukwumah, A.F. 2014. Socio-economic Determinants of Small-scale Rice Farmers' Output in Abuja, Nigeria. *Asian Journal of Rural Development*, **4**: 16-24.

Julius, O.K. 2019. Impact of Block Farming on Livelihood of Farmers in the Eastern Region of Ghana: A Case Study of Block Farmers in the Kwahu West Municipality and Kwahu South District. *Irrigat Drainage Sys Eng*. **8**(1): 229.

Kachroo, D., Kachroo, J., Bhat, A., Thakur N. P., Gupta, A.K, and Khajuria, V. 2015. Income and Livelihood Issues of Farmers: A Field Study in Jammu region of Jammu and Kashmir State. *Economic Affairs*. **60**(2): 317-321.

Kamwi, J.M, Chirwa, P.W.C., Graz, F.P., Manda, S.O.M., Mosimane, A.W., and Kätsch, C. 2108. Livelihood activities and skills in rural areas of the Zambezi region, Namibia: Implications for policy and poverty reduction. *Afr. J. Food Agric. Nutr. Dev*. **18**(1): 13074-13094.

Karane, S. V. 2016. Factors influencing on-farm common bean profitability: the case of smallholder bean farmers in babati district, Tanzania. *Msc (Ag) thesis,* Egerton University.

Katungi, E., Farrow, A., Mutuoki, T., Gebeyehu, S., Karanja, D., Alamayehu, F., Sperling, L., Beebe, S., Rubyogo, J.C., and Buruchara, R. 2010. Improving common bean productivity: An Analysis of socioeconomic factors in Ethiopia and Eastern Kenya. Baseline Report Tropical legumes II. Centro Internacional de Agricultura Tropical - CIAT. Cali, Colombia.

Kerlinger, F. (1986). Foundation of behavioural research (3rd ed.) New York: Holt, Rinehart, and Winston

Khatiwada, S.P., Wei Deng, Paudel, B., Khatiwada, J.R., Jifei Zhang, and Yi Su. 2017. Household Livelihood Strategies and Implication for Poverty Reduction in Rural Areas of Central Nepal. *Sustainability*. **9**: 612.

Kuhlman, T., and Farrington, J. 2010. What is Sustainability? *Sustainability*. **2**: 3436-3448.

Kumar, P., Sing, N.P., and Mathur, V.C. 2006. Sustainable Agriculture and Rural Livelihoods: A Synthesis. *Agricultural Economics Research Review*. **19**.

Larochelle, C., Marafo, D. A., Birol, E., and Alwang, J. 2016. Assessing the adoption of improved bean varieties in Rwanda and the role of varietal attributes in adoption decisions. *Harvestplus working paper* **25.**

Lashgarara, F., and Asadi, A. (2008). Analyzing factors affecting the adoption ofsustainable agriculture among wheat farmers in Lorestan province. *Iranian Journal of Agriculture Science*. 39-2 (1), 97-104.

Lebacq, T., Baret, P.V., and Stilmant, D. 2012. Sustainability indicators for livestock farming. A review. *Agron. Sustain. Dev*. **33**:311–327.

Liu, Z., Qianru Chen, and Hualin Xie. 2018. Influence of the Farmer's Livelihood Assets on Livelihood Strategies in the Western Mountainous Area, China. Sustainability. **10** : 875.

Livingston, D. W. 1999. Exploring the icebergs of adult learning: Findings of the first Canadian survey on informal learning practices. WALL Working Paper No.10.

Long, N (2000) Exploring local/global transformations: A view from anthropology in Albertto-Arce and Norman Long (eds). Anthropology and Modernities, Routledge, London, UK.

Luque, J.J.R., and Creamer, B. 2014. Major constraints and trends for common bean production and commercialization; establishing priorities for future research. Agronomía Colombiana. **32**(3): 423-431.

Lynam, J. K., and Herdt, R.W. 1989. 'Sense and sustainability: Sustainability as an objective in international agricultural research'. *Agricultural Economics*. **3**: 381–398.

Maongtoshi, and Mithilesh Kumar Sinha. 2014. An evaluative study of agricultural progress in Nagaland. *International Journal of Economic and Business Review*. **2**(11).

Markulev, A. and Long, A. 2013. On sustainability: an economic approach, Staff Research Note, Productivity Commission, Canberra.

Mbakwe, I., Osita Judith, and Njoku Obaji. 2015. A study of socio-economic characteristics of farmers to determined their perceptions on climatic variables and adaptation options in Imo State, Nigeria. *African Journal of Agricultural Economics and Rural Development*. **4** (2): 287-300.

Mchopa, A.D., and John, N. Jeckoniah. 2018. Sunflower and Livelihood Outcomes among Households of Smallholder Farmers in Iramba District, Tanzania. **In:** Proceedings for International Conference on Planning and Development held at IRDP under the theme towards industrialization in the Global South: Making Rural Regions Inclusive on June 28-30.

Monda, E. O., Munene, S., and Ndegua, A. 2003. French beans production constraints in Kenya. In proceedings of of 6th Biennual African Crop Science Conference. **6**: 683-687.

Mulika, T., and Routray, J.K. 2016. Farmer livelihood assets contributing to the sustainable livelihoods of smallholder livestock farmers in the Northeast Region of Thailand. *International Journal of Agricultural Management*. **5** (4): 123-134.

Mustapha, A. 2017. Effectiveness of extension methods for scaling up improved common bean technologies among small-scale farmers in Babati district, Tanzania. *Master of science in agricultural education and extension,* Sokoine University of Agriculture. Morogoro, Tanzania.

Muthulakshmi, B. and Singh, R.J. 2018. Socio - Economic and Psychological Profile of Farmers with Reference to Climate Change in Western Agro Climatic Zone of Tamil Nadu. *Int.J.Curr.Microbiol.App.Sci*. **7**(11): 2559-2565.

NCAER. 2003. India market demographics report (2002), New Delhi. https://www.ncaer.org/free-download.php?pID=276.

Neethi, B., and Sailaja, A. 2014. Study of Socio - Economic Profile of Farmers in Mahabubnagar District of Andhra Pradesh. *GJRA. Global Journal for Research Analysis*. **3**(8).

Niehof, A., and Price, L. 2001(a). Rural livelihood systems: A conceptual framework. *Wageningen UPWARD Series on Rural Livelihoods* **1.**

Niehof, A., and Price, L. 2001(b). Rural livelihood systems: A conceptual framework. *Wageningen UPWARD Series on Rural Livelihoods* **1.**

Norberth, U.C., Thomas, Adesina, K., Okoro, and Chinwe, M. 2018. Utilization of Agricultural Information Sources and Adoption of Animal and Crop Technologies Among Farming Households in Imo State, Nigeria. *Journal of Agricultural Extension* **22** (1).

Nouman, M., Fahad Siddiqi, M., Mohammad, S. A, and Hussain, Z. 2013. Impact of socio-economic characteristics of farmers on access to agricultural credit. *Sarhad J. Agric*. **29**(3): 472-473.

Nutz, N. 2017. A guide to market-based livelihood interventions for refugees. *International Labour Organization.* International Labour Office; United Nations High Commissioner for Refugees. ISBN: 9789221308133; 9789221308140

Odero, D.O., Mburu, J., Ackello-Ogutu, C., and Nderitu, J.H. 2013. Value chain analysis of smallholder snap bean production in Kirinyaga county, Kenya. **In**: Proceedings of 4th International Conference of the African Association of Agricultural Economists at Hammamet, Tunisia.

Ogunmefun, S.O., and Achike, A.I. 2015. Socio-economic characteristics of rural farmers and problems associated with the use of informal insurance measures in Odogbolu local government area, Ogun state, Nigeria. *RJOAS*. **2**(38).

Onyuka, E. O., Kibbet, J., and Gor, C. O. 2017. Socio-Economic Determinants of Groundnut Production in Ndhiwa Sub-County, Kenya. *International Journal of Agricultural and Food Research [IJAFR]* **6**(1): 1-14.

Osarenren, C. O., Ejuetueyin, J. O., and Eweka, K. I. 2016. Socio-Economic Characteristics of Registered Cocoa Farmers in Edo State, Nigeria. *J. Appl. Sci. Environ. Manage*, **20** (2): 261 –266.

Otekhile, C.A., and Verter, N. 2017. The socioeconomic characteristics of rural farmers and their net income in Ojo and Badagry local government areas of Lagos state, Nigeria. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, **65**(6): 2037–2043.

Panse, V.G., and Sukhatme, P.V. 1967. Statistical methods for agricultural workers. 2d enl. ed. Indian Council of Agricultural Research, New Delhi, p-113.

Pearce, D., and Turner, R. K. 1990. Economics of Natural Resources and the Environment. Harvester Wheatsheaf, Hemel Hempstead.

Pradipta, D., Tapati, B. B., and Subhrangsu, S. 2015. Role of Human Capital for Changing Livelihood Pattern: A Case Study in Nadia District of West Bengal. *International Research Journal of Social Sciences,* **4**(4): 98-104.

Prajapati, M., Solanki, K.D., Patel, R., and Dhandhukia, R. 2014. Measurement of the existing sustainable livelihood of the tribal and non-tribal farmers. *Adv. Res. Agri. Vet. Sci.* **1**(2): 83-87.

Prasad, N., Chamuah, J. K., Khate, K., and Perumal, P. 2017. Socio-economic profile of mithun farmers of Nagaland. *Adv. Anim. Vet. Sci* **5**(4): 148-154.

Pretty, J. 2007. Agricultural sustainability: concepts,principles and evidence. *Philosophical Transactions of The Royal Society B Biological Sciences*. **363**: 447–465.

Ram, D. H., Kumar, R., ChaudharI, G. M., Vekariya, S. J., and Savsani, H. H. 2018. A socio-economic profile of the unorganized dairy farmers. *International Journal of AgriculturalScience and Research (IJASR).* **8**(5): 49-54.

Rasul, G., and Thapa, G.B. 2004. Sustainability of ecological and conventional agricultural systems in Bangladesh: An assessment based on environmental, economic and social perspectives. *Agricultural Systems*. **79**(3), 327-351.

Ray, G.L., and Mondal, S. 2011. Research methods in social sciences and Extension Education. Published by Kalyani publishers, pp 42 – 43.

Reddy, V. K., Mahajan, G. R., Paramesh, V., and Singh, N. P. 2017. Socio-Economic Status of Livestock Farmers of Ibrahimpur Village, North Goa District: A Benchmark Analysis. *Economic Affairs* **62** (2): 335-340.

Roling, N., and Jiggins, J. 1998. The ecological knowledge system. Facilitating sustainable agriculture, participatory learning and adaptive management. *Cambridge, Cambridge University Press.*

Roy, M. L., Chandra, N., Kharbikar, H. L., Joshi, P. and Jethi, R. 2013. Socio-economic Status of Hill Farmers: An Exploration from Almora District in Uttarakhand. *International Journal of Agriculture and Food Science Technology* **4**(4): 353-358.

Roy, R., and Chan, N.W. 2012. An assessment of agricultural sustainability indicators in Bangladesh: review and synthesis. *Environmentalist*. **32**: 99–110.

Ryan, M., Hennessy, T., Buckley, C., Dillon, E.J., Donnellan, T., Hanrahan, K., and Moran B. 2016. Developing farm-level sustainability indicators for Ireland using the Teagasc National Farm Survey. *Irish Journal of Agricultural and Food Research*. **55**(2): 112-125.

Sardana, V., K.K., Dhingrae, M.S., Gille, and Ioder Jit Singh. 2000. Production technology of French bean (phaseolus Vulgar/sl.) Cultivation: a review. Agrlc. Rev. **21** (3): 141-154.

Sarkar, R., and Sinha, A. 2015. Livelihoods, Sustainability and Capitalism: an Impossible Combination? A Critique of the Sustainable Livelihoods Approach. *Indian Institute of Management*. WPS **774**: 3-4.

Sathyanarayan, K., Jagadeeswary, V., Chandrashekhar Murthy, V., Wilfred Ruban, S., and Sudha, G. 2010. Socio-economic Status of Livestock farmers of Narasapura Village - A Benchmark Analysis. *Veterinary World*. **3**(5): 215-218.

Schroter, D., 2010. Sustainability Evaluation Checklist. https://www.researchgate.net/publication/282862008_Sustainability_Evaluation_Checklist.

Scoones, I. 1998. Sustainable Rural Livelihoods: A Framework for Analysis; *IDS Working Paper 72*; Institute of Development Studies: Brighton, UK.

Scoones, I. 2009a. Livelihoods perspectives and rural development. *Journal of Peasant Studies* **36** (1).

Scoones, I. 2009b. Livelihoods perspectives and rural development. *Journal of Peasant Studies* **36** (1).

Sekaran, U., and Bougie, R. 2010. *Research methods for business: A skill building approach*, John Wiley & Sons.

Serrat, O. (2010). The sustainable livelihoods approach. Washington, DC: Asian DevelopmentBank.https://digitalcommons.ilr.cornell.edu/cgi/viewcontent.cgi?article=1207&context=intl. Access on 11 November 2020.

Shahi, K.K. 1994. Study on Knowledge and Adoption of Soybean Production Technology. Msc (Ag) Thesis, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur.

Shiri, N., Hashemi, S., Mirekzade, A., and Eshaghi, S. (2013). Factors affecting the adoption of soil conservation practices by farmers in Ilam Province. *Agriculture Economic Research and Development*. **44** (2): 308-297.

Sibiko, K. W. 2012. Determinants of common bean productivity and efficiency: a case of smallholder farmers in eastern Uganda. *Msc (Ag) thesis in Agricultural and Applied Economics,* University Egerton.

Singh A. K. 2013. Income and Livelihood Issues of Farmers: A Field Study in Uttar Pradesh. **In:** Proceedings on *Agricultural Economics Research Review*. **26**: 89-96.

Singh, B., and Singh, S.P. 2015. Sustainable Livelihood and Rural Development through Organic Farming. *Journal of Agricultural Engineering and Food Technology*. **2**(2): 145-148.

Singh, P., Singh, K.M., and Shahi, B. 2016. Pulses for Sustainable Livelihood and Food Security. MPRA Paper No. 80269. https://mpra.ub.uni-muenchen.de/80269/1 /MPRA_paper_80269.pdf. Accessed on 9 December 2019.

Subakanya, M., Hichaambwa, M., Chapoto, A., Kangasniemi, M., and Knowles, M. 2018. Quantitative Livelihood Profile Analysis of Rural Households in Zambia. **In:** Proceedings on 30th International Conference of Agricultural Economist, 1758.

Suganthkumar, P., and Philip, H. 2017. A Study on the Constraints Faced by the Rice Growers while Adopting the Climate Based Adaptation Strategy. *Madras Agric*. **104** (10-12): 386-388,

Taiy, R.J., Onyango, C., Nkurumwa, A., and Ngetich, K. 2017. Socio-economic Characteristics of Smallholder Potato Farmers in Mauche Ward of Nakuru County, Kenya. *Universal Journal of Agricultural Research*. **5**(5): 257-266.

Tekkara, A. O., Kumakech, A., Otim, G., Alexandrina, A., Wamani, S., and Turyagyenda, L. 2017. Socio economic factors affecting bean production in northern Uganda. *Journal of advances in agriculture*, **7**(1): 1009-1014. https://doi.org/10.24297/jaa.v7i1.6027

Tiwari, A.K., and Shivhare, A.K. 2017. Pulses in India: Retrospect and Prospects. *Government of India, Ministry of agriculture & farmers welfare, Directorate of pulses development*, pp 96.

Tripathy, R. R. 2018. Livelihood and Anthropology: A Study of Tribal Villages in India. *Anthropol* **6** (4).

Udin, N. 2014. Organic Farming Impact on Sustainable Livelihoods of Marginal Farmers in Shimoga District of Karnataka. *American Journal of Rural Development*. **2**(4): 81-88.

Umeh, J.C., Joseph C. Ogah, and Ogbanje, C. 2013. Socio-Economic Characteristics and Poverty among Small-Scale Farmers in Apa Local Government Area of Benue State, Nigeria. *International Conference on Food and Agricultural Sciences*. **55**(20).

UNDP. 2010. Guidance Note on Recovery Livelihood. Retrieved from https://www.unisdr.org/files/16771_16771guidancenoteonrecoveryliveliho.pdf. Accessed on 10 December 2019.

UNDP. 2015. Guidance note: Application of the Sustainable Livelihoods Framework in Development Projects. https://www.undp.org/content/dam/rblac/docs/Research%20and%20Publications/Poverty%20Reduction/UNDP_RBLAC_Livelihoods%20Guidance%20Note_EN-210July2017.pdf. Accessed on 11 December 2019.

UNEP. 2015. Sustainable Consumption and Production Indicators For The Future SDGS.UNEP Discussion Paper. https://www.iisd.org/system/files/publications/sustainable-consumption-production-indicators-future-sdgs_0.pdf.

United Nations. 1982. Provisional guidelines on standard international age classifications. Department of international economic and social affairs, Statistical office, statistical papers Series M No.74.

United Nations. 2007. Indicators of Sustainable Development: Guidelines and Methodologies.https://sustainabledevelopment.un.org/content/documents/guidelines.pdf.

Voor den Dag, T. (2003). Export chain of French beans from Kenya. MSc Thesis, Wageningen University, The Netherlands.

Wang, C. 2018. An analysis of rural household livelihood change and the regional effect in a western impoverished mountainous area of China. *Sustainability*, **10**, 1738.

Wanjiru, M.W. 1992. An economic analysis of small scale french bean production in central province of Kenya. Msc. Agricultural Economics Thesis, Faculty of Agriculture, University of Nairobi.

Xu, D., Zhang, J., Rasul, G., Liu, S., Xie, F., Cao, M. and Liu, E. 2015. Household Livelihood Strategies and Dependence on Agriculture in the Mountainous Settlements in the Three Gorges Reservoir Area, China. *Sustainability*. **7**: 4850-4869.

Yadav, K., D. K., M. L. and Revanna. 2017. A Study on Socio-Economic Status of the Farm Women of Tumakuru District of Karnataka State, India. *Int. J. Pure App. Biosci.* **5** (4): 309-314.

Yamba, S., Divine, O., Appiah, Lawrencia Pokuaa-Siaw, and Asante, F. 2017. Smallholder Farmers' Livelihood Security Options amidst Climate Variability and Change in Rural Ghana. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5733969/. Accessed on 9 December 2019.

Yang, L., Liu, M., Lun, F., Min, Q., Zhang, C., and Li, H. 2018. Livelihood assets and strategies among rural households: Comparative analysis of rice and dryland terrace systems in China. *Sustainability.***10**, 2525.

Young, H., Aklilu, Y., Were, G., Catley, A., Leyland, T., Borrel, A., Raven Roberts, A., Webb, P., Holland, D. and Johnecheck, W. (2002) Nutrition and Livelihoods in Situations of Conflict and Crises: Reducing Vulnerability and Risk, Paper Presented at the UN Forum for Nutrition's 29th Session One-Day Symposium on Nutrition in the Context of Crises and Conflict (draft).

Young, P.V. 1996. Scientific social surveys and research. Prentice-Hall of India Pvt. Ltd., New Delhi.

Zamanti, M. I., and Jaderka, O. N. 2016. Evaluation of the socio-economic characteristics of cassava farmers and their profit efficiency: Empirical evidence from South western Nigeria. *African Journal of Agricultural Economics and Rural Development*. **4** (4): 345-350.

Zhen, L., and Routray, J.K. 2003. Operational indicators for measuring agricultural sustainability in developing countries. *Environ. Manage*. **32** (1): 34–46.

Zingkhai, H. G. 2015. Forest And Livelihood: the Naga Traditional Practice of Prudent use of Forest Resources for a Sustainable Livelihood. *PEOPLE: International Journal Of Social Sciences*. **1** (1): 912-926.

APPENDICES

Interview schedule

On

A Livelihood Study on French Bean (*Phaseolus vulgaris* L.) Growers of Nagaland.

Place: Date:

	Name
1. District	
2. Block	
3. Village	
4. Name of head of household	
5. Name of the respondent	
6. Religion	
7. Type of house	
8. Social group	

1. **Village profile**
   1. Total household in the village…………………………..
   2. Headship of the household………………….
   3. Total area of the village…………….
   4. Total agricultural land of the village……….
   5. Geographical position of the village……….
   6. Literacy rate of the village……..

7. Sex ratio……………..

8. Institutional status of the village……………….. (SHG, bank, cooperative, anganwadi, NGO, school, church, village community hall)

9. Occupational details of the village (number of households)

    1. Govt. job holders

    2. Farmers

    3. Daily wagers

    4. Artisans

    5. Others

10. Road condition of the village

    (katcha, pucca, agri link road, stone road)

2. Socio-economic and livelihood features of the respondent

Housing type: 1-(Bamboo + thatch), 2-(Bamboo + tin sheet), 3-(thatch + wood plate), 4-(wood plate + tin sheet), 5-(concrete + tin sheet), 6-(RCC)

3. Socio economic profile

3.1 Personal characteristics of the respondent

SL. No	Name of the respondents	Age	Sex	Education	Occupation			Marital status
					Primary	Sec	income	

CODE

Gender code: Male-0, Female-1
Marital status code: Never married-1, Married-2, Widowed-3, Divorced/Separated-4.

Education code: Illiterate- 0, Primary-1, Secondary-2, Graduate-3, Post Graduate and above-4.

4. Material possession

4.1 Household Assets

T.V. (number)	Radio (number)	Refrigerator (number)	Bi-cycle (number)	Bike (number)	Auto rickshaw (number)	Four wheeler (number)	Mobile (number)	Sound system (number)

4.2 Agricultural machineries and implements (in numbers)

Assets	Dao	Spade	Sprayer	Duster	Power tiller	Tractor	Pump set	Tube well	Godown /store
Yes-1 No-0									
Others (please specify)									

4.3 Livestock possession

Score	Items	weight	Number	Score	Items	weight	Number
1	Duck			6	Pig		
2	Chicken			7	Goat/Sheep		
3	Pigeon			8	Cattle		

4	Beekeeping			9	Buffalo		
5	Rabbit			10	Bull		
				11	Mithun		

5. Land holdings

Land	Area		Upland	Lowland	Jhum	Units use (Acre/Bigha/Ha)
	community	Individual				
Owned						
Leased-in						
Leased-out						

5.1 Total size of the land holding…………………….acre/ha/bigha.

5.2 Size of operational land holding…………………….acre/ha/bigha

6. Cropping pattern

Season							
Pre Kharif (Feb-May)	Major crops						
	Area	IR					
		UR					
Kharif	Major crops						

(June-Oct)	Area	IR					
		UR					
Rabi (Nov-Jan)	Major crops						
	Area	IR					
		UR					

Code: hectare-1, acre-2, other (specify)-3. IR- irrigated, UR- Un-irrigated.

7. Income

7.1 Income from other sources

On-farm	Annual income (Rs.)	Off-farm	Annual income (Rs.)	Mixed	Annual income (Rs.)	Total annual income from all sources (Rs.)

(On farm: 1= Field crops; 2 = Livestock; 3 = Culture fisheries; 4 = Plantation crops; **Off-farm:** 1 = Govt. service; 2 = Private service; 3 = wage earning; 4 = capture fisheries; 5 = small business utilizing local natural resources; 6 =off-farm/non-local NR based business; 7 = group activity led earning; **Mixed:** Note prevailing combination of off and on-farm occupation)

Note: in case of on-farm/off-farm based mixed occupation appropriate combination(s) to be specified

7.2 Income from French bean cultivation

Income from dry seeds	Income from green veg.	others	Total income

8. Expenditure pattern

Sl. No.	Items	Total expenditure	
		Per week	Annual expenditure
i) Family expenditure			
1	Food		
2	Clothing		
3	Cooking fuel		
4	Health		
5	Loan payment		
6	Phone bill payment		
7	Electricity bill payment		
8	Transport		
9	Maintenance of house		
ii) Fixed asset accumulation			
iii) Social expenditure			
iv) Religious expenditure			
v) Expenditure on education			
vi) Expenditure on fixed asset			
vii) Luxury items			

(Fixed asset: House, land, heavy farm machineries, *etc*.)

(Luxury items: Jewelry, watch, high end automobiles, *etc*.)

8.1 Expenditure in French bean cultivation

Source	Expenditure (Rs)	Annual expenditure
Seed procurement		
Fertilizers		
Manuring		
Labour		
Weeding		
Harvesting		
Marketing		

9. Accessibility of village/basic amenities

9.1 Transport and communication

Types	Total Number	Distance from the village(km)	Condition of road
1. Bus station			
2. Post office			
3. Taxi stand			
4.			

9.2 Educational facilities

Types of institute	Number of institute	Distance from village

	in the village	(km)
1. Primary school		
2. High school		
3. College		
4. Others		

9.3 Medical facilities

Type	Number	Distance from the village (km)
1. Primary health center		
2. Civil hospital		
3. Private dispensary		
4. Private hospital		

9.4 Drinking water facilities

Source	Yes/No	Total Number
1. Well		
2. River/Stream		
3. Tap water		

9.5 Veterinary aid available for livestock

Particulars	Available in

	village	At nearby village/town	Distance from village (km)
1. Veterinary Dispensary			
2. Diary Society			
3.			

10. Source of information

Information source	Extent of use			
	Mostly	Sometimes	Rarely	Never
Contact farmers				
Extension personnel				
Television				
Radio				
Agricultural universities				
Farm magazines				
Newspapers				

Livelihood Activities

Crop based	Name	Area under cultivation	Production/ unit/annual ly	Income	Remarks
Livestoc k based					
Forest based					

Crop based: jhum-1, Rajma-2, Rice-3, Maize-4, king chilli-5, Ginger-6, vegetable-7, Cardamom-8, Naga dal-9, any others.

 Livestock based: Poultry-1, piggery,2, cattle-3, fishery-4, any other.

Forest based: Timber based-1, non-timber based-2, firewood-3,

Details about crop based livelihood

Sl. No	Details		Crop 1	Crop 2	Crop 3	Crop 4
1	Crop name					
2	Experience in cultivation					
3	Area under cultivation					
4	Total production					
5	Purpose					
	1. Household consumption					
	2. Selling					
	3. Both					
	Total income					
6	Cost of cultivation					
	Seed	Rupees				
		Source				
	Fertilizer					
		Rupees				
		Source				
	Composed manure	Rupees				
		source				
	Management	Land				

		management					
		Rupees per unit					
	Marketing cost						
7	Labour cost						
8	Marketing pattern						
9	Funding/source of finance						
	Loan amount	Self finance					
		Bank					
		SHG					

Details about livestock-based livelihood

S l. N o	Details	Live-stock 1	Live-stock 2	Live-stock 3	Live-stock 4	Live-stock 5
1	Name					
2	Number of animals					
3	Total production					
4	Purpose					

	1. Household consumption						
	2. Selling						
	3. Both						
	Total income						
5	Cost of rearing						
	Cost of procurement	Rupees					
		Source					
	Feeds	Rupees					
		Source					
	Labour	Rupees					
		source					
	Site selection	Land management					
		Rupees per unit					
	Others						
6	Labour cost						
7	Marketing pattern						
8	Funding/source of						

	finance						
9	**Loan amount**	**Self finance**					
		Bank					
		SHG					

Details about forest based livelihood

Sl. No	Details		Timber based	Non-timber based
1	**Name**			
2	**Types of activity**			
3	**Total production**			
4	**Purpose**			
	1. Household consumption			
	2. Selling			
	3. Both			
	Total income			
5	**Cost**			
	Procurement	**Rupees**		

	of implements	**Source**		
	Transportation	**Rupees**		
		Source		
	Labour	**Rupees**		
		source		
	Site selection	**Land management**		
		Rupees per unit		
	Others			
6	**Labour cost**			
7	**Marketing pattern**			
8	**Funding/source of finance**			
9				
		Self finance		
	Loan amount	**Bank**		
		SHG		

Details about Off farm livelihood

Sl. No	Details	Activity 1	Activity 2
1	**Name**		

2	Types of activity			
3	Total production			
4	Purpose			
	1. Household consumption			
	2. Selling			
	3. Both			
	Total income			
5	Cost			
	Procurement of implements	Rupees		
		Source		
	Transportation	Rupees		
		Source		
	Labour	Rupees		
		source		
	Site selection	Land management		
		Rupees per unit		
	Others			
6	Labour cost			
7	Marketing pattern			
8	Funding/source of finance			
9		Self finance		

	Loan amount	Bank		
		SHG		

MIGRATION

1. Have any members of this household left the area in the past year? .... Yes / No

Name of the Migrant	Destination	Time interval (months)	Purpose

PERFORMANCE OF FRENCH BEAN BASED LIVELIHOOD STRATEGY WITH REFERENCE TO SUSTAINABILITY

SL No.	Statement	Most often (5)	Often (4)	Some times (3)	Rare (2)	Very Rare (1)
Economic sustainability						
1	Potential for steady and standard					

	income					
2	Cost of management is cheaper compared to other crops					
3	Income from per unit area is higher compared to other crops					
4	Income opportunity during off season					
5	Round the year price is standard					
6	Supporting better financial savings					
7	Income opportunity for women					
8	Procurement of planting material is easy					
9	Chance of crop failure is less					
10	Cost-benefit ratio is higher					
11	Higher demand in the market					
12	Post-harvest management is easier					
Human sustainability						
1	Reducing poverty					
2	Addressing food security					
3	Addressing issues of nutrition					
4	Addressing issues of health					
5	Addressing the issues of taste/palatability					
6	Generating employment					

7	Improving living standard					
8	Unskilled workers are able to perform in cultivation practices					
9	Knowledge requirement for cultivation is not important					
10	Requirement of workers for cultivation is less					
11	Level of education is not important					
12	Can be carried out by both men and women					
Social sustainability						
1	Recognition (being engage in something worthwhile)					
2	Up scaling the social prestige					
3	Maintaining happiness of the family					
4	Compatible with landless/small farmer					
5	Gender discrimination is absent					
6	Enhance current standard of living					
7	Compatible with food habit					
8	Compatible with social norms and values					
9	Good source of income for					

	social groups like SHGs/FIGs					
10	Crops can be grown traditionally					
11	Cultivation is easily taken up by development sector for economic development of weaker section					
12	Cultivation is familiar with all the members of the family					
Environmental sustainability						
1	Restore ecological balance and biodiversity					
2	Not undermining/deteriorating the natural resources					
3	Favorable for organic cultivation and without chemical inputs					
4	Production/yield is consistent					
5	Maintain soil fertility					
6	Control soil erosion					
7	Suitable in mixed cropping and jhum field					
8	Can grow in climatic stress condition					
9	Can grow in less fertile soil					
10	Restore soil moisture					

SL No.						
11	Crop residues can be used as fodders for animals					
12	The Crop is climate resilient					

PROBLEMS FACED BY THE FRENCH BEAN GROWERS

SL No.	Category	Nature of problem encountered	Measure suggested by the farmers
1	Site selection		
2	Land preparation		
3	Planting material collection		
4	Labour		
5	Irrigation		
6	Processing and value addition		
7	Transportation		
8	Storage		
9	Field management		
10	Crop protection		
11	Harvesting		
12	Marketing		
13	Grading and sorting		
14	Non availability of suitable inputs		

14	Any other		

KELÜLÜ

KHIANGLOG

Plate 1 Popular French bean variety grown in Kiphire district

MÜHO

MÜKHIEN

Plate 2 Popular French bean variety grown in Kiphire district
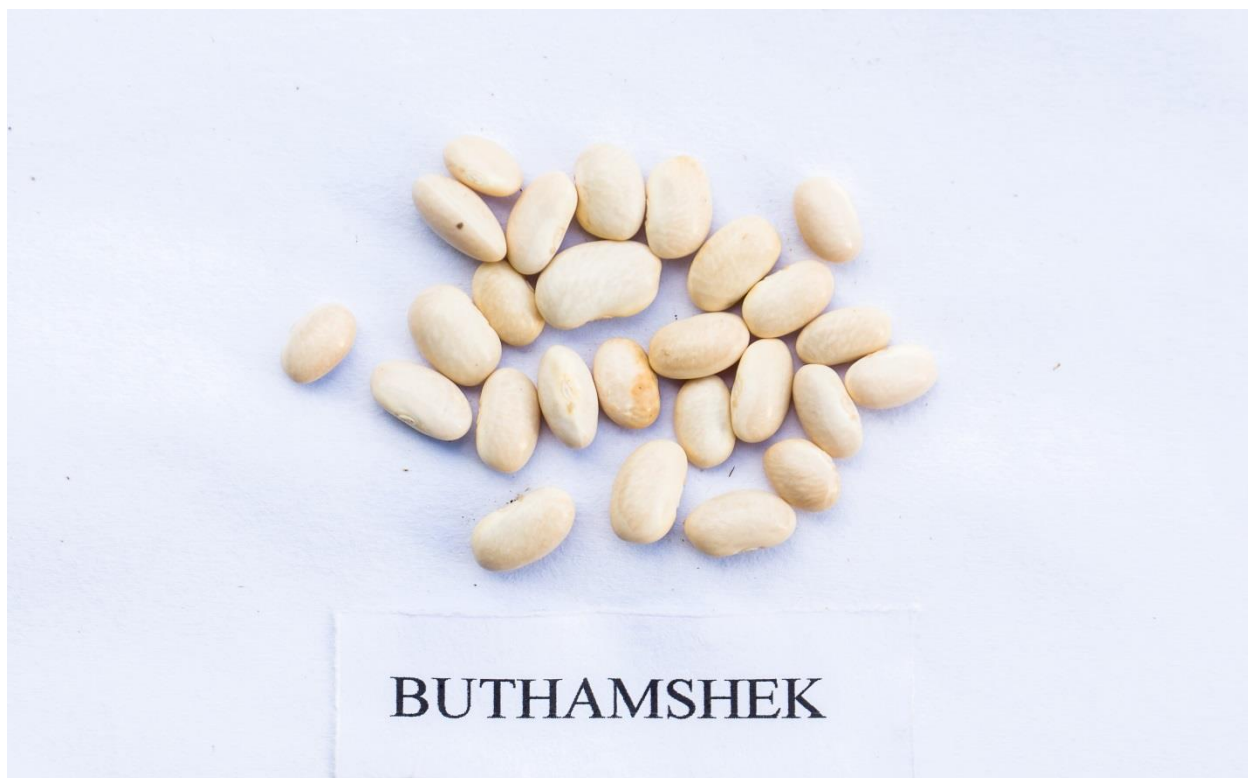
Plate 3 Popular French bean variety grown in Tuensang district

DOULOUSHEK

MEHNIEMÜJI ASHANGPIE

Plate 4 Popular French bean variety grown in Tuensang district

Plate 5 A view of French bean crop in respondents' field

Plate 6: Interviewer with the respondent during the time of interview