STATUS OF ENTREPRENEURIAL BEHAVIOUR AND TECHNOLOGICAL GAP AMONG LARGE CARDAMOM (*Amomum subulatum* Roxburgh) GROWERS IN EASTERN NAGALAND

Thesis

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DOCTOR OF PHILOSOPHY

in

AGRICULTURAL EXTENSION EDUCATION

by

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DECLARATION

I, **Ms. Kitila Walling**, 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.

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CERTIFICATE – I

This is to certify that the thesis entitled **"Status of entrepreneurial behaviour and technological gap among Large Cardamom (*Amomum subulatum* Roxburgh) growers in Eastern Nagaland"** submitted to Nagaland University in partial fulfilment of the requirements for the award of degree of Doctor of Philosophy in Agricultural Extension Education is the record of research work carried out by Ms. Kitila Walling, Registration No.Ph.D/AEX/00110, 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.

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This is to certify that the thesis entitled **“Status of entrepreneurial behaviour and technological gap among large cardamom (*Amomum subulatum* Roxburgh) growers in Eastern Nagaland”** submitted by **Ms. Kitila Walling, Admission No. Ph-215/16,**Regd. No. Ph.D/AEX/00110, to the NAGALAND UNIVERSITY in partial fulfilment of the requirements for the award of degree of Doctor of Philosophy in Agricultural Extension Education has been examined by the Advisory Board and External examiner on ………………..................

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

Member	Signature
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CONTENT

LIST OF TABLE

LIST OF FIGURES

LIST OF PLATES

LIST OF ABBREVIATIONS

%	=	Per cent
A	=	Agree
AFA	=	Agriculture Field Assistant
AI	=	Adoption Index
AO	=	Agriculture Officer
APMC	=	Agricultural Produce Market Committee
ATIC	=	Agriculture Technology Information Centre
ATMA	=	Agriculture Technology Management Agency
BCR	=	Benefit Cost ratio
DA	=	Disagree
E	=	East
EI	=	Entrepreneurial index
et al.	=	and others
f	=	Frequency
Fig	=	Figure
FYM	=	Farm Yard Manure
GoI	=	Government of India
ha	=	Hectare
HFA	=	Horticulture Field Assistant
HH	=	House Hold
IDM	=	Insect Disease Management
i.e	=	That is
INM	=	Integrated Nutrient Management
IPM	=	Insect Pest Management
IRR	=	Internal rate of return
Kg	=	Kilogram
KI	=	Knowledge Index
Km	=	Kilometers
KVK	=	Krishi Vigyan Kendra

MT	=	Metric tones
MLR	=	Multiple Linear Regression
MSL	=	Mean Sea Level
mts.	=	Meters
N	=	North
NGOs	=	Non- Government Organizations
NPV	=	Net present value
NRs	=	Nepalese Rupee
^{o}C	=	Degree Celsius
PBP	=	Payback period
PU	=	Pre University
PUC	=	Pre University Course
Qtl	=	Quintal
r	=	Correlation
RD	=	Rural Development
Rs	=	Rupees
SAU	=	State Agriculture University
SDA	=	Strongly Disagree
SDAO	=	Sub Divisional Agriculture Officer
Sl. No.	=	Serial Number
Spp.	=	Species
Sq. km	=	Square Kilometer
UD	=	Undecided
viz.	=	Namely
σ	=	Standard Deviation
$\bar{\chi}$	=	Mean

ABSTRACT

The present study entitled **"Status of entrepreneurial behaviour and technological gap among large cardamom (*Amomum subulatum* Roxburgh) growers in Eastern Nagaland"**, was carried out with objectives to examine the socio-economic, personal and psychological characteristics of large cardamom growers, status of knowledge, attitude and extent of adoption of improved cultivation practices, entrepreneurial behaviour of large cardamom growers, to study the technological gap in adoption of improved cultivation practices and to identify the constraints faced by the respondents in large cardamom cultivation. Ex-post facto research design was followed for the present study. The study was conducted in two districts under Eastern Nagaland *viz*., Longleng and Mon district. Further two RD blocks under Longleng district and three RD blocks under Mon district were selected purposively. A total of 10 villages, two villages from each selected RD block were selected randomly. A sample size of 250 respondents was selected from these ten villages by following proportionate random sampling procedure. Findings revealed that majority (64.40 %) of the respondents had age between 35to 55 years; majority (74.40 %) were male respondents; 82.80 per cent of them had medium family size ranging from 4 to 9 members and almost half (41.60 %) of the respondents were illiterate. 62.80 per cent of the respondents had semi-medium land under agriculture while (38.40 %) of the respondents had 1 to 1.5 ha of land under large cardamom cultivation;40.80 per cent of them had an annual income ranging Rs. 80000 to Rs. 100000, while 58.00 per cent of the respondents had income of Rs. 50000 to Rs. 80000 from large cardamom cultivation. The average area under large cardamom cultivation was found to be 1.69 ha, average production was 131.04 kg, average productivity was 77.53 kg/ha and average profitability was 32416.13 Rs/ha. It was found that 76.40 per cent of the respondents attended training on improved large cardamom cultivation practices during the last five years; 71.20 per cent had medium level of training need; 68.80 per cent of them had medium level of experience (years) in large cardamom cultivation; 86.80 per cent of them had medium level of information sources utilization; 74.40 per cent and 86.80 per cent of them had medium level of market orientation and economic motivation respectively. 87.20 per cent had medium level of scientific orientation and 99.20 per cent of the respondents had medium level of social participation. 65.60 per cent had favourable level of attitude towards large cardamom cultivation. 71.20 per cent, 56.80 per cent and 56.80 per cent of them had medium over all knowledge level, adoption level of the improved practices of large cardamom as well as technological gap. It was also found that respondents had fully adopted the *Ramsey* variety as per recommendation, time of planting and harvesting. Entrepreneurial behaviour index was found to be medium level (58.80 %). The mean score of respondents in management orientation was the highest (46.78). The variables income from large cardamom cultivation, annual income, farming experience, information sources utilisation, scientific orientation, marketing orientation, economic motivation, productivity, profitability, knowledge, adoption and entrepreneurial behaviour had positive significant association with attitude. Variable age was positively significant, while training exposure, information source utilization, scientific orientation, marketing orientation, extension orientation, productivity, profitability, knowledge, adoption, attitude and entrepreneurial behaviour showed negative significant association with technological gap. Annual income, income from large cardamom, farming experience, information source utilization, scientific orientation, marketing orientation, extension contact, economic motivation, productivity, profitability, knowledge, adoption and attitude had positive and significant association with entrepreneurial behaviour of the respondents. Major constraints faced by the respondents included land related *viz*., restricted use of farm machinery, undulated land posing difficulty in farm operations, limited input supply with higher cost, biophysical, plant protection, technical, labour, economic, marketing, post-harvest, climate change, social, extension as well as irrigation constraints. It is recommended to take appropriate steps of adult learning for increasing the literacy level of farmers, need based training on technical skills and knowledge on recommended technologies with priority on INM and IDM, aggregation of farm size under large cardamom cultivation to increase productivity with proper market support from the government so as to promote entrepreneurial ventures, assured profit and sustainable income to the farmers.

Keywords: *Large cardamom, attitude, knowledge, adoption, technological gap, entrepreneurial behaviour, constraints, Nagaland.*

CHAPTER I

INTRODUCTION

INTRODUCTION

India is considered as the "Spice bowl of the world", as it commands a leading position in the world spice trade with 47% share in volume and 40% in value (Hnamte *et al*., 2012). India is a major producer of spices globally, cultivating 63 different spices and covering an area of 57 lakhs hectare. India is the world's largest producer (76 lakh MT), consumer (73 lakh MT), and exporter (3.8 lakh MT) of spices. India's share in world trade of spices is 3.8 lakhs MT i.e. 48 % (Shukla, 2022). Some other important spice growing countries include Indonesia, Malaysia, Madagascar, Vietnam and China. Increase in productivity and tapping of potentiality of nonconventional spice growing areas is gaining importance in India to excel in the global market.

Large cardamom, scientifically termed as *Amomum subulatum* Roxburgh, is a prominent spice classified under the *Zingiberaceae* family. Among the spices, large cardamom is one of the oldest known spices in the world. It is known as 'queen of spices', also called 'grain of paradise'. It is the third most expensive spice in the world after saffron and vanilla (Singh *et al*., 2022). The precise origin of this spice is not well-defined, however some researchers, notably (Sharma *et al*., 2000), believe the Eastern Himalayas are a likely location where wild variants can still be found. The spice is also referred to as black cardamom (Chempakam and Sindhu, 2008). In terms of global output per annum, Nepal contributes for 52%, India for 37 %, and Bhutan for 11 % (Pothula and Singh 2013).

Large cardamom is a tall, perennial, evergreen herbaceous monocotyledonous plant. It usually thrives in moist shaded locales along mountain streams and on hilly slopes at elevations ranging from 765 to 1675 meters above sea level (Gopal *et al*., 2012). Optimal production occurs at temperatures ranging from 4°C to 20°C and humidity levels above 90% (NSCDP, 2009).Rainfall also plays an important role in increasing large cardamom productivity as the crop is sensitive to both excess rainfall and drought. A well-distributed annual rainfall of 1500 to 4000 mm is advantageous for large-scale cardamom cultivation (Ajmera *et al*., 2018), while 2000 to 4000 mm is optimum for production (Sharma *et al*., 2016). On the contrary, frost, hailstorm, snowfall, storm, water logging due to continuous rain, disease and pest affect large cardamom production negatively (Chapagain, 2011). The mature fruit of large cardamom is trilocular, reddish-brown, and contains capsules with dark pink seeds (Hussain *et al*., 2009). These capsules, measuring 20–25 mm in length and ranging from oval to globular in shape, are clustered within the spike by a viscous sugary pulp (Thomas *et al*., 2009). The plant reaches maturity in its third year (Gopal *et al*., 2012), with harvesting typically occurring between September and November, contingent upon the plant variety and the altitude of the cultivation area (Spices Board, 2001).

Large cardamom is highly esteemed for its pleasant taste, flavor, and aroma (Chempakam and Sindhu, 2008). Historically, it has been utilized as a spice and condiment (Bhandari *et al*., 2013). The seeds of large cardamom are employed to enhance the flavor of foods, confections, beverages, and liquids (Singh *et al*., 2008). Additionally, it has been used as an insecticide (Satyal *et al*., 2012) and has a well-documented history in Ayurvedic medicine. Large cardamom is reported to have numerous beneficial properties, including allopathic, analgesic, anti-inflammatory, antimicrobial, antioxidant, anti-ulcer, cardio-adaptogenic, and hypolipidemic activities. Consequently, it is regarded as a highly valuable spice. It is the third most valued spice after saffron and vanilla.

India is one of the largest spice producers and exporting country, and is called home of spices or land of spices. It has a unique position and in the global spice scenario as the largest producer, consumer and exporter. Indian cardamom is preferred by many countries for its flavour. Cardamom production in India has been around 15-18 thousand tons on average per year during the past decade. India is the world's largest producer of large cardamom, accounting for 54% of global production. Sikkim's districts, as well as West Bengal's districts of Kalimpong and Darjeeling, are among the leading producers of large cardamom in India. Furthermore, the North Eastern Hill states of Arunachal Pradesh, Nagaland, Mizoram, Manipur, Meghalaya, and Assam produce significant amounts of cardamom. Other Himalayan sub continental countries, such as Bhutan and Nepal, are major cultivators of this spice and have recently seen an increase in production and export of large cardamom.

With a total production of 8803 MT in 2020–21, India's total area with large cardamom is 44.70 thousand ha (Feroze *et al*., 2022). A total quantity of 1310 MT of large cardamom was exported with a total value of 7090.17 lakh in return (GoI, 2022). The area under large cardamom was highest in Sikkim (23312 ha), followed by Arunachal Pradesh (11403ha) and Nagaland (6499 ha) (GoI, 2021).

Nagaland is known as one of the culturally vibrant State of North East India, is an agrarian state employing about nine-tenths of its population. The state harbours a rich flora and fauna on account of its varied topography, climate and altitudes and has great potential for the development of horticultural crops like spices. Among different spices grown in the state, large cardamom offers a unique advantage to the growers with its rising demand. Large cardamom farming in Nagaland holds significant importance and offers immense potential for agricultural development and rural livelihood improvement. This crop has become an alternative source of income for the farmers of Nagaland. Spices play an important role in changing the farm practice of the Naga whose aspiration has gone beyond the earlier subsistence livelihood to income generation. Large cardamom is a significant spice crop cultivated across all districts of Nagaland, except Dimapur district. During 2021-2022, the total area and production in the state accounted for 3879.52 ha and 2159 MT respectively (Nagaland Statistical Handbook, 2023). Sensing the potential of this crop, economically, farmers have started taking interest in large cardamom cultivation, and area under cultivation has increased over in the years in the districts of Mon and Longleng. These districts have been endowed with very fertile soil and favourable climatic conditions for Large Cardamom cultivation. Mon district contribute a major portion of large cardamom production. It ranks 2nd in area (640 Ha) and 1st in production (530 MT). Longleng ranks 7th in area and 8th in production of large cardamom, 245 Ha and 113 MT, respectively.

Seasonality in production remains one main reason as to why farmers are reluctant to exclusively take up spices cultivation drastically affecting their development in the state. However post-harvest losses owing to the lack of adequate storage facilities and processing units which results in huge losses to the farmers, discourages the farmers to invest heavily in this sector. Another bottleneck is the lack of grading and standardization facilities due to which farmers are unable to sort out their produce ultimately leading to poor prices in the market and distress sale. It has been noted that farmers in the state encounter challenges in achieving profitable sales of their spices in the market due to unorganized growers association and ignorance of market intelligence which leave them at the hands of the unscrupulous traders who cheat them of their fair share in the sale of the produce. Thus farmers are unable to get remunerative prices for their produce thereby affecting the production of spices. Though the farmers have keen interest in the development of spices, transportation becomes another predicament which may be attributed to far flung farm locations, high cost of transportation due to kuccha road, poor connectivity, and inadequate collection hubs.

Number of improved production technologies is being recommended to get maximum benefits. Yet, the growers are not following all the recommended technologies and their cultivation practices vary from one farmer to another farmer according to their personal characteristics, availability of factors of production, marketing pattern of large cardamom and problems in the cultivation of large cardamom. Due to the complexity in technologies, sometimes farmers find it difficult to understand and follow all the operations, as a result of which they lag behind in the adoption of recommended package of practices. No technology is of any use unless it is adopted by the farmers. It had been seen that a large number of techniques and practises do not reach the farmers' field and those carried to the farmers get considerably distorted or often adopted partially with the results farmers does not get the potential yield. The problem of technological gap is not as simple as it commonly understood (Sharma and Sidhu, 2013). The predominant reason for the non-adoption or partial adoption of the technologies by the farmers has mainly been lack of awareness of technical know-how (Kulkarni and Jahagirdar, 2014). There is an imperative to minimize the technological gap between the agricultural technologies recommended by the scientists and researchers and its acceptance by the farmers in their field. Large cardamom cultivation has the potential of livelihood, additional income generation, employment generation and high demand of produce in the market. Entrepreneurship development is based on the assumption that entrepreneurs are not only born but can also be created. Entrepreneurs can be perceived as change agents who adopt a relatively new line of economic activity deviating from their traditional occupation for their livelihood (Mohapatra and Sahu, 2012). Thus if the farmers could be trained on improved practices of large cardamom and entrepreneurship development, it shall help build sound foundation of their economic well-being and prosperity.

1.1 Large Cardamom cultivation in Nagaland

Large cardamom is also an additional source of income for the state's farmers. Despite its limited production, the state has the potential to become a major production hub in the country. It is grown in altitude of 600-2000m above MSL, in forest loamy soils rich in organic matter, under the canopy of lofty, evergreen forest trees. The suckers are sowed randomly in the month of May to July. Intercultural operations like manual weeding is carried out in the field at regular intervals when required followed with earthing up and mulching. Application of fertilizer is not practised and also not necessary in untouched forest land. Irrigation is not carried out since the crop is grown during kharif season and moreover the farmers are solely depends on rain. Harvesting starts from August till September, after 3rd year of planting in the field. It is done when the capsules turn brown by cutting mature panicles. The capsules are either sundried or smoked in traditional fire place for curing. The cured produces are then packed in insect-proof bags. After the final harvest the field is regularly taken care of till the next 8 to 9 years, after which the yields decrease. Replanting is done after 9th year.

1.2 Statement of the problem

The existence of production and marketing problems of large cardamom growers are prominent. There exists a large potential market for large cardamom within Nagaland. In context of possibility of increasing productivity, it is imperative that the various agencies adopt immediate measures to promote the marketing of large cardamom. The strategy for marketing large cardamom essentially lies in policies and programmes that will lead to proper control of the entire marketing system starting from the purchase of large cardamom from the grower to the sale of large cardamom and large cardamom products to the consumer.

It is a well-established fact that the modern agricultural technologies can play a substantial part in increasing production and productivity of the crop. For meeting the demands for large cardamom, special care and attention is needed in extending the area under cultivation and to improve the production and productivity through better and scientific farm management practices.

Nagaland has immense potential for large-scale cardamom production. Despite the fact that the state produces a large amount of high-quality cardamom, many producers sell their harvest at exceptionally low prices during peak seasons to local markets or commission agencies. These marketplaces are distinguished by their limited size, lack of structure, and poor market leverage for smallholders, which increase market risks.

The study will highlight the entrepreneurial behaviour pattern, technological gap, marketing practices, problems persisting in the industry, especially of growers and the promising future for cardamom in Nagaland. The entrepreneurial behaviour has some specialized characteristics like innovativeness, progressiveness, decision making, risk taking ability, self-confidence, achievement motivation, ability to co-ordinate various available resources etc. Therefore, the higher level of entrepreneurial behaviour of farmers directly or indirectly leads to higher adoption of any innovation for the profitable and successful running of farming enterprise. Such a study has not been made so far. Still there is ample scope for further inter-disciplinary research in areas such as institutional assistance, intensive cultivation, crop insurance, value addition, developing new end uses, on-line/internet trading and so on.

The present study titled, **“Status of technological gap and entrepreneurial behaviour of large cardamom (*Amomum subulatum* Roxburgh) growers in Eastern Nagaland”** shall make an attempt to examine the potential of large cardamom cultivation and entrepreneurial behaviour of the farmers so that cardamom based enterprises can be promoted among the farmers to increase their income and promote livelihood security with the following objectives:

1.3 Objectives

1.3.1. To study the socio-economic, personal and psychological characteristics of the large cardamom growers.

1.3.2. To analyse the knowledge, attitude and extent of adoption of improved cultivation practices among large cardamom growers.

1.3.3. To analyse the technological gap in adoption of improved cultivation practices among large cardamom growers.

1.3.4. To analyse the entrepreneurial behaviour of respondents and suggest strategy for promoting large cardamom based agri-enterprises.

1.3.5. To know about the constraints faced by the respondents in large cardamom cultivation and management and suggest suitable measures to overcome them.

1.4 Scope and Importance of the study

The current research study attempts to measure the technological gap and assess entrepreneurial behavioural pattern of large cardamom farmers. The data generated would be helpful to the various research and developmental organisations to understand the knowledge and adoption of large cardamom cultivation practices and problems experienced by the farmers. The findings of the study shall provide valuable information about the gap that exist in the adoption of recommended practices and also provide the information on the entrepreneurial behavioural pattern. The results would help the administrators and policy makers to formulate suitable extension activities/programmes and focused research and use appropriate methods to harness the potentiality of Nagaland for quality cardamom production and also to reduce the technological gap and also helps to increase the entrepreneurial behaviour of farmers.

1.5 Limitations of the study

Limited time, resources, finance and transportation facilities posed constraints during the completion of the study. The findings and applicability of the documented practices of large cardamom may differ with similar agro-ecological settings in other districts of Nagaland.

1.6 Organization of the study

The present thesis has been presented under five chapters as follows:

1. **Introduction**: This chapter deals with the background of situation, an explanation of the problem statements, objectives. It also highlights the significance and limitations of the study.
2. **Review of literature**: This chapter includes the review of past studies relevant to the objectives of the study.
3. **Research Methodology**: This chapter contains the methodology adopted for the study, description of the study area, sampling procedure, variables selected for the study, method of data collection and procedure of statistical analysis.
4. **Findings and discussion**: The fourth chapter focuses on results and important discussions as per the objectives.
5. **Summary and conclusions**: The fifth chapter summarizes the findings of the study with policy implications of the study.

References and Appendices have been added in the end of the thesis.

CHAPTER - II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Review of literature was collected keeping in view of the variables selected for the study. Efforts were made to review number of reports, periodicals and theses having direct, indirect or derived relationship with the present investigation. Since, the literature directly related to research topic were rather limited, studies related to other crops and technologies were also reviewed and presented covering all aspects of the investigation comprehensively under the following headings:

2.1. Concept of entrepreneur.

2.2. Concept of entrepreneurship.

2.3. Socio-economic, personal and psychological characteristics of the farmers.

2.4. Knowledge regarding improved cultivation practices of large cardamom/ other spice crops.

2.5. Extent of adoption of large cardamom/ other spice crops in improved cultivation practices by the farmers.

2.6. Attitude of farmers towards improved cultivation practices of large cardamom and other spice crops.

2.7. Entrepreneurial behaviour of large cardamom/ other spice crops farmers.

2.8. Technological gap of large cardamom/ other spice crops farmers.

2.9. Constraints faced by the farmers in cultivation and management of large cardamom/ other spice crops.

2.1. Concept of entrepreneur

Joshi and Kapur (1973) described farm entrepreneur as the person or a group of persons who organize and operate the business and is responsible for the results i.e., losses and gains from the business. He is pioneer in organizing and developing the farm.

Pickle and Abrahamson (1990) defined that an entrepreneur is one who organizes and manages a business undertaking, assuming the risk, for the sake of profit. The entrepreneur evaluates perceived opportunities and strives to make the decisions that will enable the firm to realize sustained growth.

Harold (1994) stated that entrepreneurs take personal risks in initiating change, and they expect to be rewarded for it. They need some degree of freedom to pursue their ideas, which in turn requires that sufficient authority be delineated.

Sarmah and Singh (1994) stated that an entrepreneur is one who can transform raw materials into goods and services, who can effectively utilize physical and financial resources for creating wealth, income and employment, who can innovate new products, standardize or upgrade existing products for creating new markets and new customers.

According to Desai (1995), an entrepreneur is one who can see possibilities in given situation, where others see none and has the patience to work out the idea into scheme to which financial support can be provided.

Envick and Langford (2000) defined an entrepreneur as someone who owns and operates his/her own business.

Gulati and Sharma (2013) defined that an entrepreneur is a person who innovates, allocates and manages the factors of production. This particular person has the ability to perceive latest economic opportunities and to device their exploitation

Khan *et al.* (2016) in their study on the problems of entrepreneurs in Jammu and Kashmir stated that the entrepreneur develops a business plan, acquires the human and other required resources, and is fully responsible for its success or failure.

According to Patel and Desai (2016), an entrepreneur is one of the important segments of economic growth. His role in economic development varies from economy to economy, country to country, depending upon its material resources, industrial climate and more importantly, the responsiveness of the political system to the growth of entrepreneurs. Basically, he is a person who is responsible for setting up a business or an enterprise. In fact, he is one who has initiatives, skill for innovation and who looks for higher achievement.

Garcia *et al.* (2022) in their study stated that entrepreneur is a person that can identify certain needs of people and could generate transformations before anyone. It should be noted that being an entrepreneur is not always synonymous with success and there is always a risk.

According to Das *et al*. (2023), entrepreneurs are one of the major change-makers in the country presently with significant contribution to the economy. They drive change in the society and the nation through their ventures that have a direct or indirect influence on providing empowerment, employment and socio-economic security to people.

2.2. Concept of entrepreneurship

According to Ronstadt (1984), entrepreneurship is the dynamic process of creating incremental wealth. The wealth is created by individuals who assume the major risks in terms of equity, time and career commitment to provide value for some product or service. The product or service may or may not be new or unique but value must somehow be infused by the entrepreneur by receiving and allocating the necessary skills and resources.

Petrin (1994) defined entrepreneurship as an innovative activity that needs not involve anything new from a global or even national perspective, but rather the adoption of new forms of business, business organizations, new technologies and new enterprises producing goods not previously available at a location.

Desai (1995) described entrepreneurship as the persons' propensity to take calculated risks with confidence to achieve a pre-determined business or industrial objective.

Ganeshan (2001) stated that entrepreneurship is the capacity for innovation and caliber to introduce innovative techniques in the business operations.

According to Gree and Thurnik (2003), entrepreneurship has been recognized as one of the tools that drive the economy of a country.

According to Reddy (2003), entrepreneurship is a composite skill, the resultant of a mix of many qualities and traits – these include tangible factors as imagination, readiness to take risks, ability to bring together and put to use all factors of production viz., capital, labour, land, as also intangible factors such as the ability to mobilize scientific and technological advances.

According to Maas and Herrington (2006), entrepreneurship is a significant component of the solution to a nation's development issues.

Turker and Selcuk (2009) pointed out that entrepreneurial activities are not only the incubator of technological innovation, but they also provide employment opportunities and increase competitiveness.

Mohapatra and Sahu (2012) considered entrepreneurship as tactical development interference to speed up the process of economic development.

Gulati and Sharma (2013) defined that an entrepreneurship is a social phenomenon and it is not inherent within a person, rather it exists in the interaction between people.

Khan *et al.* (2016) stated that entrepreneurship is the attempt to create value through recognition of business opportunity, the management of risk taking appropriate to the opportunity and through the communicative and management skills to mobilize human, financial material resources necessary to bring project to fruition

According to Patel and Desai (2016), entrepreneurship is the de fact barometer of overall economic, social and industrial growth has brought revolutionary changes in the society. It has facilitated large scale production and distribution. It has widened the area and scope of the marketing of goods and services. It is a creative and innovative response to the environment.

According to Johnson (2022), entrepreneurship is the capacity and preparation to create, sort out and maintain a business undertaking, alongside any of its vulnerabilities to create a gain.

Therefore, entrepreneurship is a deliberate behavioural change made to initiate, promote, and maintain economic activity for the production and mobilisation of financial resources.

2.3. Socio-economic, personal and psychological characteristics of large cardamom/ other spice crops farmers

2.3.1 Age

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that majority (58.33%) of the respondents belonged to the middle age group ranging 35-50 years followed by 33.33 per cent of them who were more than 50 years of age. None of the respondents were found below the age group of 35 years.

Patra *et al.* (2019) in their study on assessing socio-economic and modernization status of King Chilli (*Capsicum* spp.) growers: Evidence from Nagaland, North East India found that most of the respondents (59 %) belonged to middle age group and the remaining 37 per cent and 4 per cent were belonged to the old age group and young age group respectively. The average age of the respondents was 48 years and it ranged from 35 to 60 years.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India found that majority (71.67 %) of the respondents had age between 30 to 56 years.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India revealed that majority 61.34 per cent of respondents were from middle age group followed by old age group 25.33 per cent and young age group 13.33 per cent respectively.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that more than half (53.75 %) of the respondents belonged to middle aged category followed by old age (23.75%) and young age category (22.50 %).

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that majority (68.33%) of respondents belonged to middle age group of 36-55 years.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology observed that the majority of the respondents 66.66 per cent were from middle age group whereas, 20.00 per cent respondents were from old age group and 13.33 per cent of the respondents belong to young group.

2.3.2 Gender

Shrestha *et al*. (2021) in their study on factors affecting turmeric production in Sunsari district, Nepal found that majority of the respondents were male (68 %) while 32 per cent were female.

Govindasamy *et al.* (2022) in their study on constraints faced and socio-economic profile of turmeric cultivators with special reference to Coimbatore District revealed that majority of the farmers were (95.7 per cent) belongs to male, whereas only 4.3 per cent of the farmers were belongs to the female respondent.

Kumar *et al.* (2022) in their study on satisfaction level and constraints faced by farmers in adopting the bio control products in western zone of Tamil Nadu revealed that number of male respondents (95.8%) were higher than female respondents in using the bio control products.

Sangma and Kalita (2022) in their study on present scenario of ginger farming in West-Garo hills district Meghalaya: An analysis found that 35 percent of the participants in the ginger cultivation are female, whereas 65 percent are men.

Sharma *et al.* (2023) in their study on constraints in ginger cultivation by farmers of West Garo Hills District of Meghalaya stated that majority (53.33%) of the respondents were from male category.

2.3.3 Family size

Chetan (2011) in his study on knowledge and adoption of cardamom cultivation practices by the farmers of Chikmagalur district revealed that majority of (53.33%) respondents belonged to medium size family followed by 30.00 per cent and 16.66 per cent of small and large size family respectively.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India 79.17 per cent of them had medium family size ranging from 4 to 9 members.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that the majority, more than half of the turmeric grower 69.33 per cent had medium family size whereas, 22.00 per cent of turmeric grower belonged to small family size. Thus, 08.67 per cent of turmeric growers belonged to big family size.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that most (75.00 %)

of them had medium family size comprising 4-8 members, followed by small family (18.75 %) having less than 4 members and only 6.25 percent of them had large family comprising more than 9 members in the family.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that (70.83%) of the respondents were having nuclear family and (76.66%) of the respondents had family size of up to 5 members.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology observed that majority 64.16 per cent respondents had medium family size whereas, 23.33 percent of the turmeric growers had small family size category and remaining 12.50 per cent belong to big family size category.

Govindasamy *et al.* (2022) in their study on constraints faced and socio-economic profile of turmeric cultivators with special reference to Coimbatore District highlighted that about half of the respondents were living in nuclear family and remaining half prefers joint family.

Jha (2023) in his study on entrepreneurial behaviour of ginger growers – an analysis revealed that majority 56.67 per cent had family size of 5 to 8 members, 34.37 per cent had less than 5 members and 9.16 per cent had more than 8 members.

2.3.4 Education

Madhu (2010) conducted a study on technological gap in turmeric production practices in Belgaum district reported that, 38.00 per cent educated up to middle school, 28.00 per cent of respondents upto PUC followed by 15.00 per cent having primary school education, 5.00 per cent illiterate and 4.00 per cent graduate respectively.

Patel *et al.* (2015) in their study on training need assessment of visitor farmers of ATIC regarding groundnut production technology revealed that majority (67.5%) of respondents were having primary level of education, followed by secondary level (18.75%). Higher secondary level (5.0%), college level and above (0.0%) whereas (8.75%) of the farmers were found illiterate.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that most (47.92 %) of the farmers had education up to secondary level followed by 22.92 per cent having education up to middle school; 16.67 per cent of them had education up to higher secondary level; 6.25 per cent of them had education of graduation level and above; 4.17 per cent of them had education up to primary level and 2.08 per cent of them had no formal education.

Patra *et al.* (2019) in their study on assessing socio-economic and modernization status of King Chilli (*Capsicum* spp.) growers: Evidence from Nagaland, North East India found that around 40 per cent of the respondents were illiterates, another, 39 per cent had received education only upto class IV, followed by 20 per cent of respondents who received middle school education and only 1 per cent of the respondents received education upto matriculation. It was also observed that older respondents were having lower educational qualification and young respondents were relatively more qualified.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India found that almost half (49.17 %) of the respondents were illiterate and only 5.83 per cent of them had education up to PU level.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that the majority 38.00 per cent of respondents were educated up to High school, where as one third 24.67 per cent up to College level. About 16.67 per cent respondents educated up to Middle school and very few 11.33 per cent was found in primary whereas 06.00 per cent and 03.33 per cent of the respondents are illiterate and can read and write respectively.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that with regard to the literacy level, more than one-fourth (26.25 %) of the respondents had completed above graduation followed by illiterates (25.00 %) and primary schooling (25.00 %), high schooling (12.50 %) and only 6.25 per cent had completed middle school education, and only a small fraction (5.00 %) proportion of the respondents had PUC.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that most of (43.33 %) of respondents were illiterate.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology observed that majority 30.00 per cent of the respondents were educated up to primary school whereas, 19.16 per cent were educated up to collage level/ graduate/ diploma while 15.00 per cent educated up to higher secondary education and 14.16 per cent can read and write only. While 12.5 per cent of the respondents are illiterate and remaining 9.16 per cent educated up to secondary school.

Govindasamy *et al.* (2022) in their study on constraints faced and socio-economic profile of turmeric cultivators with special reference to Coimbatore District revealed that 39.4 per cent of the respondents has completed middle level education which was followed by 36.1 per cent those who were illiterate.

Hazari and Kalita (2022) in their study an economic analysis of chilli production in Tripura, India observed that out of the total farmers, 33.32 per cent of farmers are found to be illiterate and only 12 per cent of farmers are found to be graduate at overall level.

Jha (2023) in his study on entrepreneurial behaviour of ginger growers – an analysis revealed that majority of the respondents (42.50 %) were illiterate, 35.83 per cent had primary education, 19.17 per cent had middle schooling and only 2.50 per cent had high school and above education.

2.3.5 Occupation

Shanthya and Premavathi (2018) in their study on an analytical study on turmeric cultivation found that more than half (55.85%) of the respondents had farming alone as their occupation followed by farming + business (28.82 %), farming + services (12.61 %) and farming +wage earner (2.70 %).

Patra *et al.* (2019) in their study on assessing socio-economic and modernization status of King Chilli (*Capsicum* spp.) growers: Evidence from Nagaland, North East India found that around 94 per cent of the respondents' primary occupation was farming. Remaining 3 per cent each of the respondents were continuing with business and government job, respectively but they were continuing agriculture and king chilli cultivation as subsidiary occupation.

Thakur *et al.* (2020) in their study on extent of adoption of recommended chilli (*Capsicum annum* L.) production technology among the farmers of Patharia in Madhya Pradesh found that majority of the respondents(56.87%) were involved in farming (chilli cultivation), followed by farming (chilli cultivation)+ labours (20.00%), farming (10.83%), farming(chilli cultivation) + others (07.50%), farming (chilli cultivation) + service (5.00%), and none of the respondents were found in farming (chilli cultivation) + occupation + service and farming(chilli cultivation) + animal husbandry + service. It can be concluded that majority of the respondents were involved in farming (chilli cultivation).

Singh *et al.* (2021) in their study on socio-economic profile of the dairy farmers in Central Plain Zone of Uttar Pradesh reported that majority of the respondents (70.00%) had Agriculture as their primary occupation. 10.30 per cent of the respondents practiced Dairying as their major occupation followed by 7.58 per cent, 6.36 per cent and 5.76 per cent of the respondents who choose labor work, Business and Service sector as their major occupation. On the other hand, majority of the respondents (75.15 %) choose Dairying as their secondary occupation, followed by 20.00 per cent of the respondents who had agriculture as their secondary occupation. Whereas, very few respondents *i.e* 3.94 per cent and 0.91 per cent of the respondents had labor work and Business as their secondary occupation, respectively. None of the respondents choose service sector as their major occupation.

Jhansi and Kalal (2022) in their study on socio-personal profile of APMC women involved in post-harvest activities of dry chilli and their constraints – a comparative study revealed that, cent per cent of women from both the districts were labourers doing chilli post-harvest activities in APMC. The results in the study also indicated that 06.66 per cent of Byadgi APMC respondents had agriculture and 26.66 per cent involved in animal husbandry activities. Whereas in Guntur APMC, 10.00 per cent had agriculture and 06.66 per cent had animal husbandry apart from women working as APMC labourers in chilli post-harvesting activities.

Yadava *et al.* (2022) observed in their study on economic assessment of black pepper under hilly zone multi-storyed ecosystem of Karnataka, India that all income group families have primary occupation as farming except middle income group (primary occupation was business).

2.3.6 Land holding

Patel *et al.* (2015) in their study on training need assessment of visitor farmers of ATIC regarding groundnut production technology revealed that majority (62.50%) of the farmers were large farmers followed by medium farmers (25.0%) and small farmers (11.25%). Only (1.25 %) of them were marginal farmers.

Mathew and James (2017) in their study on problems and prospects of cardamom cultivation in Idukki District reported that In Udumbanchola Taluk alone has 28306 hectares of cardamom plantation; constituting 58 per cent holdings are marginal holders, while 30 per cent holdings are small holders and 18 per cent are large holders.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that majority (45.83 %) of them belonged to marginal (< 1 ha) category of farmers followed by semi medium land holding size (2-4 ha) comprising 27.08 percent of the respondents, small category (1-2 ha) comprising 18.75 percent of the respondents and medium category of land holding (4-10 ha) comprising 08.33 percent of the respondents. It was characteristics to note that none of the respondents had big size of land holding (more than 10 ha).

Patra *et al.* (2019) in their study on assessing socio-economic and modernization status of King Chilli (*Capsicum* spp.) growers: Evidence from Nagaland, North East India found that in respect of land under king chilli cultivation, 37 per cent of respondents had marginal (0.025-2.5 Acre) area of land under king chilli cultivation and remaining 63 per cent had Small (2.51-5 Acre) area of land under king chilli cultivation. Land under king chilli ranged from 1-5 acre, where average size of holding under king chilli was 2.80 acre. It was concluded that 63 per cent of the respondents had possessed 2.51 to 5 acres of land under king chilli cultivation.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India revealed that 61.67 per cent of the king chilli growers had 2.47 acre to 4.94 acre of land under agriculture while all (100 %) of the respondents had less than 2.47 acre of land under king chilli cultivation.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that maximum percentage of the turmeric growers were found in semi medium and medium land holding category.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that regarding land holding, 40.00 per cent respondents were small farmers, followed by marginal farmers (28.75 %), medium farmers (22.50 %) and very less (8.75 %) big farmers.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that majority of the respondents (59.16 %) had land size between 1 to 2 ha.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology observed that majority 55.83 per cent of the turmeric grower belong to category of marginal land holding whereas, 35.83 per cent belong to small land holding category while 6.66 per cent of the turmeric grower belong to semi medium land holding and 1.66 per cent of the turmeric grower belong to medium land holding category. And no one is found in big land holding category.

2.3.7 Annual income

Patel *et al.* (2015) in their study on training need assessment of visitor farmers of ATIC regarding groundnut production technology revealed that (66.25%) and (31.25%) of the respondents had annual income of Rs. 50,000/- to Rs. 2,50,000/- and above Rs. 2,50,000/- respectively. Only (2.50 %) of the respondent were having the income below Rs. 50,000/- per year.

Viraja *et al.* (2018) in their study on cost structure and profitability of turmeric cultivation in Navsari district of South Gujarat found that the gross income per hectare was Rs 285285 on sample farms while the average net income per hectare was Rs 80548. It was ranged from Rs59662 on small farms to Rs 98910 on large farms. The input-output ratio was 1:1.39. The farm business income and family labour income was Rs 115704 and Rs 107860 respectively.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that majority (68.75 %) of the chilli growers had annual income in the range of Rs.30000 to Rs.70000 from farming, followed by 18.75 per cent of them having annual income of Rs.70,000 to Rs.110000. Further 06.25 per cent of them had annual income more than Rs.150000 and 4.17 per cent of them had annual income in the range of Rs.110,000 to Rs.150000. It was observed that only 2.08 per cent of them had annual income less than Rs.30,000.

Patra *et al.* (2019) in their study on assessing socio-economic and modernization status of King Chilli (*Capsicum* spp.) growers: Evidence from Nagaland, North East India found that majority of the respondents (76%) were in medium (Rs 13,834-43,266) level of income from king chilli cultivation, whereas, 16 per cent of the respondents had high level of income from king chilli cultivation. Around 8 per cent of the respondents were having low level of income from king chilli cultivation. The annual income of the respondents from king chilli cultivation was ranged from Rs.1,000 to Rs. 90,000 with mean annual income from king chilli was Rs. 28,550. It is also emerged that income from king chilli contributed around 77.42 per cent of annual income from agriculture and around 70 per cent of annual income.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India found that 91.67 per cent of the respondents had an annual income ranging Rs. 11,901 to Rs.2,45,158 while, 82.50 per cent of them had income range of Rs.23,844 to Rs.1,69,230 from king chilli cultivation.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that majority 76.00 per cent had annual income of Rs. 99176 to Rs. 380824, followed by 15.33 per cent of the respondent had annual income of below Rs. 99175 and only 08.67 per cent had annual income of Rs.3,80,822 and above.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that majority of the farmers belonged to medium level of income (51.25 %) followed by high level (33.75 %) and low (15.00 %) annual income groups.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that (63.33%) of the respondents were having annual income between 60,000-80,000 rupees.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology observed that majority of the turmeric grower 79.16 per cent had annual income of Rs. 12,097 to 2,92,071, followed by 18.33 per cent had high annual income i.e. Rs. 2,92,071 and above, rest of 2.50 per cent of the turmeric grower had annual income below Rs. 12,096.

Govindasamy *et al.* (2022) in their study on constraints faced and socio-economic profile of turmeric cultivators with special reference to Coimbatore District found that majority of the farmers had income earning from agriculture ranging between Rs.2 and Rs.3 lakhs. However only 8.5 per cent of the farmers were earning income between Rs.300000 – Rs.400000 from agriculture.

Yadava *et al* (2022) observed in their study on economic assessment of black pepper under hilly zone multi-storyed ecosystem of Karnataka, India that the black pepper growing farmers have very well established economic status which was proved here with average family income/farm of Rs. 3,27,182. Moreover, the farm income/acre was Rs.1,15,767. Whereas, the average family income was about Rs.5,49,005. However, in which high income group earns about Rs.6,98,000. and low income group earns Rs.36,666.

2.3.8 Farming experience

Madhu (2010) carried out a study on technological gap in turmeric production practices in Belgaum district observed that majority of respondents (39.30%) had high level of experience followed by 34.28 and 26.42 per cent of medium and low level of experience respectively in turmeric production practices.

Patra *et al.* (2019) in their study on assessing socio-economic and modernization status of King Chilli (*Capsicum* spp.) growers: Evidence from Nagaland, North East India found that 52 per cent of the respondents were having 4 to 6 years of experience in king chilli cultivation and 29 per cent were having 7 to 10 years of experience. Another, 11 per cent of the respondents had only upto 3 years of experience and 8 per cent had above 11 years of experience in king chilli cultivation.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India found that 70.00 per cent of them had medium level of experience (10 to 36 years) in traditional method of king chilli cultivation.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that the majority 71.33 per cent of the turmeric growers had medium experience in turmeric production for a period ranging between 8 to 17 years, followed by 18.00 per cent of respondents had low experience in the turmeric production for a period ranges up to 7 years. The 10.67 per cent of the respondents had high experience in the turmeric production for a period ranging between 18and above years.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that half (50.00 %) of respondents belonged to high level of farming experience category with more than 20 years of experience followed by medium (37.50 %) with 10 to 20 years and low (12.00 %) level with less than 10 years of farming experience respectively.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that majority (63.33%) of the respondents were having farming experience between 10-20 years.

Sharma *et al.* (2023) revealed in their study on constraints in ginger cultivation by farmers of West Garo hills district of Meghalaya that majority 74.17 per cent had 9–27 years of cultivation because it has been a family tradition for generations.

2.3.9 Training exposure

Patel *et al.* (2011) in their study on perception of the farmers about transfer of technology system in North Gujarat reported that majority (45%) had not attended any training while 30 per cent of the respondents had attended one-two trainings and 24 per cent of them had attended more than two trainings.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India found that 30.00 per cent of the respondents attended training on improved king chilli cultivation during the last five years.

Baby *et al.* (2021) in their study on profile of eco-friendly cardamom growers in Idukki district of Kerala projected that 50 per cent of the respondents had medium level of training undergone followed by low (35.00%) and high (15.00%) level of training undergone.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology observed that majority 43.33 per cent of the respondents received one training, followed by 37.5 per cent do not received any training while 10.00 per cent of the respondents received two training and remaining 9.16 per cent of the respondents received three training.

2.3.10 Training needs

Bajpai *et al*. (2014) in their study on training needs of garlic (*Allium cepa* L.) production technology among small farmers of Hoshangabad district revealed that that the farmers needed more training in areas of plant protection, manures and manuring, weeding, seed and sowing, irrigation management with mean scores 2.80, 2.73, 2.65, 2.55 and 2.50, respectively. Whereas, extent of training need was found medium preparatory cultivation and Harvesting and marketing with mean scores 1.91 and 1.7, respectively. The overall mean was found to be 2.40 meaning thereby that the farmers expressed their desire high need of training for garlic cultivation in all the selected areas including improved varieties.

Bhise and Kale (2014) Result of their study on training needs about improved cultivation practices for the onion growers revealed that near about two third (65.00%) of the growers comes under medium to high training need level. Similarly in case of the practice wise training need of the onion growers it was observed that there are various practices of onion crop about them growers require training need like spraying of mallichydrazide (100.00%), to identify major diseases of onion crop (97.00%), plant protection measures against onion diseases (96.00%), improved storage practices of onion (88.00%), important intercultural operation recommended for onion crop (65.00%), different storage methods of onion (63.00%), plant protection measures against onion pests(50.00%), irrigation water management (49.00%) and identification of major pests of onion crop (47.00%).

Borate *et al.* (2018) in his study on knowledge and training needs of turmeric growers about turmeric production technology found that regarding training needs of the turmeric growers, it was observed that 39.17 per cent respondents had training need for stage for selection of seed (rhizome), 46.67 per cent respondents had need of training in the field of recommended dose of fertilizer, 58.34 per cent had need of training about application of N in equal two doses. Training need of 55.83 per cent respondent had for identification of rhizome fly, 46.67 per cent had for control measures of rhizome fly, 47.50 per cent had for identification of rhizome rot and 37.50 per cent had training need for storage of rhizome in cold storage and these were found to be most important areas of training need. Data also noted that majority of the respondents (75.00%) had medium level of training need about turmeric production practices, whereas 16.66 and 8.34 per cent had low and high level of training need, respectively.

Chowdary *et al.* (2018) in their study on training need assessment among farmers in Kurnool district of Andhra Pradesh revealed that majority of the farmers (82.00%) needs training on crop production aspects on groundnut, onion and tomato, vegetable cultivation in shade net and poly houses. In crop protection aspect majority need training on virus management in chilli. In Horticulture majority of farmers opined that they need information on Pest and Disease resistant high yielding varieties in Tomato, Chilli and Onion. In home science majority need information on Value addition in minor millets. In Veterinary Aspects majority of farmers need information on scientific management of cattle and Hydroponic grass fodder production.

Shanmugaraja *et al.* (2020) in their study on training needs of turmeric growers in Namakkal District revealed that majority of the turmeric growers attended one training programme and had moderate knowledge on recommended turmeric cultivation practices. Majority of the turmeric growers expressed huge level of training needs for two major subject areas *viz.*, “rhizome treatment” and “disease management”. Majority of the turmeric growers preferred to have training during the cropping season in their own village for two days duration. Majority of the farmers preferred to have training during the cropping season in their own village for two days duration. Majority of the respondents preferred to have peripatetic type of training once in a month.

Vysali and Mishra (2024) in their study revealed that among all the different categories of training needs of chilli growers in Andhra Pradesh, the respondents perceived crop protection and crop production as the most important training needs, with mean scores of 2.324 and 2.159 and were ranked first and second. Training needs pertaining to marketing, harvesting and post-harvest handling, processing and value-addition, nursery management and mechanization occupied the next 3rd to 7th ranks respectively.

2.3.11 Information sources utilization

Reddy *et al.* (2018) in their study on extent adoption and utilization of sources of information in recommended chilli production technology found that majority of respondents 63.34 percent were having medium level of sources of Information, While slightly more than one fifth 20.66 percent of respondents were having low level of sources of information and Only 16.00 per cent of respondents were having high level of sources of information.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that majority (70.83%) of chilli growers had medium level of information sources utilization, while 20.84 per cent and 8.33 per cent of them had high and low level of information sources utilization respectively

Jamir and Jha (2020) in their study on information sources utilization for sustainable king chilli production-An analysis revealed that majority (79.17 %) of the respondents had medium level of overall utilization of information sources for sustainable king chilli production while 17.50 per cent had high level and only 3.33 per cent had low level of overall utilization of information sources, with utilization of informal information sources identified as the most preferred source for utilization of agriculture related information by the king chilli farmers.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that more than two third 64.00 per cent of respondents uses medium sources of information followed by, low 20.00 per cent and high category of sources of information 16.00 per cent respectively.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that mass media exposure is concerned, fifty per cent of the farmers belonged to high mass media exposure category followed by high and low level of mass media exposure category 25.00 % each.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that (61.5%) of respondents watch television on a daily basis, (27.5%) of the respondents read the newspaper, (21.66%) sometimes read magazine and only (5.83%) of the respondents listen to the radio.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology found that 57.50 per cent of the turmeric grower had medium sources of information whereas, followed by 21.66 per cent of the turmeric growers had low sources of information and remaining 20.83 per cent had high sources of information.

2.3.12 Social participation

Hanumanaikar *et al.* (2009) conducted a study on adoption behaviour of chilli growers in Tunga Bandra Project (TBP) area of Bellary district revealed that over all participation of the respondents in social organization was low.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that most (77.08 %)

of the chilli growers had low level of social participation followed by 20.83per cent of them having medium level of social participation and 2.08 per cent of them had high level of social participation.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India revealed that most (98 %) of the respondents had medium level of social participation.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that the majority 77.33 per cent of the turmeric growers had high social participation, while, 12.67 per cent of turmeric growers were having medium level of social participation. Only, 10.00 per cent of them had low social participation.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that nearly half (48.75 %) of the respondents belonged to high level of social participation followed by medium (46.25 %) and low (05.00 %) level of social participation.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology observed that majority 41.16 per cent of the turmeric grower had medium social participation whereas, 34.16 per cent of the turmeric grower had low social participation and remaining 21.66 per cent of the turmeric grower had high social participation.

2.3.13 Extension contact

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that most (93.75 %) of them had medium level of extension contact followed by 6.25 per cent of them having high level of extension contact. It was further observed that none of them had low level of extension contact.

Patra *et al.* (2019) in their study on assessing socio-economic and modernization status of King Chilli (*Capsicum* spp.) growers: Evidence from Nagaland, North East India found that only 57 per cent of the respondents had accessed extension service from functionaries of NGO and KVK.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that nearly half (46.25 %) of the respondents belonged to high extension contact category followed by 30.00 per cent in medium and 23.75 per cent in low level of extension contact category, respectively.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that (52.50 %) of the respondents were having medium level of extension contact.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology found that majority 55.83 per cent of the turmeric grower belong to medium extension contact category, whereas, 23.33 per cent belong to high extension contact category and rest of 20.83 per cent of the respondents belong to low extension contact category.

2.3.14 Economic motivation

Chandrashekhar (2007) investigated an analysis of onion production and marketing behaviour of farmers of Gadag district of Karnataka and reported that, majority of respondents (65.00%) had high economic motivation, while 34.17 per cent had medium economic motivation and 0.83% had low economic motivation.

Madhu (2010) conducted a study on technological gap in turmeric production practices in Belgaum district observed that majority, 68.00 per cent of the turmeric growers had low level of economic motivation followed by 25.00 per cent medium and high (7.00%) respectively.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India found that majority of the respondents had medium level (90.83 %) of economic motivation.

Baby *et al.* (2021) in their study in their study on profile of eco-friendly cardamom growers in Idukki district of Kerala revealed that 58.33 per cent of the respondents had medium level of economic motivation followed by low (21.67%) and high (20.00%) level of economic motivation.

Verma and Bose (2023) conducted a study on the knowledge of improved onion production practices of farmers in Gaya, District in Bihar, it was found that 46.67 per cent of the respondents had medium level of economic motivation followed by high (33.33 %) and low (20.00 %) level respectively.

2.3.15 Scientific orientation

Singh and Ramchandra (2019) in their study on socio economic profile of farmers in Prayagraj district of Easter Uttar Pradesh, India showed that maximum 69.23%, 50.70% and 51.35% of respondents belonged to medium level of scientific orientation of small, medium and large farmers respectively.

Peer *et al.* (2020) conducted a study to know the socio-economic status of the chilli growers in district Baramulla (Jammu and Kashmir), the study revealed that majority (56 %) of the growers were having medium level of scientific orientation followed by low (30 %) and high (14 %) level of scientific orientation respectively.

Baby *et al.* (2021) in their study on profile of eco-friendly cardamom growers in Idukki district of Kerala revealed that 63.33 per cent of the farmers had medium level of scientific orientation, followed by low (25.00%) and high (11.67%) levels of scientific orientation.

Khose *et al.* (2022) in their study on entrepreneurial behaviour of ginger growers found that majority of the ginger growers 58.33 per cent respondents had medium scientific orientation, 23.33 per cent had low level and 18.34 per cent had high level of scientific orientation.

Sharma *et al.* (2023) revealed in their study on constraints in ginger cultivation by farmers of West Garo hills district of Meghalaya that 45.83% of respondents had medium level of scientific orientation towards improved cultivation practices of ginger in the study area which showed the interest of the farmers towards new innovations and technologies.

Khawale and Chinchmalatpure (2023) in their study on adoption of turmeric cultivation practices by turmeric growers revealed that, majority of the respondents (50.83%) had medium level of scientific orientation.

Lalhlimpuii and Bose (2023) in their study on knowledge of farmers towards improved cultivation practices of ginger in Serchhip district of Mizoram found that majority of the ginger growers 47.50 per cent respondents had medium scientific orientation, 35.00 per cent had low level and 17.50 per cent had high level of scientific orientation.

Verma and Bose (2023) conducted a study on the knowledge of improved onion production practices of farmers in Gaya, District in Bihar, it was found that majority 45.00 per cent had medium level of scientific orientation followed by high (31.67 %) and low (23.33 %) level respectively.

2.3.16 Market orientation

Mehta and Sonawane (2012) conducted a study on entrepreneurial behaviour of mango growers of Valsad district of Gujarat state and revealed that Majority of the mango growers were founds in medium to high level category as far as entrepreneurial behaviour is concerned. The indicators decision making was ranked first followed by market orientation (rank second) and economic motivation (rank third).

Mohapatra and Sahu (2012) observed in their study on a study of socio-economic and entrepreneurial characteristics of tribals of Mayurbhanj district in sabai grass enterprise that 53.75 per cent and 18.75 per cent of the respondents with low and high level of market orientation respectively.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India found that majority (99.17 %) of the respondents had medium level of market orientation followed by 0.83 per cent with low level of market orientation.

Shende *et al.* (2020) on their study on the profile of the turmeric growers in Hingoli District, India concluded that more than half of respondent 70.00 per cent had medium level of market orientation, whereas 16.67 per cent of respondent had low market orientation and 13.33 per cent of respondent found high market orientation.

Barme *et al.* (2022) in their study on correlation analysis of the turmeric growers regarding knowledge and adoption of post-harvest technology indicated that majority 57.50 per cent of the turmeric grower had medium market orientation whereas, 21.66 per cent of the turmeric grower had high market orientation and remaining 20.83 per cent of the respondents had low market orientation.

2.3.17 Productivity

Patel *et al.* (2015) in their study on economics performance of chilli (*Capsicum annuum* L.) cultivation in Raigarh District of Chhattisgarh State found that the yield of green chilli was observed 95.81 quintal per hectare, 107.11 quintal per hectare, 123.50 quintal per hectare and 141.31 quintal per hectare at marginal, small, medium and large farms respectively along with 117.40 quintal per hectare on an average.

Mathew and James (2017) in their study on problems and prospects of cardamom cultivation in Idukki District reported that on the average the cardamom growers possess 4.27 hectares of land with an annual average productivity of 400 kg per hectare.

Birla *et al.* (2018) in their study on a comparative assessment on relative productivity and profitability of chilli under irrigated and unirrigated land in Khargone District of Madhya Pradesh revealed that the average yield on irrigated condition farm was found to be 33.95 quintal per hectare as a green chilli. On the other hand, the average yield on unirrigated condition farm was found to be 23 quintal per hectare as a green chilli. The average yield on different size of holding in irrigated condition, data shows it was found to maximum 34.93 quintal per hectare on large size of holding followed by 33.89 quintal per hectare on small size of holding and 33.02 quintal per hectare on medium size of holding. The average yield on different size of holding in unirrigated condition, data shows it was found to maximum 23.50 quintal per hectare on small size of holding followed by 23.25 quintal per hectare on medium size of holding and 22.25 quintal per hectare on large size of holding.

Bhandari and Bhandari (2018) in their study on marketing and socioeconomics aspects of large cardamom production in Tehrathum, Nepal found that the productivity was estimate to be 232.5 kg/hectare but the analysis showed that only 3.39 kg yield was increased with increase in one hectare of land.

Viraja *et al.* (2018) in their study on cost structure and profitability of turmeric cultivation in Navsari district of South Gujarat found that the average yield per hectare was 247.00 quintals which was the highest on large sized farms (270.00 q) and lowest on small sized farm (220.00 q).

Shaker *et al.* (2020) revealed on their study on operation-wise economics of chilli cultivation in Khammam district of Telangana state that the average yield of chilli recorded was 63.25 quintals per hectare where as 67.50 quintals per hectare, 63.50 quintals per hectare and 58.75 quintals per hectare was recorded at marginal, small and big farmers respectively.

Tsopoe and Murry (2020) in their study on economics of chilli cultivation in Wokha District of Nagaland, India reported that the average yield of chilli per hectare in the study area was found to be 75.00 q, 74.76 q and 75.57 q for marginal, small and medium group of farmers respectively.

Adhikari and Bhandari (2022) found in their study on socio-economic analysis of ginger production in Terhathum district, Province no. 1, Nepal that the overall productivity of ginger in the study site was found to be 989.57 kg/ ropani (19.3 mt/ha) while the average production of ginger per kg was 12.89 kg per kg of rhizome used.

2.3.18 Profitability

Rajashekar and Kumar (2017) in their study on cost and return of ginger in Bidar district of Karnataka an economic analysis found that the net return per hectare obtained by large size farms were high (Rs.4,38,016.00/ha) as compared to medium and small size farms (Rs.4,16,027.20/ha and Rs.3,98,226.00/ha) respectively.

Birla *et al.* (2018) in their study on a comparative assessment on relative productivity and profitability of chilli under irrigated and unirrigated land in Khargone District of Madhya Pradesh revealed that the net income is the real income realized by chilli growers and it was found to on an average Rs.39,194 per hectare. The maximum net return under irrigated chilli cultivation was realized by large chilli growers Rs.40,764 per hectare followed by medium chilli growers Rs.38,574 per hectare and small chilli growers Rs.38,243 per hectare. The trend of net income revealed that it was increased with increasing size of holding.

The net income is the real income realized by chilli growers and it was found to on an average Rs.17,769 per hectare. The maximum net return under unirrigated chilli cultivation was realized by small chilli growers Rs.13,115 per hectare followed by medium chilli growers Rs.18,677 per hectare and large chilli growers Rs.15,516 per hectare. The trend of net income revealed that it was increased with increasing size of holding.

Bhandari and Bhandari (2018) in their study on marketing and socioeconomics aspects of large cardamom production in Tehrathum, Nepal found that the total cost of cardamom production for one hectare of land was found to be NRs. 2,36,705 and 232 kg of cardamom was estimated to be produced. The average farm gate price of cardamom was estimated to be NRs.2, 372 per kg whereas the total income from one hectare of land calculated was NRs. 550,305 and the gross revenue (net profit) obtained from one hectare was NRs. 313,600 with the B:C ratio of 2.0 after the completion of gestation period of four years.

Shresta (2018) in his study on profitability of large cardamom enterprise in Nepal: Evidence from financial analysis revealed that the economic yield of cardamom starts from the fourth year and remains similar up to 20 years. But, it was found from the study that with the proper management of the crop cultivation packages, about 10% yield starts from third year which have not been reported yet. The financial analysis result showed that, the Return on Investment was found about 160% with payback periodof 4.09 years. Similarly, Net Present Value was assessed at NRs. 3,545,771 at 12% discount rate. Likewise, the Internal Rate of Return Benefit-Cost Ratio of cardamom production was 82.6% and 3.06, respectively. The sensitivity analysis with 20% increase in the cost of production and 20% decrease in the sold price rate also found profitable and viable enterprises as its Return on Investment is 34%, PBP is 5.64 years, NPV equals NRs. 2,154,393, IRR 57.6% and BCR found 2.06.

Viraja *et al.* (2018) in their study on cost structure and profitability of turmeric cultivation in Navsari district of South Gujarat found that the average turmeric growers received harvest price of Rs. 1,155/q The highest harvest price was received by large sized farms (Rs. 1,210/q) while the lowest was in case of small sizes farms (Rs. 1,100/q).

Tsopoe and Murry (2020) in their study on economics of chilli cultivation in Wokha District of Nagaland, India reported that considering the prevailing price of chilli in the study area which is Rs.4,000.00 per q the gross income was found to be Rs. 3,00,000.00, Rs. 2,99,040.00 and Rs.3,02,280.00 for marginal, small and medium group of farmers respectively. The average yield in the study area was found out to be 75.11q with a gross income of Rs.3,00,440.00 and with an average net return of Rs.1,47,892.00.

Govindasamy *et al.* (2021) in their study an economic analysis on turmeric cultivation in Coimbatore District of Tamil Nadu concluded that turmeric cultivation is profitable with Total Cost of production for acre of Rs. 108794 and gross income from turmeric cultivation was Rs. 2,14,821. The Net Income was Rs. 1,06,027 per acre.

Hazari and Kalita (2022) in their study an economic analysis of chilli production in Tripura, India observed that the net revenue on the entire investment was Rs. 1,04,572.94 per hectare, ranging from Rs. 89,936.24 per hectare in South Tripura to Rs. 1,20,705.94 per hectare in West Tripura. When compared to other districts, West Tripura had the greatest return per rupee (2.44), while the overall level was 2.17.

2.4 Knowledge level regarding improved cultivation practices of Large Cardamom/ other spice crops

Choudhary and Sharma (2012) in their study on knowledge of chilli growers about various interventions of chilli cultivation under Institution Village Linkage Programme (IVLP) revealed that majority of respondents possessed medium level of knowledge about interventions of chilli cultivation under IVLP, whereas the benefited chilli growers possessed higher knowledge than non-benefited chilli growers.

Gudade *et al*. (2012) in their study regarding the level of awareness of the tribal farmers about recommended large cardamom production technology in Dzongu areas of North Sikkim, a majority of respondent were found in medium awareness category, like improved varieties (52.00 %), planting materials (52.80 %), sucker treatment (69.60 %), recommended dose of manuring (59.20 %), irrigation management (56.00 %), method of weed control (57.60 %), plant protection measures (48.00 %) improved curing system (51.20 %). Two respondents were found in high awareness category (50.40 %), like planting time.

Gohil *et al.*(2017) conducted research on knowledge of garlic growers with respect to Garlic Production Technology showed that Majority of the garlic growers (65.00 per cent) had medium level of knowledge about recommended garlic production technology, followed by 20.00 per cent and 15.00 per cent with high and low level of knowledge about recommended garlic production technology respectively.

Borate (2018) in his study on knowledge and training needs of turmeric growers about turmeric production technology found that regarding training needs of the turmeric growers, revealed that 61.66 per cent of the respondents had proper knowledge about ploughing and harrowing, while 72.50 and 82.50 per cent of the respondents had proper knowledge about selection of land and application of compost/FYM as preparatory tillage, respectively. Whereas 82.50 per cent respondents had knowledge about selection of rhizome, 83.33 per cent respondents had knowledge about proper sowing time, whereas 85.83 per cent of them had knowledge about proper method of sowing. Data also revealed that 85.00 and 77.50 per cent of them had knowledge about proper spacing for ridges and furrow and proper spacing for broad bed furrow method, respectively. Regarding plant protection, only 17.50 and 15.83 per cent of the respondents had knowledge about pest and disease identification, respectively. A perusal of result indicates that majority of the respondents (64.16%) had medium level of knowledge about turmeric production practices, whereas

20.00 per cent and 15.84 per cent of them had low and high level of knowledge, respectively.

Sundresha *et al.* (2020) in their study on a study on knowledge level of ginger growers on improved cultivation practices in Hassan District, India reported that little less than two third (60.00 %) of the respondents belonged to higher category group of knowledge in improved cultivation practices of ginger followed by medium category (21.25 %) and low category (18.75 %) of knowledge level, respectively.

Bankitbok *et al.* (2021) in their study on knowledge of the ginger growers toward improved cultivation technology in Ri-Bhoi District of Meghalaya revealed that majority of the respondents had full knowledge about land preparation (80.00 %), soil type (80.83 %), improved varieties (65.00 %), sowing time (98.33 %), spacing (66.67 %), weeding (86.67 %) and method of harvesting (98.33 %). It was also found that majority, i.e., 65.83 per cent of the respondents had medium level of knowledge towards improved cultivation technology of ginger, 21.67 per cent of the respondents had low level of knowledge and remaining 12.5 per cent of the respondents had high level of knowledge.

Jha (2023) in his study on entrepreneurial behaviour of ginger growers – an analysis revealed that majority 56.67 per cent of the respondents had high knowledge, followed by 26.67 per cent and 16.66 per cent with low and high level of knowledge of improved ginger production technology.

2.5. Extent of adoption of Large Cardamom/ other spice crops in improved cultivation practices by the farmers

Hanumanaikar *et al.* (2009) conducted a study on adoption behaviour of chilli growers in Tunga Bandra Project (TBP) area of Bellary district revealed that majority of the respondents adopted recommended variety sowing time, irrigation as per the recommendation. Almost all recommended adopted application of chemical fertilizer and plant protection measure more than the recommendation.

Gudade *et al.* (2012) in their study regarding the adoption of tribal farmers about recommended large cardamom production technology in Dzongu areas of north Sikkim, a majority of respondent who were found in medium adoption category, like improved varieties (45.60 %), planting materials (48.00 %), sucker treatments (64.80 %), method of planting (40.00 %), recommended dose of manuring (52.00 %), irrigation management 54.40 per cent, method of weed control (60.00%), plant protection measures (43.20 %), improved curing system (54.40 %). Two respondents found in high adoption category (42.40 %), like field preparation.

Divya and Sivakumar (2014) in their study adoption of good agricultural practices (GAP) in chillies cultivation by farmers in Southern Districts of Tamil Nadu revealed that 43.75 per cent of the contract farmers had high adoption followed by medium adoption (38.75 % of farmers) about the chillies cultivation practices with mean adoption index scores of 70.79 and 61.79, respectively. While, 17.50 per cent of them possessed low overall adoption level with mean technological score of 53.33. In the case of non-contract farmers, 37.50 per cent had high adoption while 32.50 per cent of them had low adoption level.

Sundar *et al*. (2015) conducted a study on adoption of Improved BhutJolokia cultivation Practices by farmers of the upper Brahmaputra Valley Zone of Assam showed that majority of the respondents (51.00%) were in the high extent of adoption category followed by 49.00 per cent in the medium extent of adoption category.

Singhal and Vatta (2017) in their study on impact of Krishi Vigyan Kendra on adoption of improved agricultural production practices reveal that nearly 85 per cent beneficiary respondents had high to medium level of adoption of improved agricultural production technologies. While, only 15.83

per cent of the respondents had low level of adoption. In case of non-beneficiary respondents majority of the farmers (45.00 %) had low level of adoption of improved technologies.

Reddy *et al.* (2018) in their study on extent adoption and utilization of sources of information in recommended chilli production technology found that majority of the respondents 57.34 per cent were observed in the medium level of adoption of chilli cultivation practices, while 26.66 per cent and 16.00 per cent had high and low level of adoption category.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that majority (70.83%) of the chilli growers fully adopted the harvesting time of chilli followed by suitable season of chilli cultivation (29.17%), raising of seedlings (20.83 %), recommended seed rate (18.75 %), time of planting (10.42 %), intercultural operations and water management techniques (2.08 %), whereas none of the respondents had fully adopted the recommended variety, spacing and plant protection measures with respect to chilli cultivation. Further it was found that most (87.50 %) of them partially adopted the recommended planting time while 95.83 per cent of them didn't adopt the recommended varieties of green chilli.

Chigadolli *et al*. (2020) in their study on relationship and extent of contribution of profile of turmeric growers towards the adoption of improved cultivation practices in Belagavi, Karnataka indicated the distribution of turmeric cultivators with respect to their overall adoption of improved turmeric cultivation practices showed that47.50 per cent of turmeric farmers were in medium level adoption, 32.50 per cent of turmeric farmers had high extent of adoption and it is also noticed that only 20.00 percent had low level adoption of improved turmeric cultivation practices.

Khawale and Chinchmalatpure (2023) in their study on adoption of turmeric cultivation practices by turmeric growers revealed that, majority of respondents of turmeric growers (63.33%) having medium level of adoption about turmeric cultivation practices followed by 27.5 per cent of the respondents were found low level of adoption and only 9.16 per cent of the respondents were found in high level of adoption category.

2.6 Attitude of farmers towards improved cultivation practices of Large cardamom/ other spice crops

Thorat *et al.* (2014) reported from their study on knowledge, adoption and attitude of the banana growers about the banana cultivation technology in Anand district of middle Gujarat that 68.66 per cent of the respondents had favourable attitude whereas 16.67 per cent and 14.67 per cent of the respondents had highly favourable least favourable attitude towards banana cultivation technology.

Kumar *et al.* (2017) in their study on opinion of farmers toward improved ginger production technology in Udaipur District of Rajasthan, India found that out of 100 respondents, majority of respondents 65.00 per cent have favourable opinion about ginger cultivation whereas, 20.00 per cent ginger growers have least favourable in cultivation of this crop and remaining 15.00 per cent respondents possessed more favourable opinion about improved ginger production technology.

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura found that most (58.33%) of them possessed favourable attitude towards adoption of recommended potato production technology followed by 22.92 per cent of them who had less favourable attitude and only 18.75 per cent of them possessed highly favourable attitude towards recommended green chilli cultivation technology.

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India revealed that most of the respondents had favourable level (61.67 %) of attitude towards king chilli cultivation while 20.00 per cent and 18.33 per cent had highly favourable and less favourable level of attitude respectively.

Panigrahi *et al*. (2021) that majority (39.9%) of respondents were moderately interested to adopt the recommended agricultural practices of organic turmeric whereas nearly equal to 37.8 per cent of respondents had high willingness to adopt the recommended agricultural practices of organic turmeric, they have been cultivating traditionally from the beginning. Besides this 22.3 per cent of respondents had very less willingness to adopt the recommended agricultural practices of organic turmeric.

Yadav *et al.* (2022) in their study on the impact of NHM programme on adoption and attitude of chilli growers in Khargone district of Madhya Pradesh concluded that in study area, most of the beneficiaries were found to have favourable (38.57 %) attitude towards various components of chilli production technology in NHM programme followed by neutral (32.86 %) and unfavourable (28.57 %) attitude towards various components of chilli production technology in NHM programme. The result also showed that majority of the non-beneficiaries 37.14 per cent found to unfavourable attitude towards various components of chilli production technology in NHM programme followed by neutral attitude 34.29 per cent and favourable attitude 28.57 per cent towards various components of chilli production technology in NHM programme respectively.

2.7 Entrepreneurial behaviour of Large Cardamom/ other spice crops farmers

Sabale *et al.* (2014) in their study on entrepreneurial behaviour of farmers in Marathwada region of Maharashtra revealed that majority of farmers (51.20%) belonged to medium level of innovativeness, medium farm decision making (63.20%) with medium achievement motivation (58.40%). About (55.20%) farmers had medium knowledge of farm enterprises with medium (71.20%) risk taking ability. The data revealed that 63.20 per cent had medium information seeking behaviour with low leadership ability (40.00%) and medium cosmopoliteness (56.80%).

Jamir and Jha (2020) in their study entrepreneurial behaviour of king chilli growers in Peren district, Nagaland, India revealed that out of all the entrepreneurial attributes exhibited by the king chilli growers, management orientation ranked first followed by risk taking ability, achievement motivation, entrepreneurial competencies, innovativeness, decision making ability and entrepreneurial intentions. It was also found that majority (71.67 %) of the respondents had medium level of entrepreneurial behaviour with respect to cultivation and management of king chilli followed by low level (21.67 %) and high level (6.66 %) respectively.

Shrestha *et al.* (2020) in their study on entrepreneurial behaviour of large cardamom growers: A case study in Lamjung District of Nepal showed that a greater proportion of large cardamom growers were found to have medium level of innovativeness (45.00 %), decision-making ability (51.20 %), information-seeking ability (48.80 %), risk orientation (46.20 %), leadership ability (43.80 %), achievement motivation (46.20 %) and low management orientation (56.30 %) which contributed to the overall medium entrepreneurial behaviour (47.50 %) of large cardamom growers in the study area. About 35 percent of farmers were belonging to the low entrepreneurial behaviour and only a few numbers of farmers (17.50 %) were under the high entrepreneurial behaviour category.

Jangwad *et al.* (2021) in their study on entrepreneurial behaviour of onion seed producers in Akola district found that majority (66.67%) of the respondents possess medium entrepreneurial behaviour, followed by 19.17 per cent of respondents had high entrepreneurial behaviour, whereas 12.50 per cent of respondents possess low entrepreneurial behaviour.

Khawale *et al.* (2021) in their study on factors influencing on entrepreneurial behaviour of turmeric growers observed that majority (40.00%) of the respondents possess medium entrepreneurial behaviour, followed by 32.5 per cent of respondents had high entrepreneurial behaviour, whereas 27.5 per cent of respondents possess low entrepreneurial behaviour.

Sentizungla *et al.* (2021) in their study on agri-entrepreneurial behaviour of king chilli growers under Dimapur District, Nagaland found that majority of 65.83% of the respondents were having medium level of entrepreneurial behaviour, followed by 25 per cent of the respondents having low level of entrepreneurial behaviour and 9.16 percent of the respondents having high level of entrepreneurial behaviour. It was also found that majority of 75 per cent of the respondents have medium level of innovativeness, 85.83 per cent of the respondents had medium level of achievement motivation, 73.33 per cent of the respondents had medium level of risk taking ability, 66.66 per cent of the level of respondents towards entrepreneurial intentions and 84.16 per cent of the respondents had medium level of entrepreneurial competencies.

Khose *et al.* (2022) in their study on entrepreneurial behaviour of ginger growers found that majority of the ginger growers 73.33 per cent of the respondents had medium level of entrepreneurial behaviour, followed by 13.34 per cent of the respondents had high level of entrepreneurial behaviour and 13.33 per cent of respondents had low level of entrepreneurial behaviour.

Jha (2023) in his study on entrepreneurial behaviour of ginger growers – an analysis revealed that most (78.33 %) of the ginger growers had moderate level of innovativeness. Majority (76.67 %), of the ginger growers had medium level of achievement motivation. Majority (73.33 %), of them had medium level of risk orientation. Thus most of the entrepreneurs had potential to undertake a moderate degree of risk in respect of starting new ventures and initiatives in form of start-ups. Most of them had moderate level of planning, production as well as marketing orientation. Most (65.00 %), of the farmers had medium level farm decision making ability and majority (56.67 %), of them had low level of scientific orientation. High level of self-confidence was evident in case of 56.67 per cent of the respondents and most (48.33%) of the respondents had high level of economic motivation.

2.8 Technological Gap of Large Cardamom/ other spice crops farmers

Dipika *et al.* (2014) conducted study on Technological Gap in Adoption of Recommended Turmeric Production Technology among Turmeric growers concluded that Majority of the respondent turmeric growers were found in the medium level of technological gap i.e. 61.60 per cent. 15.90 per cent of the respondent turmeric growers were found in high technological gap while, 22.50 per cent of the respondent turmeric growers were found in low technological gap.

Reddy *et al.* (2018) in their study on extent gap in adoption of recommended chilli cultivation by the farmers revealed that majority (76.00%) of respondents had medium level of adoption gap followed by (16.00%) respondents had low level of adoption gap and (8.00%) respondents had high level of adoption gap in chilli. In case of nursery management lowest adoption gap (30.00%) was found in size of seed bed and Seed rate, highest adoption gap (94.66%) was found in seed treatment. Similarly, in case of main field cultivation lowest adoption gap (21.33%) was found in time of transplanting, highest adoption gap level (90.00%) was found in disease management.

Lyngdoh *et al.*(2019) in their study on correlates of technological gap in turmeric production technology by the farmers of West Jaintia Hills District, Meghalaya, India observed that majority (61.67%) of the respondents belonged to medium category of technological gap followed by low level of technological gap (21.67%) and 16.67 per cent with high level of technological gap. This indicates that majority of the farmers falls under the partial and full gap category in adoption of the recommended package and practices.

Kakade *et al.* (2021) in their study on technological gap in adoption of improved onion cultivation practices concluded that more than half (58.34 %) of the onion growers were found in the medium technological gap and 23.33 per cent onion growers belonged to a high technological gap and only 18.33 per cent belonged to the low technological gap. In the case of practice wise technological gap, the highest technological gap was observed in seed and sowing methods (56.04 %), followed by nursery practices (37.92 %), plant protection measures (36.46 %), irrigation management (22.08 %), maturity indices (13.75 %) and intercultural operations (9.58 %).

2.9 Constraints faced by the farmers in cultivation and management of large cardamom/ other spice crops.

Chetan (2011) in his study on knowledge and adoption of cardamom cultivation practices by the farmers of Chikmagalur district reported that high percentage (86.66%) of the respondents of the respondents is facing the problems of animal damage, followed by 80.66 per cent by natural hazards, moreover 76.00 per cent of growers faced the problem of frequent harvesting. Similarly, 75.33 per cent expressed damage of pest and diseases, 74.66 per cent faced the problem of inadequate technical guidance, 64.66 per cent responded to loss of top soil due to heavy rains and with a least of 24.66 per cent faced the problem of use poor planting material.

Sharma and Singh (2013) in their study on constraints perceived by farmers in adoption of spices production technology found that input constraints like 'supply of inferior quality seed' was on first rank for the beneficiary farmers and 'untimely availability of chemicals and fertilizers' was on first rank for non-beneficiary farmers. Regarding financial constraints 'respondents were not convinced about profit' was on first rank and 'high cost of perforated bags' was on second rank for both the beneficiary and non-beneficiary farmers.

Modi *et al.* (2013) conducted a study in Dharwad and Belgaum district and found that a high percentage of respondents expressed the constraints of labour shortage and high wages (75.00%) and lack of technical knowledge (71.00%). Around fifty per cent of respondents experienced the constraints of non-availability of credit (54.17%), high cost of pesticides (53.37%) and non-adaptability of recommended post-harvest practices (51.66%).

Pawar and Natikar (2015) in his study on technological gap of pepper cultivation in Uttara Kannada district in Karnataka observed that majority of the farmers indicated high labour cost of plant protection chemicals (91.11%), price fluctuation and non-availability (90%) as the major problems.

Sharma *et al.*(2016) conducted a study on sustainable economic analysis and constraints faced by the Naga king chilli growers in Nagaland and revealed that the resource use-efficiency for naga king chilli was found to be maximum on human labour (5.388), followed by seed cost (3.458133) and it was found to have negative impact on marketing cost (-3.42835) and FYM cost (3.54689), respectively. It was further observed that the foremost constraints was lack of warehouse/godown for proper storage, followed by lack of market information, problem of credit facilities, lack of transportation facilities, etc.

Vikas *et al.* (2016) conducted a study on constraints perceived by the farmers in adoption of improved ginger production technology in Udaipur District of Rajasthan and found that major constraints faced by ginger growers in the study area were lack of knowledge about high yielding varieties and lack of technical guidance (Technical constraints), non-availability of improved high yielding varieties of the ginger crop and lack of processing facilities in the study area (Input supply constraints), perishable commodities and high fluctuation in market price (Economic & marketing constraints),resources poor farmers and poor education status (General constraints). Among the selected constraints, technical constraints were up to greatest extent by the ginger growers with MPS 75.71 followed by general constraints with MPS 66.00 however, the extent of economic & marketing constraints with MPS 64.03 and input supply constraints with MPS 63.93 of ginger growers in the study area.

Geetha and Selvarani (2017) conducted a study on constraints and suggestions of chilli growers in Virudhunagar District and revealed that unfavorable system of processing has become the major problem in production of chilli. Inadequate traders, price fluctuation, delay in payment were other problems in marketing of chillies.

Mathew and James (2017) in their study on problems and prospects of cardamom cultivation in Idukki District reported that 44 per cent of growers are faced by financial problems; while 42 per cent of growers are faced by marketing problems. The absence of open market for cardamom is the major marketing problem.

Dhruw *et al.* (2018) in their study on constraints perceived and suggestions offered by turmeric growers about turmeric production technology revealed that 53.75 per cent respondents faced the constraints of unavailability of processing unit, followed by high cost of manure and fertilizers (34.06 %), unavailability of labour at planting and harvesting time (26.88 %), unavailability of storage facilities (23.75 %), distant market for selling produce (22.81 %), unavailability of fertilizers at proper time (22.50 %), high cost of plant protection chemicals (22.19 %), inadequate availability of FYM (19.06 %), lack of proper market (18.44 %), high wages of labour (17.81 %), unavailability of seed rhizomes at proper time (16.88 %) and high cost of seed rhizomes (6.56 %).

Shohe and Roy (2018) in their study on constraints of Large Cardamom cultivation in Zunheboto District of Nagaland found that constraints faced by growers in production of large cardamom were non availability of planting materials on time was the major constraint reported by 74.28 per cent of the respondents due to which expected growth is not attained because of delay in planting. Other constraints reported were high cost of suckers(68.70%), damage due to natural calamities (54.70%),attack of pest and diseases in field (50.38%), lack of knowledge and technical knowhow (36.41%), less access to market (34.31%) and lack of extension advisory (31.65%).

Jha and Das (2019) in their study on adoption of recommended production technology by chilli growers in Tripura revealed that majority (70.83 %) of the chilli farmers faced the constraint in terms of unavailability of adequate quality planting materials followed by requisite post-harvest storage facilities as reported by 65.27 per cent of them. 62.50 per cent of the respondents faced the constraints in terms of high incidence of pest and diseases followed by high cost of planting materials as reported by 61.11 per cent of them. 58.33 per cent of the respondents faced the constraints of limited extension support followed by unavailability of inputs like fertilizers, plant protection chemicals, herbicides etc. as reported by 52.77 per cent of them. 50.00 per cent of the respondents faced the constraints of lack of technical knowledge for crop production followed by inadequate loan/credit facility as reported by 37.50 per cent.

Benny *et al.* (2020) in their study on constraints in cardamom cultivation in post disaster scenario: A study in Idukki District of Kerala found that the major production constraints were high cost of plant protection chemicals and the high incidence of pests and diseases. The fluctuation in the market price of cardamom and delay in payment of sale proceeds were the marketing constraints. Major barriers to adaptation were lack of knowledge about proper adaptation strategies and lack of disease resistant varieties in cardamom.

Gurung *et al.* (2020) in their study on large cardamom: Its constraints and strategies for better production in Sikkim and hilly districts of West Bengal revealed that the major causes of low productivity of large cardamom in the past few decades are lack of proper shade management, viral and fungal diseases, lack of improved planting materials, moisture stress conditions and climate change. By using the good and healthy planting materials, application of farm yard manure, weed management, irrigation during dry period, diseases and pests management income of the farmers can be improved. Promising large cardamom varieties coupled with optimum inputs and technologies can increase yield.

Nithin and Chacko (2020) in their study on struggle of cardamom growers: local level study in Idukki district of Kerala reported that frequent and continuous droughts, inadequacy of monsoon, changes in climate etc. result in considerable crop loss. Increasing cost of fertilizers, insufficient irrigational facility and lack of governmental organisation are other pressing problems of cardamom producing sector.

Govindasamy *et al.* (2022) in their study on constraints faced and socio-economic profile of turmeric cultivators with special reference to Coimbatore District found that among the various constraints, the problem of low productivity stood first with the mean value of 57.37 which was followed by high cost of labour of turmeric (52.67) was the second problem faced by the farmers in the study area. According to the Garret ranking analysis, lack of proper storage facilities has been ranked fifth with a least mean value of 41.89.

Yadava *et al.* (2022) observed in their study on economic assessment of black pepper under hilly zone multi-storeyed ecosystem of Karnataka, India that timely non availability of skilled labourers and high wage rate of labour and hired machines were severe constraints for production of quality black pepper. Similarly, harvesting and storage costs are high and high price volatility were found intensified problems for better marketing of black pepper in multi-storeyed ecosystem.

Sahoo *et al.* (2023) in their study on perceived constraints of organic turmeric farmers in Kandhamal district of Odisha concluded that the unavailability of green manuring material, unavailability of different types of biofertilizer, runoff loss, and unavailability of water at the proper time was major general constraints under 4 components. The high cost of organic inputs and the incidence of more diseases and pests were major technological constraints under two components. While in the case of extension activity constraints, inadequate Training was the major constraint. Getting lesser price for the produce was a major organic market-related constraint, unavailability of loans during the proper time was major economic constraint, poor condition of the farmers was major social constraints and natural hazard was major constraints among other constraints faced by the farmers.

CHAPTER - III

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

The research methods and procedures used for conducting the study are described under the following heads:

3.1 Research design

3.2 Locale of research

3.3 Sampling procedure

3.4 Selection and empirical measurement of variables

3.5 Tools and techniques used for data collection

3.6 Hypothesis

3.7 Analysis of data

3.1 RESEARCH DESIGN

"Ex-post facto research design" was employed in the present research as the events have already occurred and design was considered appropriate.

Ex-post-facto research is a systematic empirical enquiry in which the scientist does not have direct control over independent variables because their manifestations have already occurred or because they are inherently not manipulatable. Inferences about relations among variables are made, without direct intervention from associated variation of independent and dependent variables (Kerlinger, 2010).

3.2 LOCALE OF RESEARCH

3.2.1 Selection of state

The state of Nagaland was purposively selected for the present study. The state came into existence as the 16th state of India on 1st December, 1963.

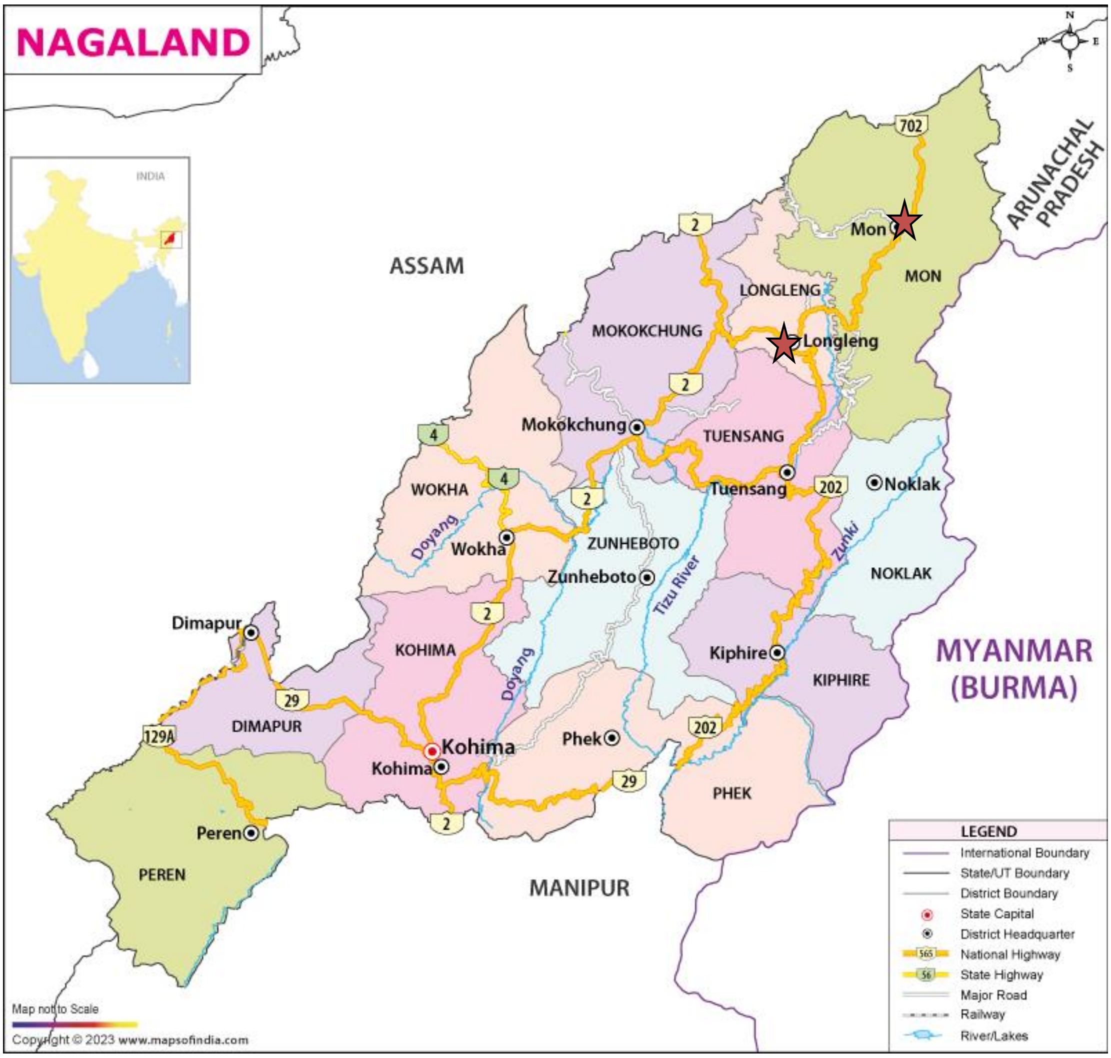


Fig 3.2.1 Map of Nagaland

The state covers an area of 16,579 square kilometer, lies between 25°6'N and 27°4' N and 93°20'E and 95°15'E with its highest point at an elevation of 3,826meters above sea level. It is situated in the north-east region of India bordering Myanmar. It is one of the eight sisters of north-east India. It borders the state of Assam to the west, Arunachal Pradesh and part of Assam to the north, Burmato the east, and Manipurto the south. Kohima district is the state capital. The state has 16 administrative districts *viz.,*Chümoukedima, Dimapur, Kiphire, Kohima, Longleng, Mokokchung, Mon, Niuland, Noklak, Peren, Phek, Shamator, Tuensang, Tseminyü, Wokha and Zunhebotoinhibited by 18 major tribes Angami, Ao, Chakhesang, Chang, Khiamniungan, Konyak, Kuki, Lotha, Phom, Pochury, Rengma, Rongmei, Sangtam, Sumi, Tangkhul, Yimchunger, Zeliang and Tikhir. Each of whom have their distinct customs, attires, languages and dialect.

The state of Nagaland has hilly terrains and enjoys a salubrious climate with maximum average temperature recorded in summer is 31ºC while the minimum is as low as 4ºC and an average annual rainfall of 1800 mm to 2500mm.The state is drained by four chief rivers of Doyang, Jhanji, Dhansiri and Dikhu. While mineral resources like oil, iron, limestone, cobalt, coal, nickel and chromium are found in abundance in the state. Nagaland has four soil types-inceptisols, entisols, alfisols, and ultisols. The mountainous slopes of the state of Nagaland are rich in the growth of natural vegetation. 8,62,930 hectares of land or 20 percent of the total land area of the state is covered with the tropical and sub- tropical evergreen forests that are endowed with rich flora and fauna and agro-climatic conditions favourable for agriculture. Nagaland is basically a land of agriculture. Around 70 per cent of the population is engaged in agriculture sector. Rice is the staple food and covers about 70 per cent of the total area under cultivation and constitutes about 75 per cent of the total food production in the State. Other crops include maize, millets, pulses, tobacco, oilseeds, sugarcane, potatoes, fibers, spices, etc.

3.3 SAMPLING PROCEDURE

Sampling procedure for selection of respondents has been displayed in the flowchart as detailed in the Fig 3.3.

3.3.1 Selection of district

Longleng district

Longleng district has a considerable area (245 ha) and production (122 MT) of large cardamom and provide an immense potential for commercialization on a large scale Therefore, the district was purposively selected for the present study. Longleng is the 10th district of Nagaland, it is referred as the "Land of Clouds". It is located in the north eastern part of Nagaland, and is home to the Phom Naga tribe. It lies between 94ºE - 95ºE longitude and 26ºN - 27ºN latitude of the equator, with an altitude of 1067 meter above sea level. The district is mountainous with an area of 1066.80 sq.km and bounded by Mon district in the east; Assam's Sivasagar District in the north; Tuensang district in the south; and Mokokchung district in the west. The boundary of the district is well demarcated by natural rivers such as Dikhu with Mokokchung district; Yongmon with Mon district; and Nyapa stream with Tuensang district. The mount Yingnyiüshang in the south-eastern part of the district bordering Tuensang with an approximate height of 2500 meters above sea level is the highest peak in Longleng district. Yingnyu mount is identified as biodiversity hotspot, it hosts species-rich tropical rain forest and supports diverse flora and fauna.

Longleng district is rich in natural vegetation. Sub-tropical mixed forest characterized by broad-leaved evergreen trees and deciduous trees abounds. The main species in the high altitude are Bonsum, Gogra, Alder, Oak species etc. Wild cherries, wild apples, wild lemon, wild fig *etc*. and a variety of edible plants and leaves at selected places are also found. At the foothill, Gomari, Holloc, Koroi, Mesua, Tita-chapa, Neem, Wild mango, Amla and Bamboo

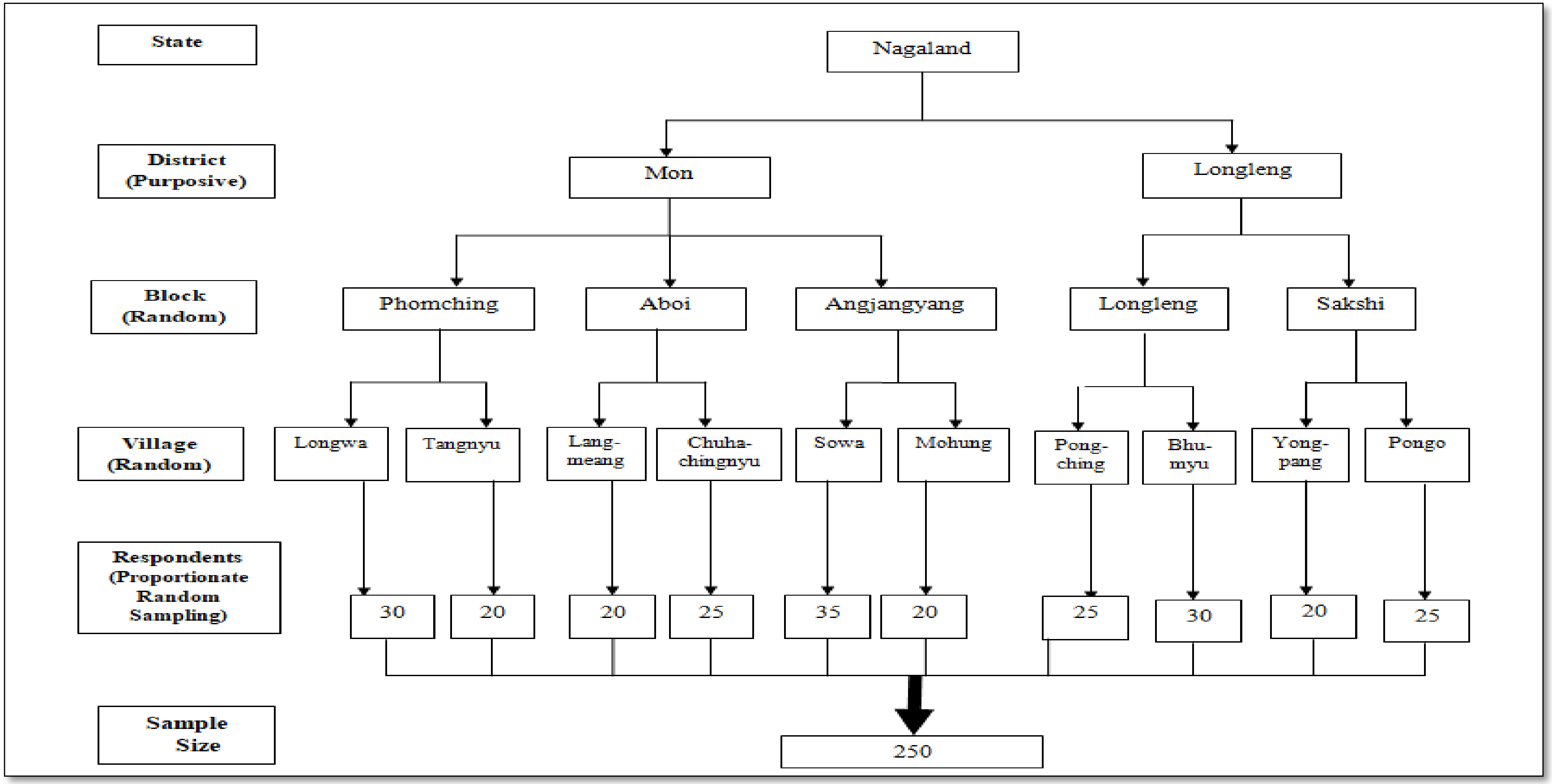


Fig 3.3 Sampling design

Fig 3.3.1(a) Map of study area under Longleng district, Nagaland

species are the dominant species. Varieties of shrubs, herbs – many with medicinal values, climbers, ferns and grasses are found in patches throughout the district. The forest resource is one of the main sources of livelihood of the people. Rice is the staple food and agriculture is the main stay and majority of the people practice jhum cultivation. Rice, maize, yam, soybean and varieties of vegetables such as pumpkin, ginger, tapioca, chilli, colocasia, mustard, potatoes; fruits like banana, mango, orange, sugarcane, pineapple, jackfruit and plantation crops like large cardamom, arecanut and betel vine are grown in abundance.

Mon district

Mon district has a considerable area (640 ha) and production (535 MT) of large cardamom**.** “Land of the Anghs”**-** Mon district is the home of Konyak Naga, one of the biggest tribe of Nagaland. It is situated in the northernmost district of Nagaland, bordered by the Tuensang district in the south, Longleng in the west, Sibsagar district of Assam in the northwest, Longding district of Arunachal Pradesh in the northeast and Myanmar in the east. With and area of 1786 sq. km Mon lies between latitude 26°30' to 26°53' N and longitude 94°51' to 95°13' E and the altitude varies from 290 to 1800 m above mean sea level and the topography is of undulating nature with gentle to steep slope. Average rainfall ranges from 2000 to 3000 mm (mostly between May and October), while average relative humidity and temperature are 76 % and 24.4°C, respectively. Soil is predominantly laterite in hilly areas and red in the plains bordering Assam. Three major rivers −Dikhu, Tizit and Young flow through the district and their tributaries form major watersheds. Vegetation covers about 89 % of total geographical area; predominant forest types are Northern Tropical Wet Evergreen Forest and Northern Sub-Tropical Broad Leaf Wet Hill Forest. This district can be divided into three agro-climatic zones: upper region − Longchin, Chen, Mopong, Longwa, Tobu areas with sub-temperate

Fig 3.3.1(b) Map of study area under Mon district, Nagaland

climate; middle region − Aboi, Mon with warmer climate; lower region– Tizit, Tiru Valley, Naginimora areas with sub-tropical climate.

Agriculture occupies a huge role in the lives of the people, in both income source and employment. It is the main stay of economy and the traditional form of farming had been in practice since time immemorial. In this process they have developed skills and ideas on how to enhance their productivity. They mostly depend on agriculture for their livelihood and the major crops grown and cultivated are rice, taro, maize, tapioca, french bean, chilli and millets of which rice is the staple diet of the people. Besides jhum cultivation, handicraft, hunting and collection of minor forest products are the other important occupations.

3.3.2 Selection of blocks

There are three rural development (RD) blocks in Longleng district, namely, Longleng, Sakshi and Tamlu. Out of these, two blocks, *viz*., Longleng and Sakshi were selected randomly. Mon district has eight rural development (RD) blocks namely – Aboi, Angjangyang, Chen, Mon, Phomching, Tizit, Tobu and Wakching. Thus three blocks, *viz.*, Mon, Aboi and Angjangyang were randomly selected for the present study.

3.3.3 Selection of villages

Large cardamom is cultivated in almost all the villages of Longleng and Mon district. Out of the two blocks of Longleng district, four villages were selected randomly *viz.*, Bhumnyu, Phomching, Pongo and Yongpang respectively. From the selected three RD blocks of Mon district, six villages namely – Longwa, Tangnyu, Langmeang, ChaohaChingyu, Mohung and Sowa were selected randomly. Thus a total of ten villages were selected for the present study.

3.3.4 Selection of respondents

From each of the selected village, large cardamom growers with more than five years of continuous experience in large cardamom production, at least 0.5 hectares area of large cardamom under cultivation, and also primarily involved in agriculture and allied activities were selected randomly. Out of these, minimum 10 per cent of the household growing large cardamom from each of the selected villages was selected based on proportionate random sampling. Thus the final sample size included 250 respondents.

3.4 SELECTION OF VARIABLES AND THEIR EMPIRICAL MEASUREMENT

The following independent and dependent variables were selected for the research:

Table 3.4.1: Selection of variables and their empirical measurement

Sl. No.	Variables	Empirical Measurement
A.	**Independent Variables**	
1.	Age	Chronological age in years
2.	Gender	Categorization into Male and Female
3.	Family size	Number of members in a family
4.	Occupation	Agriculture, Traditional occupation, Labour, Business
5.	Education	Scale developed by Trivedi (1963)
6.	Size of total land holding	Agriculture Census (2015-16)
7.	Size of land holding under large cardamom	Hectare (ha)
8.	Total annual income	Rs.
9.	Annual income from large cardamom	Rs/ha
10.	Training exposure	Participation in training
11.	Experience in large cardamom cultivation	Number of Years

12.	Information sources utilization	Scale developed by Ramchandran (1974)
13.	Social participation	Modified scale of Belli (2008)
14.	Marketing orientation	Scale developed by Samanta (1997)
15.	Scientific orientation	Scale developed by Supe (1969)
16.	Extension contact	Procedure followed by Nagesh (2006)
17.	Economic motivation	Scale developed by Supe (1969)
18.	Productivity of large cardamom	Kg/ha
19.	Profitability of large cardamom	Rs/ha
20.	Knowledge level about large cardamom cultivation	Modified scale of Chaturvedi (2000)
21.	Adoption of improved large cardamom cultivation practices	Adoption Index
B.	**Dependent Variables**	
1.	Attitude towards improved large cardamom cultivation practices	Attitude scale was developed based on Likert (1932) technique
2.	Technological gap in adoption	Scale developed by Ray *et al*., Procedure followed by Madhu (2010)
3.	Entrepreneurial behaviour	
	i. Innovativeness	Scale developed by Saharkar (1995)
	ii. Achievement motivation	Scale developed by Chandrapaul (1988)
	iii. Decision making ability	Modified scale of Supe (1969)
	iv. Risk taking ability	Modified scale of Supe (1969)
	v. Leadership ability	Scale developed by Nandapurkar (1980)
	vi. Management orientation	Modified scale of Samanta (1977)

A. Empirical measurement of independent variables

i. Age

Age was operationalized as the number of chronological years of the respondents at the time of conducting interview. Based on the completed years the respondents were classified under following categories:

Sl. No.	Category of age	Range of Age (in years)
1.	Young	≤35
2.	Middle	35-55
3.	Old	> 55

ii. Gender

Gender refers to the biological and physiological characteristics that define male and female. The respondents were classified as male and female along with the scores as follows:

Sl. No.	Category of gender	Nominal Score
1.	Male	1
2.	Female	2

iii. Family size

Family size was conceptualized as the total number of members in the family living together in a single household sharing the same economic unit. It was measured as the absolute number of members in the household.

Respondents were categorized into three sub-categories (small, medium and large family size) based on parameters of mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Family size	Score range
1.	Small	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	Large	Above ($\bar{\chi} + \sigma$)

iv. Family Type

It refers to the family which consisted of husband and wife with their unmarried children is considered as nuclear family, whereas two or more married individual with common kitchen are considered as joint family. On the basis of information regarding the nature of family, they have been categorized into two groups:-

Sl. No.	Family type	Nominal Score
1.	Joint	1
2.	Nuclear	2

v. Occupation

It was operationalized as the activities in which the farmer and his family are regularly engaged and earn some income for their livelihood. The respondent under investigation has various occupations other than large cardamom cultivation. These are agriculture, traditional occupation, labour and business.

The responses from the farmers were collected and computed and then the respondents were grouped into five categories as: Main (agriculture) alone, agriculture with traditional occupation, agriculture and labour, agriculture and business and agriculture with other occupations. The score of 1, 2, 3, 4 and 5 were assigned respectively and the respondents were also categorized accordingly. Various categories were assigned scores and measured using frequency and percentage.

The scoring procedure followed as given below:

Sl. No.	Occupation	Nominal Score
1.	Agriculture	1
2.	Agriculture + Traditional occupation	2
3.	Agriculture + Labour	3
4.	Agriculture + Business	4
5.	Agriculture + Traditional occupation + Labour + Business	5

vi. Education

Education was conceptualized as the ability of the respondents to read and write or the extent of formal education possessed by them, to bring desirable change in their behaviour. It was quantified using the scale developed by Trivedi (1963). Respondents were classified into seven categories and their percentage and frequency was calculated as follows:

Sl. No.	Category	Score
1.	Illiterate	0
2.	Primary	1
3.	Middle	2
4.	High school	3
5.	PU	4
6.	Graduate	5

vii. Size of total land holding under agriculture

Total land holding under agriculture was referred as the total cultivable land owned by the respondents in hectares.As per Agriculture Census 2015-16, the operational holdings of the respondents were categorized in five size classes as follows:

Sl. No.	Category of land holding under agriculture	Criteria
1.	Marginal	Less than 1.00 ha
2.	Small	1.00-2.00 ha
3.	Semi- Medium	2.00-4.00 ha
4.	Medium	4.00-10.00 ha
5.	Large	More than 10.00 ha

viii. Size of total land under Large cardamom cultivation

Total land under large cardamom cultivation referred to the total land under large cardamom cultivation owned and rented by the respondents in hectares. The respondents were categorized into four groups as follows:

Sl. No.	Classification of land under large cardamom	Frequency	Percentage
1.	Less than 1 ha		
2.	1.1 to 1.5 ha		
3.	1.51 to 2 ha		
4.	More than 2 ha		

ix. Annual income

Income was operationalized as the total income in rupees obtained by a respondent's family from different sources like crops, animal husbandry enterprises, wages, salary, business and other sources during previous year. The total income obtained from all the sources by the respondent was considered and expressed in terms of rupees. Respondents under different category of land holding were categorized based on the mean annual income as follows:

Sl. No.	Category of farmer	Mean Annual Income (Rs.)
1.	Marginal (<1.0 ha)	
2.	Small (1.01-2.0ha)	
3.	Semi- Medium (2.01-4.0 ha)	
4.	Medium (4.01-10.0 ha)	
5.	Large (>10.0 ha)	

x. Income from large cardamom

It referred to the earnings obtained by the respondents in terms of rupees in a year from large cardamom cultivation. The respondents were categorized as per land under large cardamom based on their mean annual income from large cardamom as follows:

Sl. No.	Category of farm	Mean Annual Income (Rs.)
1.	<1.0 ha	
2.	1.01-1.5 ha	
3.	1.51-2.0 ha	
4.	>2.0 ha	

xi. Productivity

Productivity is the capacity of an area to produce crops to the maximum achievable productivity limit under existing conditions of the farm environment.

$$Productivity = \frac{Total\ Production\ of\ LC\ (Kg)}{Total\ area\ under\ Large\ Cardamom\ (ha)}$$

xii. Profitability

Profitability is the ability to earn a return from a given investment. It is a numerical data obtained by using the formula:

$$Profitability = \frac{Total\ Production\ of\ LC\ (Kg) x\ Rate\ of\ Sale\ per\ Kg\ (^{Rs}/_{Kg})}{Total\ Area\ under\ Large\ Cardamom\ (ha)}$$

xiii. Training exposure

Training is one of the means by which farmers acquire new knowledge and skill. Training exposure was measured by counting the response of respondents who attended training related to large cardamom cultivation during the last five years were assigned a score of '1' for training attended and those who did not receive any training were assigned '0' as follows:

Sl. No.	Training attended	Score
1.	Yes	1
2.	No	0

xiv. Experience in large cardamom cultivation

Experience referred to the number of years of large cardamom cultivation practiced by the respondents for their livelihood. Respondents were categorized into three groups based on mean ($\bar{\chi}$) and standard deviation (σ) of the score obtained out of scored experience in large cardamom cultivation as follows:

Sl. No.	Level of Experience	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

xv. Information source utilization

Information source utilization referred to the various sources of information utilized by the respondents for large cardamom cultivation. Information source utilization was classified based on the use of mass-media sources, formal information sources and informal information sources. It was quantified by Ramchandran scale (1974).

a) Mass-media information sources:

Under mass- media sources, seven sources of information (radio, television, exhibition, extension publication, newspaper mobile messages and internet) were included and their frequency of use was scored as Most often (2), Sometimes (1) and Never (0).The scale developed by Trivedi (1963) was adopted for measuring mass media use of the respondents. The scoring pattern followed was as follows:

Sl. No.	Frequency of use	Score
1.	Most often	2
2.	Sometimes	1
3.	Never	0

b) Formal information sources:

Under formal information sources six sources of information (AFA/HFA, AO/SDAO/HO,KVK,ATMA,NGOs and other sources) were included and their frequency of use was scored as Most often (2), Sometimes (1) and Never (0). The scoring pattern was as follows:

Sl. No.	Frequency of use	Score
1.	Most often	2
2.	Sometimes	1
3.	Never	0

c) Informal information sources

Under informal information sources four sources of information (friends, relatives, neighbours and progressive farmers) were included and their frequency of use was scored as Most often (2), Sometimes (1) and Never (0). The scoring pattern was as follows:

Sl. No.	Frequency of use	Score
1.	Most often	2
2.	Sometimes	1
3.	Never	0

The overall information sources utilization was calculated based on the total scores obtained on all the three different sources of information and classified them into three categories using mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Level of information source utilization	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

xvi. Social participation

It refers to the degree of participation or involvement of the respondents in formal and informal organizations either as member or as an office bearer. Social participation of the respondents can be calculated on the basis of the nature of participation and the number of organization he/she participates. The procedure followed by Belli (2008) with slight modification was adopted for measuring social participation.

Social participation included six statements. For each positive answer, a score of '1' was given and a score of '0' was assigned for every negative answer. Based on the total score, the respondents were classified into three categories using mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Level of Social participation	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

xvii. Marketing orientation

The scale developed by Samanta (1997) was used to measure the marketing orientation which included six statements. All positive statements were assigned the score of 4, 3, 2 and 1 for Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) and vice versa for negative statements.

Based on the total score, the respondents were classified into three categories using mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Level of Marketing orientation	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

xviii. Extension Contact

It is operationalized as the awareness of the respondents about various extension agencies and their frequency of contact with them to acquire information or seek advice related to farming. This variable was quantified by adopting the procedure followed by Nagesh (2006) was used to measure the extension contact.

Sl. No.	Frequency contact	Score
1.	Once a month	3
2.	Once in 15 days	2
3.	When problem arises	1
4.	Never	0

xix. Extension Participation

It is the degree to which an individual respondents had participated in various extension activities including individuals, group and mass contact methods with a view to obtain information related to farming and allied aspects. Respondents were asked to indicate the participation in the activities among the pre-listed activities in the interview schedule. The responses were collected and subjected to the scoring treatments. The extent of regular participation was quantified by adopting a scoring of 2 for regular and 1 for occasional and 0 for never, respectively based on the procedure followed by Dhaliwal (1963).

Then, the respondents were categorized into three categories *viz.*, high, medium and low based on mean and standard deviation of the distribution.

Sl. No.	Level of Extension Participation	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

xx. Scientific orientation

It is operationally defined as the degree to which a rose cultivator's is oriented towards the use of scientific method in rose cultivation. This variable was quantified by using the scientific orientation scale developed by Supe and Singh (1969) with slight modification. Six statements were included for the present study with three response categories as 'agree', 'undecided', and 'disagree'. For five statements (except statement no.2) the score assigned was 2, 1 and 0 for 'agree', 'undecided and 'disagree', respectively, whereas the scoring procedure was reversed in case of negative statement *i.e.*, statement no. 2. The summation of the scores obtained by a large cardamom grower for all the six statements indicated his scientific orientation score. The total score one would obtain ranged from 0 to 12.

The respondents were grouped into three categories based on mean and standard deviation of the total score:

Sl. No.	Level of Scientific orientation	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

xxi. Economic motivation

Economic motivation was operationally defined as the degree to which a farmer was oriented towards profit maximization in farming and the relative value placed by the farmer on economic ends (Supe, 1969). Economic motivation included six statements. For a positive statement scoring was done as 3,2and 1for a response of Agree, Undecided and Disagree and for a negative statement, scoring was done vice-versa as 1, 2 and 3.

After obtaining the total scores, the respondents were classified into three categories based on mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Level of Economic motivation	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

xxii. Knowledge level on improved large cardamom cultivation

Rogers (1983) defined knowledge as a function or stage of innovation-decision process when the individual (or other decision-making unit) is exposed to an innovator's existence and joins some understanding of how it functions. Knowledge level refers to the information process in respect of recommended farming practices.

The knowledge test developed by Chaturvedi (2000) was adopted with slight modification to develop knowledge index for measuring the knowledge of the respondents about improved large cardamom cultivation. Package of practice of improved practices of large cardamom were included in knowledge test. The items selected were in the objective/ multiple choice forms. 1 score was assigned to each correct answer and 0 score to each incorrect answer. Therefore maximum obtainable score was 59. The responses obtained were counted and converted into Mean Percentage Score (MPS).

$$Knowledge\ Index\ (KI) = \frac{Total\ Score\ Obtained\ by\ the\ Respondents}{Maximum\ Obtainable\ Score}\ x\ 100$$

Based on the extent of knowledge possessed, the respondents were classified into three categories using mean ($\overline{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Knowledge level	Score range
1.	Low	Below ($\overline{\chi}$ – σ)
2.	Medium	Between ($\overline{\chi}$ – σ) and ($\overline{\chi}$ + σ)
3.	High	Above ($\overline{\chi}$ + σ)

xxiv. Adoption

According to Rogers (1962) adoption is a decision to make full use of an innovation. Dasgupta (1989) defined it as the integration of an innovation into a farmer normal farming activity over an extended period of time. Thus, adoption can be termed as a behaviour response. It is the overt behaviour of a farmer expressed in terms of aggregate adoption scores obtained by him with respect to recommended technologies of large cardamom.

The large cardamom cultivation practices recommended by the Department of Horticulture, Government of Nagaland, and Krishi Vigyan Kendra (KVK), Longleng were considered for study. The adoption level of a particular practice was calculated by the procedure followed by the Rathod (2005) was used with suitable modification.

To find out the status of adoption of the recommended practices, adoption index was calculated. For each question, a score of ‘2’ was assigned incase of full adoption, a score of ‘1’ was assigned in case of ‘partial adoption’ and ‘0’ for ‘no adoption’. The maximum score that a respondent could obtain was 76. Full adoption was categorized among the respondents who have adopted the recommended practices within their respective village and is still continuing; partial adoption was categorized among those respondents who adopted the activities but in the later years discontinued it; and no adoption were categorized among those respondents who has not adopted particular activities.

The following method was adopted to develop adoption index for measuring the adoption of the respondents about improved large cardamom cultivation.

$$Adoption\ Index\ (AI) = \frac{Total\ Score\ Obtained\ by\ the\ Respondents}{Maximum\ Obtainable\ Score}\ x\ 100$$

Based on the extent of adoption, the respondents were classified into three categories using mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Adoption level	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

B. Empirical measurement of dependent variable

Technological gap

Technological gap has been defined as the proportion of gap in the adoption of practices recommended and it expressed in percentage (Ray *et. al.*, 1995). The responses elicited from the respondents were quantified as full, partial and non-adoption of the recommended practices. A score of 2 for full adoption, 1 for partial adoption and zero for non-adoption was given. Any remarkable deviation from the adoption of normal recommendation was treated as partial adoption. The maximum score that a respondent could obtain was 76 and minimum was zero. The maximum score was deducted by the actual score of the respondents to find out the gap in adoption of recommended practices of individual.

The technological gap of a particular practice expressed in percentage was:

$$Technological\ Gap = \frac{Maximum\ Possible\ Score - Actual\ Score\ Obtained}{Maximum\ Possible\ Score}\ x\ 100$$

Mean technological gap in adoption of improved large cardamom cultivation was taken as the dependent variable. The respondents were then divided into three categories *viz*. low, medium and high based on their mean technological gap and standard deviation. The procedure followed by Madhu (2010) was used for measurement:

Sl. No.	Technological gap	Score range
1.	Low	Below ($\bar{\chi} - \sigma$)
2.	Medium	Between ($\bar{\chi} - \sigma$) and ($\bar{\chi} + \sigma$)
3.	High	Above ($\bar{\chi} + \sigma$)

Entrepreneurial behaviour

Entrepreneurial behaviour was studied in terms of nine components viz., innovativeness, achievement motivation, risk taking ability, decision making ability, entrepreneurial competencies, entrepreneurial intentions, management orientation, production orientation and marketing orientation.

1. **Innovativeness:** It refers to the behaviour pattern of a respondent who had interest in and desire to seek changes in farming technologies and to introduce such changes in to his operations which were practical and feasible. It was measure by using the scale developed by Saharkar (1995).The scale consisted of five statements. All the positive statements were assigned the score of 3, 2, and 1 for Agree (A), Undecided (UD) and Disagree (D) and vice versa for negative statements.

After obtaining the total scores, the respondents were classified into three categories based on mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. o.	Level of innovativeness	Score range
1.	Low	Below ($\bar{\chi}$ – σ)
2.	Medium	Between ($\bar{\chi}$ – σ) and ($\bar{\chi}$ + σ)
3.	High	Above ($\bar{\chi}$ + σ)

2. **Achievement motivation:** It is the desire to do well, not so much for the sake of social recognition or prestige, but to attain an inner feeling or personal accomplishment. It was measured with the help of procedure adopted by Chandrapaul (1998).

The scale consisted of six statements. All the positive statements were assigned the score of 3, 2, and 1 for Agree (A), Undecided (UD) and Disagree (D) and vice versa for negative statements.

After obtaining the total scores, the respondents were classified into three categories based on mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Level of achievement motivation	Score range
1.	Low	Below $(\bar{\chi} - \sigma)$
2.	Medium	Between $(\bar{\chi} - \sigma)$ and $(\bar{\chi} + \sigma)$
3.	High	Above $(\bar{\chi} + \sigma)$

3. **Decision making ability:** The decision making ability of a farmer is operationally defined as the degree of weighing the available alternatives in terms of their desirability and their likelihoods and choosing the most appropriate one for achieving maximum profit on his farming. The scale developed by Supe (1969), and as adopted by Nagesh (2006) with suitable modifications. The scale consisted of six statements. The response given by the respondents in terms of their choice as considered independently, considered after consultation with others and not considered were scored as 3, 2 and 1.

After obtaining the total scores, the respondents were classified into three categories based on mean $(\bar{\chi})$ and standard deviation (σ) as follows:

Sl. No.	Level of decision-making ability	Score range
1.	Low	Below $(\bar{\chi} - \sigma)$
2.	Medium	Between $(\bar{\chi} - \sigma)$ and $(\bar{\chi} + \sigma)$
3.	High	Above $(\bar{\chi} + \sigma)$

4. **Risk Orientation:** It refers to the degree to which the respondents oriented towards risk and uncertainty in adopting new ideas or technologies in farming. Risk orientation scale developed by Supe (1969) with some modifications. The scale consisted of six statements. All the positive statements were assigned the score of 3, 2, and 1 for Agree (A), Undecided (UD) and Disagree (D) and vice versa for negative statements.

After obtaining the total scores, the respondents were classified into three categories based on mean $(\bar{\chi})$ and standard deviation (σ) as follows:

Sl. No.	Level of risk orientation	Score range
1.	Low	Below $(\bar{\chi} - \sigma)$
2.	Medium	Between $(\bar{\chi} - \sigma)$ and $(\bar{\chi} + \sigma)$
3.	High	Above $(\bar{\chi} + \sigma)$

5. **Leadership ability:** Leadership ability was operationalized as the degree to which an individual initiate or motivates the action of others. Scale developed by Nandapurkar (1980) with suitable modifications and as followed by Nagesh (2006) was used to measure leadership ability. In the present study, leadership ability was measured on a three-point continuum, *viz*, "always", "sometimes" and "never" with scores i.e., 2, 1 and 0 respectively. The total score was computed for each respondent by summing up the scores recorded. Based on the total scores obtained, the respondents were classified into following three categories, keeping the mean and standard deviation as a measure of check.

Sl. No.	Level of leadership ability	Score range
1.	Low	Below $(\bar{\chi} - \sigma)$
2.	Medium	Between $(\bar{\chi} - \sigma)$ and $(\bar{\chi} + \sigma)$
3.	High	Above $(\bar{\chi} + \sigma)$

6. **Management orientation:** It refers to the degree to which a farmer is oriented towards scientific farm management comprising of planning, production and marketing functions on his farm.

In order to know the farmers management orientation, the scale developed by Samanta (1997) and as followed by Shilpashree (2011) with slight modifications. Management orientation was classified into three parts viz. Planning orientation, production orientation and marketing orientation. The scale consisted of 18 statements. All positive statements were assigned the score of 4, 3, 2 and 1 for Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) and vice versa for negative statements.

After obtaining the scores comprising all three sections of Management Orientation, the respondents were classified into three categories based on mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Level of Management orientation	Score range
1.	Low	Below ($\bar{\chi}$ – σ)
2.	Medium	Between ($\bar{\chi}$ – σ) and ($\bar{\chi}$ + σ)
3.	High	Above ($\bar{\chi}$ + σ)

The overall level of entrepreneurial behaviour was measured by developing an entrepreneurial index as follows:

$$Entrepreneurial\ Index\ (EI) = \frac{EBc}{n}$$

Where, $EBc = \sum_{i=1}^{n} Ei$

Ei- is the ratio of the scores obtained by the respondents to the maximum obtainable score in a particular entrepreneurial behaviour component;

n - is the number of the entrepreneurial behaviour components.

After obtaining the scores of "Entrepreneurial Index (EI)", the respondents were grouped in three categories based on mean ($\bar{\chi}$) and standard deviation (σ) as follows:

Sl. No.	Level of overall entrepreneurial behaviour	Score range
1.	Low	Below ($\bar{\chi}$ – σ)
2.	Medium	Between ($\bar{\chi}$ – σ) and ($\bar{\chi}$ + σ)
3.	High	Above ($\bar{\chi}$ + σ)

Attitude

Attitude here is defined as the degree of positive or negative affect associated with some psychological object (Thurstone, 1946) for measuring the attitudes, different type of scales developed by Thurstone, Likert, Guttman and Bagardus were available. The present study, Likert Method of Summated Ratings (Likert's 1932) procedure was followed to develop a scale to measure attitude of respondents towards improved cultivation practices of pulse crops. The procedure narrated here under.

Item collection

A set of items covering the area of improved cultivation practices of pulse crops were collected based upon review of previous research studies and discussion with experts in the field of extension, agronomy, pathology, entomology, sociology and psychologists. The following components of improved cultivation practices were identified. They are Land preparation, Seeds and sowing, Intercropping, Inter cultivation and weed management, fertilizer and nutrient management, Plant protection, Harvest and post-harvest practices and other related statements. In these components, a tentative list of 102 items consisting of 68positive and 34 negative items were drafted keeping in view of the applicability of statements suited to the area of study.

Editing of items

The items collected were examined and each item was carefully edited by following the criteria suggested by Edwards (1957). After rigorous culling, a total of 64 statements were retained out of 102 statements. Each statement comprised minimum possible words and these were checked for their easy comprehension.

Final selection of item

Based upon the total scores, the respondents were arranged in ascending order. The top 25 per cent of the respondents with their total scores were considered as the high group and the bottom 25 per cent as the low group, so as these two groups provide criterion groups in terms of evaluating the individual items as suggested by Edwards (1957). Thus, out of 20 farmers to whom the items were administered for the item analysis, 5 respondents with lowest, 5 with highest scores were used as criterion groups to evaluate individual items. The critical ratio, that is the ‘t’ value which is a measure of the extent to which a given statement differentiates between the high and low groups of the respondents for each statement was calculated by using the formula suggested by Edwards (1957). After computing the ‘t’ value for each item, the statements were arranged in rank order according to their ‘*t* ‘values. 17 (10 positive and 7 negative) statements with ‘t’ value equal to or greater than 1.75 were finally selected and included in the attitude scale (Edwards, 1957).

Scale developed to measure the attitude of farmers towards improved cultivation practices of large cardamom

Sl. No.	Statements	't' value
1.	Adoption of improved large cardamom cultivation opens the door of progressive aspiration. (+)	6.0
2.	For preservation of planting material, diseased and unhealthy plants can also be stored. (-)	6.0
3.	Processing and marketing of LC can be best done at local and regional level. (+)	4.42
4.	I believe that improved cultivation practice of large cardamom is worth to adopt though it is laborious and complicated. (+)	4.0
5.	Recommended large cardamom production technology can't bring significant change in cultivation practices of farmers. (-)	4.0
6.	The risk of cultivation is minimized with the adoption of improved production technology. (+)	4.0
7.	Though it takes lot of time for a farmer to learn improved production technologies, it is worth the efforts. (+)	4.0
8.	It is recommended to remove the entire plant when virus diseases are noticed. (+)	4.0
9.	The improved cultivation practices of large cardamom can improve the social status of the farmers. (+)	2.88
10.	I think that improved cultivation practices of large cardamom are possible to adopt for all farmers. (+)	2.55
11.	Maintaining soil moisture and optimum temperature is not required for planting. (-)	2.52
12.	Large cardamom cultivation is also possible by untrained farmers. (+)	2.44
13.	Land preparation, planting time and spacing as per recommendation have no effect on LC production. (-)	2.44
14.	Improved large cardamom cultivation is difficult to do for inexperienced farmers. (-)	2.23
15.	I believe that improved cultivation practices of large cardamom help to produce quality production. (+)	2.13
16.	Large cardamom cultivation is not being properly promoted by the Government. (-)	2.13
17.	There is no surety of getting the highest price from large cardamom even if a farmer adopts improved production technology. (-)	2.13

Standardization of the scale

The validity and reliability was ascertained for standardization of the scale. Reliability was measured by split half method.

Reliability of the scale

Reliability is the ability of a ‘test instrument’ to yield consistent results from one set of measures to another. A good instrument should evoke responses that are valid and yield nearly same results if administered twice to the same respondents (Goode and Hatt, 1952). According to Kerlinger (1964) reliability is the accuracy or precision of a measuring instrument.

Split half method

In the present study, split-half method was used for testing reliability. The scale was split into two halves on the basis of odd and even number of statements and administered to 40 respondents. Karl Pearson product moment correlation coefficient was calculated between the two sets of scores obtained. The reliability of the test was 0.726. The ‘r’ value was significant at one per cent level of significance, indicating the attitude scale has high reliability and suitable for administration to the farmers as the scale was stable and dependable in its measurement. It may be said that, the test is reliable to measure the attitude of farmers towards improved cultivation practices of pulse crops.

Validity

Validity of a scale is the property that ensures the obtained test score as valid, if it measured what it supposed to measure. A scale is said to be valid if it stands for one’s reasoning. The attribute of technology scale does possess face validity, content validity and intrinsic validity as they have been established. The details of each are given below.

Content validity

Content validity indicates how adequate is the content of the scale, sampling the domain of which inferences are to be made. To restore such validity to the scale, an attempt was made to see that all the components of attributes of technology were embraced by it. Under each attributes, and adequate number of sample items were included which was proceeded by through and systematic gleanings on all the components of attributes of technology in books and journals. The instrument was subjected to the scrutiny, criticism and comment of the experts in agricultural extension, agricultural microbiology, pathology, entomology and psychology. The scale was modified in the light of their comments and criticism. Thus, it may be said that the scale possessed content validity.

Administering scale

The final scale was administered to farmers and they were asked to respond on five-point continuum *viz,* strongly agree, agree, undecided, disagree and strongly disagree against17selected statements of which 10 were positive and 7negative. The scoring orders for the response were 5, 4, 3, 2 and 1, respectively for positive statements and reverse in case of negative statements. Thus, the possible attitude score of the individual respondent about improved cultivation practices of pulse crops could range from 25 to 75. Attitude scores of the respondents were calculated by adding up the score of all the statements. Further, the farmers were categorized into less favourable, favourable and more favourable categories by considering mean and standard deviation.

Sl. No.	Category	Score range
1.	Less favourable	Below $(\bar{\chi} - \sigma)$
2.	Favourable	Between $(\bar{\chi} - \sigma)$ and $(\bar{\chi} + \sigma)$
3.	More favourable	Above $(\bar{\chi} + \sigma)$

3.5 TOOLS AND TECHNIQUES OF DATA COLLECTION

An interview schedule directed towards the objectives of the study was developed to be used as the tool for data collection. The schedule was prepared with reference from similar research materials from within and outside the institution.

3.5.1 Development of interview schedule

Research schedule was prepared in consultation with the experts in the field of agricultural extension keeping in view the objectives of the study. The schedule was divided into four parts. The first part consisted of the general information of the respondents and socio- economic, personal and psychological characteristics of the respondents. While the second, third and the fourth part were divided to collect information about the status of large cardamom cultivation practices followed by the respondents, entrepreneurial behaviour of the respondents and constraints faced by the respondents in the management of large cardamom cultivation respectively.

3.5.2 Method of data collection

For the present study two types of data *viz*. primary and secondary data's were collected. The primary data was collected by the researcher with the help of pre-tested schedule through personal interview method and group discussions. The necessary data for the present research was collected from May 2019 to February 2020. Different sources like internet and journals were also studied in view of the subject of research. While preparing the schedule, available literatures were studied on the concerned subject consistent with the objectives specified and examined thoroughly for gaining proper knowledge of the parameters to be used and based on it the required schedule was designed to collect information from the respondents. The Secondary data was collected from relevant text books, journals, internet sources and other reference materials. These collected data has been utilised in the study for methodology and review literature and the sources have been cited in the pertinent sections.

3.6 FORMULATION OF HYPOTHESES

Following null hypothesis was developed for the study:

H_o1: There is no association between the selected socio-economic, personal and psychological variables with the *attitude* of large cardamom growers.

H_o2: There is no association between the selected socio-economic, personal and psychological variables with the *entrepreneurial behaviour* of large cardamom farmers.

H_o3: There is no association between the selected socio-economic, personal and psychological variables with the *technological gap* in adoption of improved large cardamom cultivation practices.

3.7 ANALYSIS OF DATA

The data collected from the respondents were scored, tabulated and analysed to calculate frequency, mean, standard deviation and correlation. Purpose of using those statistical measures is stated below:

3.7.1 Percentage:

Percentages were calculated for making comparisons of the sub components of the selected attributes.

$$\text{Percentage} = \frac{\text{Number of Observations}}{\text{Total Number of Observations}} \text{ x } 100$$

3.7.2 Mean and standard deviation:

The Mean or Arithmetic mean is generally known as the average. It is simplest of all averages and it is also known as true average.

$$\bar{\chi} = \frac{\sum Xi}{N}$$

According to Karl Pearson (1923), standard deviation is defined as the square root of the average of squared deviations of the frequency distribution.

Means and standard deviations were used to classify the respondents into the categories based on scores obtained through Mean = SD values.

$$\sigma = \sqrt{\sum_{i=1}^{n} \frac{(Xi - \overline{\chi})2}{n}}$$

Mean and standard deviation were used to classify the respondents into three categories based on scores obtained through Mean ± SD values.

3.7.3 Correlation:

If the change in one variable affects the change in the other variable, the variables are said to be correlated. In other words, the systematic interrelationship between the variables is termed as correlation. The index of the degree of relationship between two continuous variables is known as correlation coefficient. The correlation coefficient is symbolized as *r* in case of a sample and ρ (rho) in case of population. The correlation coefficient, *r* is known as Pearson's Correlation coefficient since it was developed by Karl Pearson.

The correlation coefficient, *r* is given as the ratio of covariance of the variables *x* and *y* to the product of the standard deviations of *x* and *y*. Symbolically, it can be simplified as:

$$r = \frac{N\sum xy - \sum(x)(y)}{\sqrt{[N\sum x2 - \sum(x)2]\,[N\sum y2 - \sum(y)2]}}$$

where,

r = Pearson r correlation coefficient
N = number of value in each data set
$\sum x$ = sum of x scores
$\sum y$ = sum of y scores
$\sum xy$ = sum of the products of paired scores
$\sum x^2$ = sum of squared x scores
$\sum y^2$ = sum of squared y scores

Correlation was used to calculate ‘r’ value in order to know the strength of the association between dependent and independent variables.

3.7.4 Linear multiple regression analysis

Regression analysis was done and calculated the ‘r’ value which facilitated to know relative importance of dependent variable with independent variables. Multiple Linear Regression (MLR) analysis is generally considered as an efficient and powerful hypothesis – testing and inference making technique. Since correlation analysis only gives the nature of relationship where the extent of the relationship was not known. In order to find out the extent of relationship Multiple Linear Regression analysis was used to know the influence of independent variables to the dependent variable.

3.7.5 Principle component analysis

A method of analysis which involves finding the linear combination of a set of variables that has maximum variance and removing its effect, repeating this successively. The Principal Component Analysis is used to reduce the dimensionality of several underlying variables to enable better visualization and analysis of the data. The principal component, their standard deviations and the loading of each variable or dimension on the principal component were generated in the analysis. Scores for each component were calculated using the formula given below.

$$C_i = b_{i1}(X_1) + b_{i2}(X_2) + \dots b_{ip}(X_p)$$

Where, C_i = the subject’s score on principal component i (i component extracted)

b_{ip} = the regression coefficient (or weight) for observed variable p, as used in creating principal component i.

$X_1 - X_p$ = the subject’s score on observed variable 1 to p.

3.7.6 Path Coefficient Analysis

Path coefficient analysis was done according to the procedure suggested by Dewey and Lu (1959). To estimate various direct and indirect effects, the following set of simultaneous equations were formed and solved

r1y= P1y + r12 P2y + r13 P3y +………..+ r1l Ply

r2y= r2y P1y + P2y + r23 P3y +………..+ r2l Ply

rly= r11P1y + rl2 P2y + rl3 P3y +………..+ Ply

Where,

r1y to rly = coefficient of correlation between casual factor 1 to l and dependent character y,

r12 to r1-1,l = coefficient of correlation between among factors themselves,

and P1y to Ply = Direct effect of characters 1 to 1 on character y.

3.7.7 Henry Garrett's ranking technique

This technique was used to evaluate the most disturbing factor or constraints faced by the respondents. The identified problems of growers in the cultivation of large cardamom were ranked by making use of Garrett's Ranking Technique (Garrett and Henry, 1969). The technique was used to rank the preference mentioned by the respondents on different factors and aspects of the cultivation process. It is used to find the most significant factor which had influenced the respondent in their practices. Founded on the Garrett's Ranking technique, the study had the respondents rank different problems and outcome based on their impact thereby converting into score value and rank with the help of the following formula:

$$Percent\ Position = \frac{100\ (Rij - 0.5)}{N}$$

Where,

Rij = Rank given for the i^{th} item by j^{th} respondent

N = Number of item ranked by j^{th} respondents

With the help of Garrett's Table, the percent position estimated is converted into scores by referring to the table given by Garret and Woodworth (1969). Then for each factor, the scores of each individual are added and divided by the total number of respondents. The factors having highest mean value is considered to be the most important factor. Thus the mean score for each constraint was ranked by arranging them in a descending order.

3.7.8 Z test

Z test is a test that follows the normal probability distribution and is used for judging the significance of several statistical measures, particularly the mean. This test is generally used for comparing the mean of a sample to some hypothesized mean for the population in case of large sample, or when population variance is known. It is also used for judging the significance of difference between means of two independent samples in case of large samples, or when population variance is known (Kothari, 2009). It is denoted as:

$$Z = \frac{\bar{\chi} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

Where,

$\bar{\chi}$ = Sample mean

μ = Population Mean

σ = Standard deviation

n = Sample size

CHAPTER - IV

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

Findings of the present study based on the objectives with relevant discussions are presented under the following sub-heads:

4.1 Socio-economic, personal and psychological characteristics of the large cardamom growers.

4.2 Knowledge, attitude and extent of adoption of improved cultivation practices among large cardamom growers.

4.3 Entrepreneurial behavior of the large cardamom growers and strategy for promoting large cardamom based agri-enterprises.

4.4 Technological gap in adoption of improved cultivation practices among large cardamom growers.

4.5 Constraints faced by the respondents and suitable measures to overcome them.

4.1 SOCIO-ECONOMIC, PERSONAL AND PSYCHOLOGICAL CHARACTERISTICS OF THE LARGE CARDAMOM GROWERS

4.1.1 Age

It was observed from Table 4.1.1 and Fig 4.1.1that majority of the large cardamom farmers in Longleng (68.00 %) and Mon district (62.00 %) were found to be in the middle age group (35 to 55 years). In case of farmers above 55 years, the majority (24.67 %) belonged to Mon district followed by 21 per cent from Longleng district. While farmers below 35 years was found highest in Mon (13.33 %) followed by 11 per cent of Longleng.

Overall majority (64.40 %) belonged to the age category of 35 to 55 years, followed by 23.20 per cent and 12.40 per cent of the respondents who belonged to above 55 years and below 55 years categories respectively.

This revealed that majority of the farmers in the study area were middle aged. This age group has more involvement in the large cardamom cultivation; this may be attributed to the fact that they are more enthusiastic, energetic and willing to try new technologies to make a profit than the other age group. Furthermore, older and middle-aged farmers were encouraged to cultivate by embracing modern production techniques and reaping lucrative rewards. Another factor could be that the majority of young people leave their hometowns in quest of white-collar jobs and engage in government work, different business ventures, and other lucrative occupations in search of a more secure lifestyle than farming.

Table 4.1.1: Distribution of Large Cardamom farmers based on age

N = 250

Sl. No	Age	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Below 35 years	11	11.00	20	13.33	31	12.40
2.	35 to 55 years	**68**	**68.00**	**93**	**62.00**	**161**	**64.40**
3.	Above 55 years	21	21.00	37	24.67	58	23.20
	Total	100	100	150	100	250	100
	Mean	46.80		46.96		46.90	
	SD	9.43		10.26		9.92	

Z =-0.0744^{NS}

4.1.2 Gender

From Table 4.1.2 and Fig 4.1.2 it was found that 71 per cent of the respondents from Longleng were male and 29 per cent were female. Mon had

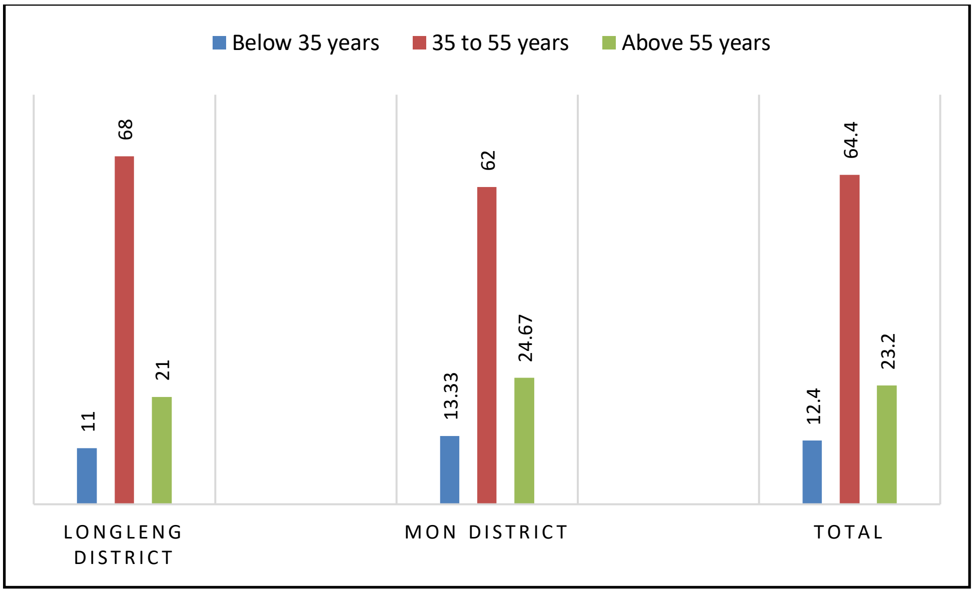


Fig 4.1.1: Distribution of Large Cardamom farmers based on age

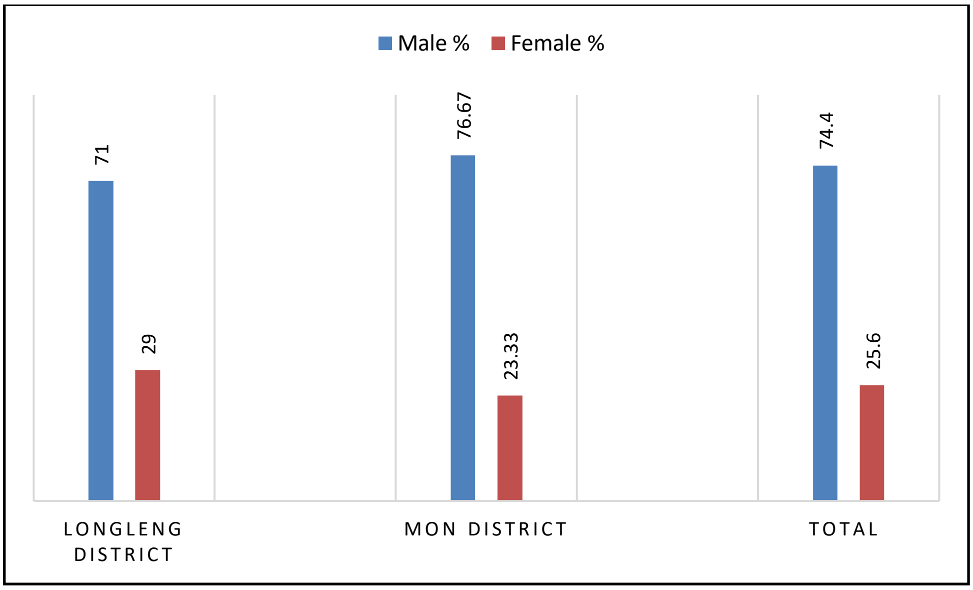


Fig 4.1.2: Distribution of respondents based on Gender

76.67 per cent male respondents and 23.33 per cent female. It was also observed that the overall respondents consisted of 74.40 per cent male and 25.60 per cent female.

Table 4.1.2: Distribution of respondents based on Gender

N = 250

Sl. No	**Gender**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Male	**71**	**71.00**	**115**	**76.67**	**186**	**74.40**
2.	Female	29	29.00	35	23.33	64	25.60
	Total	100	100	150	100	250	100

4.1.3 Family type

It is apparent from Table 4.1.3 and Fig 4.1.3 that 51 per cent of respondents in Longleng district belonged to joint family and 49 per cent belonged to nuclear family. Where as in Mon district majority of the respondents belonged to joint family (51.33 %) followed by nuclear family (48.67 %).

In pooled situation majority of the respondents belonged to joint family (51.20 %) followed by nuclear family (48.80 %).

Table 4.1.3: Distribution of respondents based on Family Type

N = 250

Sl. No	**Family Type**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Joint	**51**	**51.00**	**77**	**51.33**	**128**	**51.20**
2.	Nuclear	49	49.00	73	48.67	122	48.80
	Total	100	100	150	100	250	100

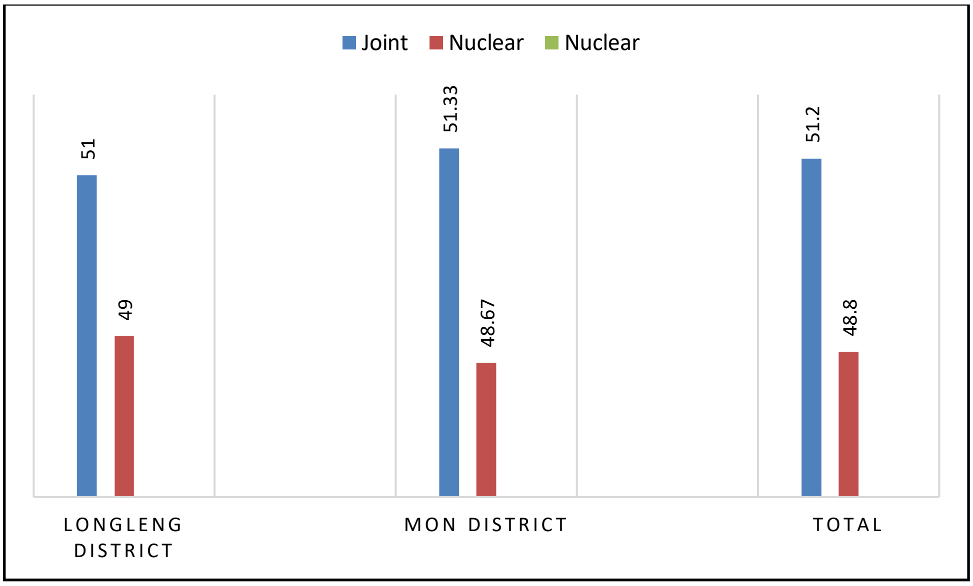


Fig 4.1.3: Distribution of respondents based on Family Type

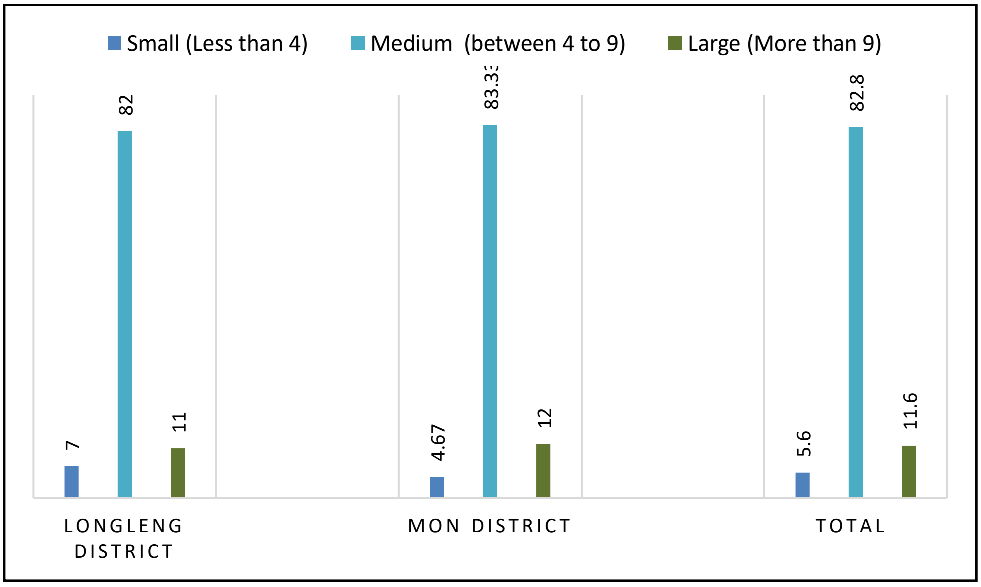


Fig 4.1.4: Distribution of respondents based on Family Size

4.1.4 Family size

Table 4.1.4 and Fig 4.1.4 revealed that 82.00 per cent of Longleng and 83.33 per cent of Mon belonged had medium family size, followed by 11.00 per cent and 12.00 per cent with large family size, and small family size with 7.00 per cent in Longleng and 4.67 per cent in Mon respectively.

In pooled data, more than half (82.80 %) had medium family size ranging between 4 to 9 members, 11.60 per cent had large (more than 9 members) family size, whereas only 5.60 per cent has small family size consisting of less than 4 members.

If the family size is optimal, one can take risks for development activities; there is also opportunity for division of labour and idea sharing. If the family has more members, it is more difficult to invest, and if there are fewer, they may lack resources. As a result, a medium family size is ideal for growth. Z value was calculated using SPSS software and was found non-significant, this indicated that there is no significant difference between Longleng and Mon district.

Table 4.1.4:Distribution of respondents based on Family Size

N = 250

Sl. No	**Family Size**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Small (Less than 4)	7	7.00	7	4.67	14	5.60
2.	Medium (between 4 to 9)	**82**	**82.00**	**125**	**83.33**	**207**	**82.80**
3.	Large (More than 9)	11	11.00	18	12.00	29	11.60
	Total	100	100	150	100	250	100
	Mean	6.58		6.76		6.78	
	SD	2.27		2.20		2.23	

Z = -0.6145^{NS}

4.1.5 Education

It is clear from the Table 4.1.5 and Fig 4.1.5 that majority of the growers (41.60 %) were illiterate, 21.20 per cent were educated up to primary level, 19.60 per cent were educated up to middle school. While as 13.60 per cent were educated up to high school, and 4.00 per cent were educated up to pre-university, there was no respondent found to be graduate. Further, Mon and Longleng district had majority of the growers that were illiterate with 44.67 per cent and 37.00 per cent respectively.

The reason for illiteracy could be a lack of interest, a lack of encouragement from family members, or a poor economic situation. To raise the level of education, efforts must be made to educate illiterates and school dropouts through adult education and functional literacy programmes in the village. The large cardamom growers are likely to be educated up to primary school due to their medium annual family income and the availability of primary schools in their village. Lack of high school and college education facilities in nearby villages, which forces them to travel to cities if they want to pursue high school and college education, may be a rationale for the lower percentage.

Table 4.1.5: Distribution of respondents based on Education

N = 250

Sl. No	Education level	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Illiterate	**37**	**37.00**	**67**	**44.67**	**104**	**41.60**
2.	Primary	22	22.00	31	20.67	53	21.20
3.	Middle School	21	21.00	28	18.67	49	19.60
4.	High School	17	17.00	17	11.33	34	13.60
5.	Pre University	3	3.00	7	4.67	10	4.00
6.	Graduate	0	0	0	0	0	0
	Total	100	100	150	100	250	100
	Mean	1.27		1.11		1.17	
	SD	1.21		1.23		1.22	

$Z = 1.0319^{NS}$

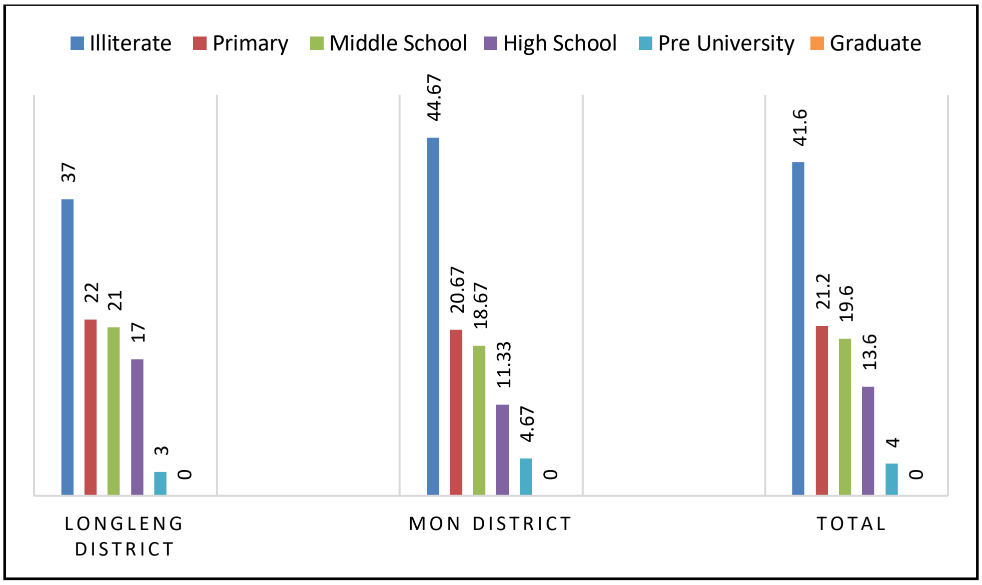


Fig 4.1.5: Distribution of respondents based on Education

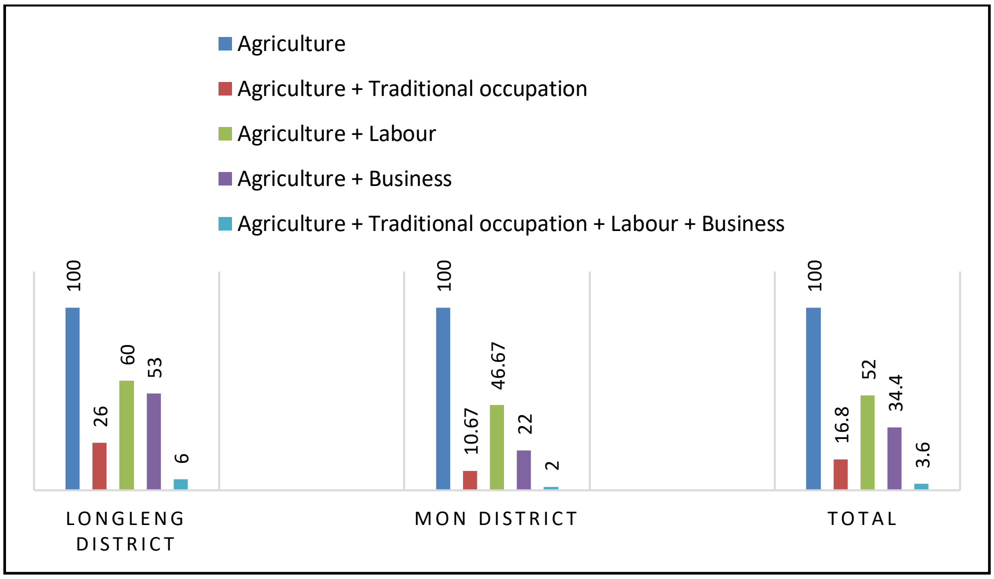


Fig 4.1.6: Distribution of respondents based on their Occupation

4.1.6 Occupation

Households depend upon more than one activity to sustain their livelihood; instead, they engage in a variety of activities to reduce the prevalence of poverty, build resilience against risk, and increase their income. It is evident from Table 4.1.6 and Fig 4.1.6 that all the farmers (100 %) have agriculture as their main occupation. 52.00 per cent of the farmers were engaged both in agriculture and labour, while 34.40 per cent were engaged both in agriculture and business, and 16.80 per cent were engaged both in agriculture and traditional occupation as their subsidiary occupation, while only 3.60 per cent were involved in all the occupation. Traditional occupation included pottery, handicraft, handloom, iron smith, weaving, basketry, wood work and jewellery making.

Table 4.1.6: Distribution of respondents based on their Occupation

N = 250

Sl. No	Occupation	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Agriculture	100	100	150	100	250	100
2.	Agriculture + Traditional occupation	26	26.00	16	10.67	42	16.80
3.	Agriculture + Labour	60	60.00	70	46.67	130	52.00
4.	Agriculture + Business	53	53.00	33	22.00	86	34.40
5.	Agriculture + Traditional occupation + Labour + Business	6	6.00	3	2.00	9	3.60

4.1.7 Size of land holding under Agriculture

The data in Table 4.1.7 and Fig 4.1.7 indicates that 64.00 per cent, 18.67 per cent and 17.33 per cent of the large cardamom growers in Mon district had Semi-medium, small and medium land holding size respectively. Whereas, in

Longleng district 61.00 per cent, 23.00 per cent and 16.00 per cent of the growers had semi-medium, medium and small land holding size under agriculture.

In the pooled data, it could be inferred that majority (62.80 %) had semi-medium land holding size under agriculture, 19.60 per cent and 17.60 per cent had medium and small land holding size respectively. It was found that there were no respondents who had marginal and large land holding size under agriculture.

Table 4.1.7: Distribution of respondents based on size of land holding under Agriculture

N = 250

Sl. No	**Land Holding under Agriculture**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Small (1.1 to 2 ha)	16	16.00	28	18.67	44	17.60
2.	Semi-Medium (2.1 to 4 ha)	**61**	**61.00**	**96**	**64.00**	**157**	**62.80**
3.	Medium (4.1 to 10 ha)	23	23.00	26	17.33	49	19.60
	Total	100	100	150	100	250	100
	Mean	3.55		3.42		3.48	
	SD	1.23		1.18		1.20	

$Z = 0.8098^{NS}$

4.1.8 Size of land under Large Cardamom

From Table 4.1.8 and Fig 4.1.8, it was evident that among the Longleng respondents, 48.00 per cent of the farmers had 1.1 to 1.5 ha of land

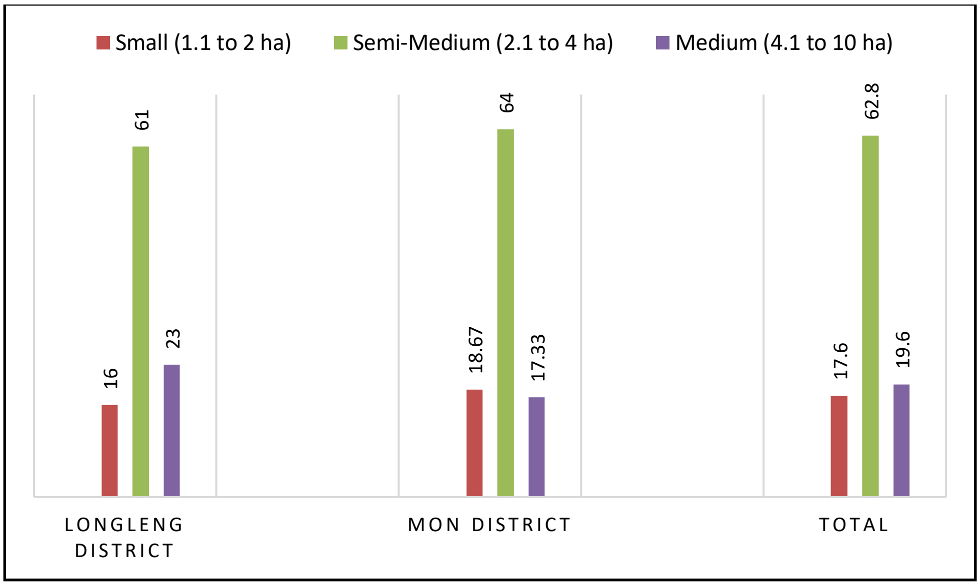


Fig 4.1.7: Distribution of respondents based on Size of Land Holding under Agriculture

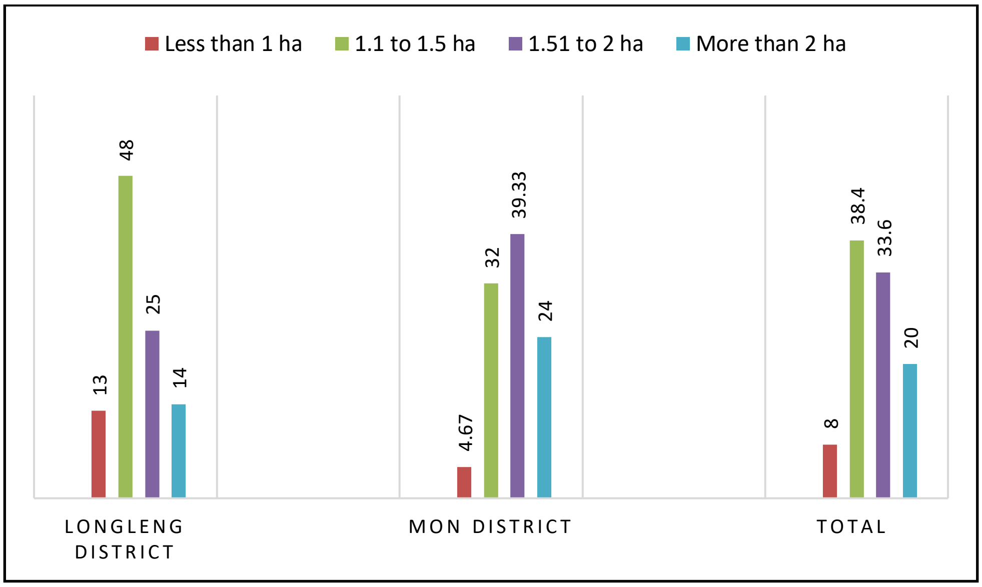


Fig 4.1.8: Distribution of respondents based on Size of Land Holding under Large Cardamom

Plate 1. Tools and implements used for large cardamom cultivation

under large cardamom. Further, 25.00 per cent, 14.00 per cent and 13.00 per cent of the respondents had 1.51 to 2 ha, more than 2.00 had and less than 1.00 ha of land holdings under large cardamom.

In respect to Mon respondents, 39.33 per cent had 1.51 to 2 ha of land holding under large cardamom followed by 1.1 to 1.5 ha (32.00 %). 24.00 per cent had more than 2.00 ha and only 4.67 per cent had less than 1 ha of land holding under large cardamom.

The pooled data furnished that 38.40 per cent of the respondents had 1.1 to 1.5 ha of land holding followed by 1.51 to 2.00 ha with 33.60 per cent and more than 2.00 ha with 20.00 per cent and less than 1 ha with 8.00 per cent, respectively.

Table 4.1.8: Distribution of respondents based on size of land under Large Cardamom

N = 250

Sl. No	Land under Large Cardamom	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Less than 1 ha	13	13.00	77	4.67	20	8.00
2.	1.1 to 1.5 ha	**48**	**48.00**	48	32.00	**96**	**38.40**
3.	1.51 to 2 ha	25	25.00	**59**	**39.33**	84	33.60
4.	More than 2 ha	14	14.00	36	24.00	50	20.00
	Total	100	100	150	100	250	100
	Mean	1.54		1.80		1.69	
	S.D	0.63		0.57		0.61	

Z = -3.2722**

** Significant at 1 % level of probability

4.1.9 Average Area, Production, Productivity and Profitability

Average area, production, productivity and profitability of large cardamom have been shown in Table 4.1.9(a)and Fig 4.1.9(a) given below. Cyclicality in the area and production could be observed. The average area under the cultivation of large cardamom was 1.55 ha in 2017, which increased to 1.61 ha in 2018 and 1.69 ha in 2019. The average production of large cardamom is 131.04 kg in 2019, which were 120.98 kg and 125.10 kg in 2017 and 2018 respectively.

The cyclicality in the average productivity (yield) can also be observed. It was 78.05 kg per hectare in 2017, which decreased to 77.70 kg per hectare and 77.53 kg per hectare in 2018 and 2019 respectively. The average profitability from large cardamom cultivation in 2017 was observed to be 73015.31 Rs. per hectare which drastically decreased to 46700.80 and 32416.13 Rs. per hectare in the year 2018 and 2019 respectively.

As per the respondents the main reasons of declining productivity and profitability of large cardamom was the outbreak of devastating viral diseases like chirke (mosaic streak) and foorkey (bushy dwarf). When chirke infects a plant, the leaves turn yellow and the plant withers. Flowers do not form capsules in foorkey disease. And also due to factors including old plantation, poor management, unavailability of quality planting material and change in local weather condition.

Table 4.1.9(a): Average Area, Production, Productivity and Profitability of Large Cardamom (2017 to 2019)

	2017	**2018**	**2019**
Average Area (ha)	1.55	1.61	1.69
Average Production (Kg)	120.98	125.10	131.04
Average Productivity (Kg/ha)	78.05	77.70	77.53
Average Profitability (Rs/ha)	73015.31	46700.80	32416.13

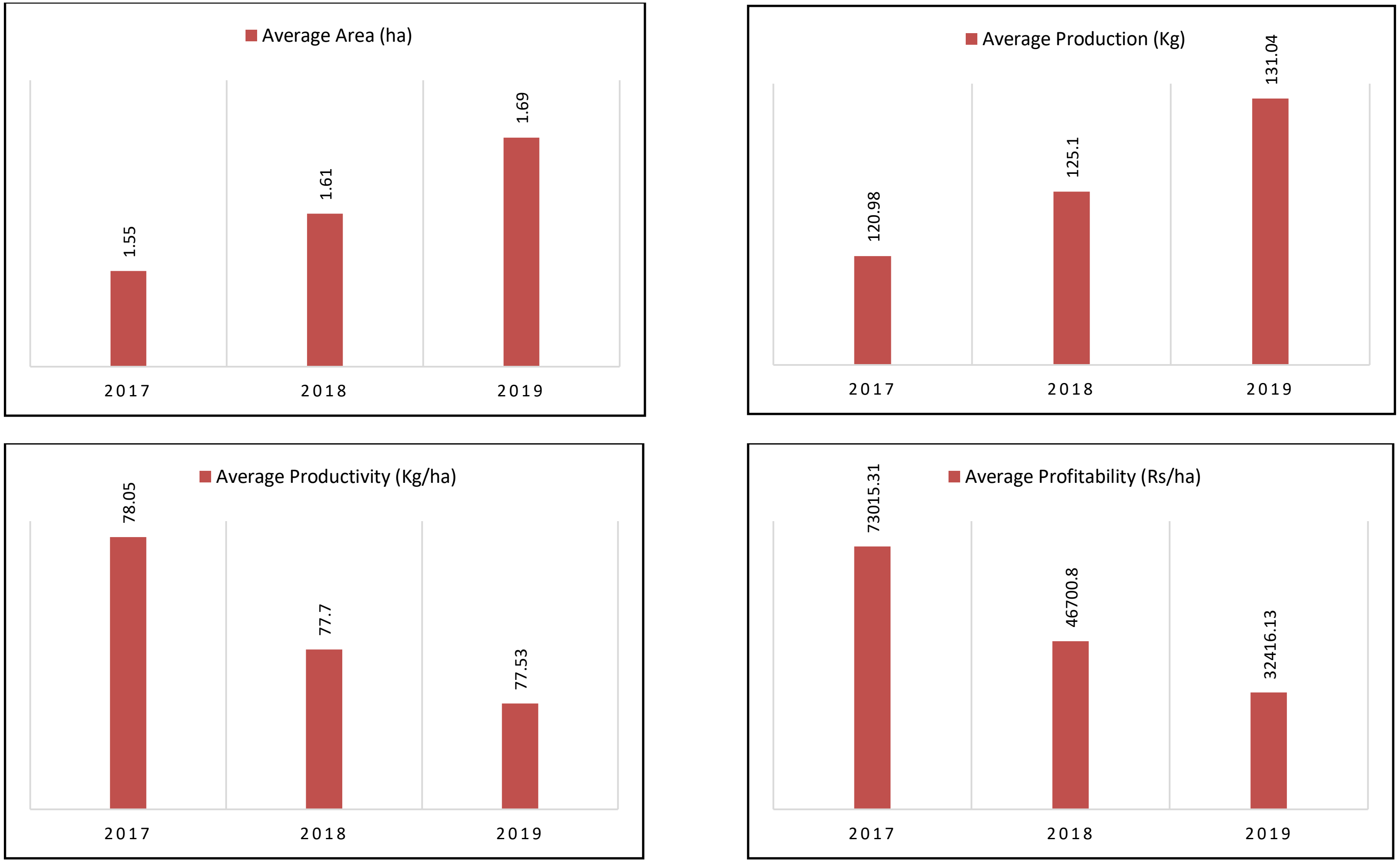


Fig 4.1.9(a): Average Area, Production, Productivity and Profitability of Large Cardamom (2017 to 2019)

The results of district-wise area, production and productivity and profitability of large cardamom in Longleng and Mon from the year 2017-19 are outlined in the Table 4.1.9(b) and Fig 4.1.9(b), which indicate that the total area under large cardamom in both Longleng and Mon district has been increasing from 2017 to 2019. The production and productivity were found also found to be increasing in Longleng district, whereas in Mon production was increasing but the productivity has slight decrease over the years. Profitability differs from production volume and productivity in that it takes into account the product's cost as well as the current market price.

The monetary return on any type of cultivation is determined by a number of factors, including seed variety, agro climatic conditions, soil quality, disease, cultural practises, market prices, cultivation cost, and so on. Because these factors differ by region, so does the return across different district. A crop that yields a high return in one state may not yield a high return in another. Thus, before beginning any type of farming, a profitability analysis is critical.

It is evident that the profitability has consistently decreased in both Longleng and Mon district. Farmers in the study area are more comfortable in their traditional methods and the lack of a proper irrigation system, a lack of insect pest and disease management, shifting cultivation, and poor road connectivity would undoubtedly present several challenges and harm the profitability of large cardamom cultivation. Despite these challenges, farmers with no other options were able to make a good living.

Table 4.1.9(b): Average Area, Production, Productivity and Profitability of Large Cardamom of Longleng and Mon district (2017 to 2019)

District		2017	2018	2019
Longleng	Average Area (ha)	1.40	1.46	1.54
	Average Production (Kg)	114.25	121.10	127.70
	Average Productivity (Kg/ha)	81.55	82.83	83.14
	Average Profitability (Rs/ha)	60070.26	44594.84	30220.34
		2017	2018	2019
Mon	Average Area (ha)	1.64	1.70	1.79
	Average Production (Kg)	125.47	127.77	133.27
	Average Productivity (Kg/ha)	76.35	75.01	74.40
	Average Profitability (Rs/ha)	81645.35	48104.77	33879.98

Productivity	Mean Productivity	Z Test	P Value
Longleng District	83.14	2.5486**	0.007
Mon District	74.40		
Profitability	**Mean Profitability**	**Z Test**	**P Value**
Longleng District	30220.34	-2.4809**	0.005
Mon District	33879.98		

** Significant at 1% level of probability

The Table 4.1.9(c) and Fig 4.1.9(c) provides data on the average area, production, productivity, and profitability of Large Cardamom among different categories of farmers for the years 2017 to 2019.

2017:

- Less than 1 ha: Farmers with land holdings of less than 1 hectare had an average area of 0.77 ha. The average production was 78.91 kg, resulting in an average productivity of 105.32 kg/ha. The average profitability for this category was Rs 82,727.72 per hectare.
- 1 to 1.5 ha: Farmers with land holdings between 1 to 1.5 hectares had an average area of 1.24 ha. The average production was 110.29 kg, resulting in an average productivity of 90.10 kg/ha. The average profitability for this category was Rs 78,903.10 per hectare.

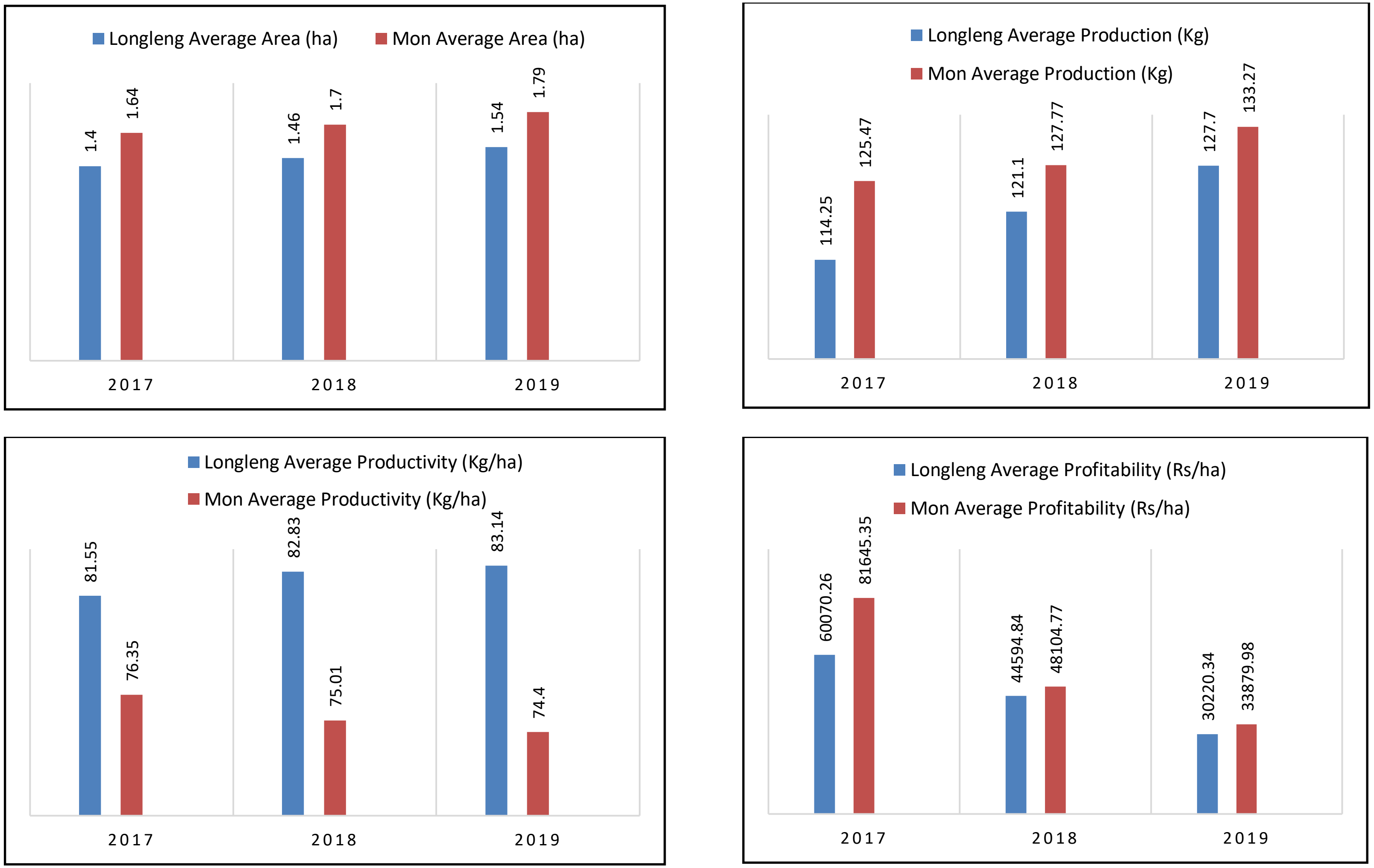


Fig 4.1.9(b): Average Area, Production, Productivity and Profitability of Large Cardamom of Longleng and Mon district (2017 to 2019)

- Over 1.5 to 2 ha: Farmers with land holdings over 1.5 to 2 hectares had an average area of 1.96 Ha. The average production was 137.10 kg, resulting in an average productivity of 70.00 kg/ha. The average profitability for this category was Rs 65,907.27 per hectare.
- Over 2 ha: Farmers with land holdings over 2 hectares had an average area of 2.41 Ha. The average production was 159.20 kg, resulting in an average productivity of 66.92 kg/ha. The average profitability for this category was Rs 60,000.30 per hectare.

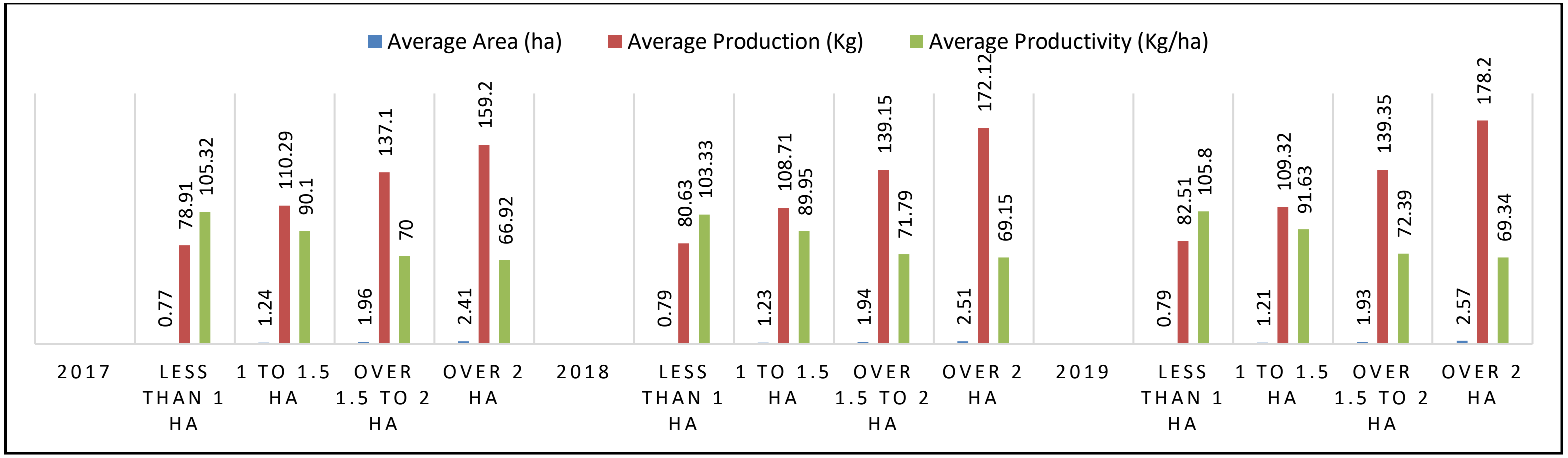
2018 and 2019:

- The data for 2018 and 2019 follows a similar pattern to 2017, with decreasing profitability across the different landholding categories. However, the specific values for average area, production, productivity, and profitability differ for each category.

Overall, the data highlights the relationship between landholding size, productivity, and profitability in Large Cardamom farming. Generally, smaller landholdings tend to have higher productivity and profitability. However, it is important to consider other factors such as management practices, market conditions, and input costs when evaluating the profitability of Large Cardamom farming.

Table 4.1.9(c): Average Area, Production, Productivity and Profitability of Large Cardamom among different category of farmers (2017 to 2019)

Land Holding under Large Cardamom	Average Area (ha)	Average Production (Kg)	Average Productivity (Kg/ha)	Average Profitability (Rs/ha)
2017				
Less than 1 ha	0.77	78.91	105.32	82727.72
1 to 1.5 ha	1.24	110.29	90.10	78903.10
1.5 to 2 ha	1.96	137.10	70.00	65907.27
Over 2 ha	2.41	159.20	66.92	60000.30
2018				
Less than 1 ha	0.79	80.63	103.33	57975.81
1 to 1.5 ha	1.23	108.71	89.95	51853.12
1.5 to 2 ha	1.94	139.15	71.79	41082.04
Over 2 ha	2.51	172.12	69.15	37090.39
2019				
Less than 1 ha	0.79	82.51	105.80	40884.51
1 to 1.5 ha	1.21	109.32	91.63	37965.76
1.5 to 2 ha	1.93	139.35	72.39	28046.14
Over 2 ha	2.57	178.20	69.34	25715.06



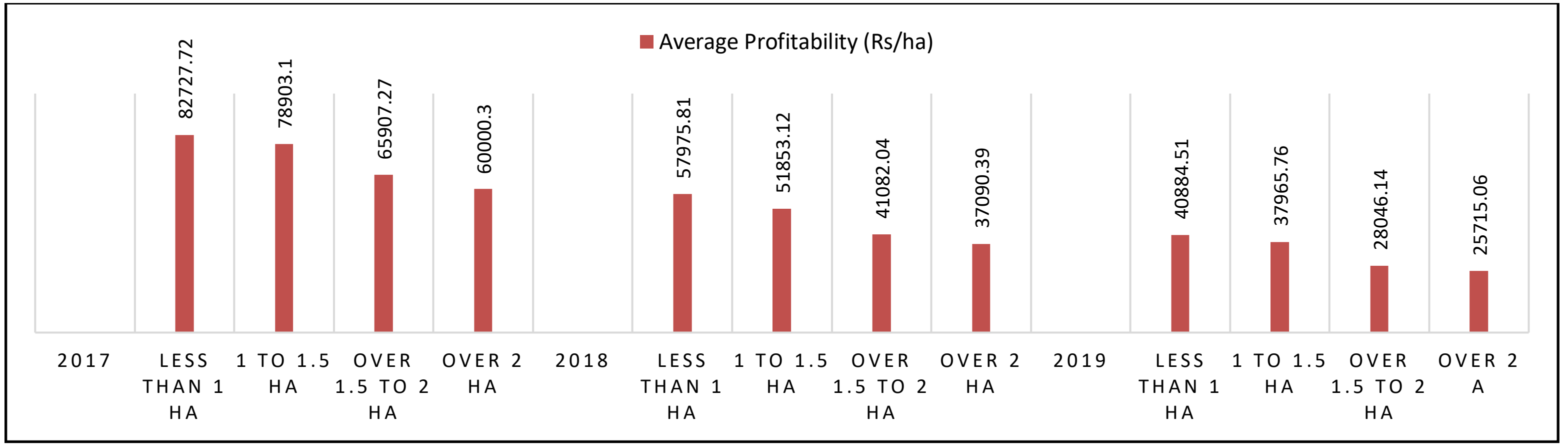


Fig 4.1.9(c): Average Area, Production, Productivity and Profitability of Large Cardamom among different category of farmers (2017 to 2019)

Plate 2. Respondents from Longleng district, Nagaland

4.1.10 Total Annual Income

Annual income of respondents is given in the data presented in Table 4.1.10(a) and Fig 4.1.10(a), which shows that 40.80 per cent of the respondents who reported their annual income ranged between Rs.80000 to Rs.100000, followed by 40.40 per cent of the respondents who were having their annual income between Rs.100000 to Rs.120000. Whereas, 10.40 and 8.40 per cent of the respondents were having their annual income more than Rs.120000 and less than Rs.80000 respectively.

From the table we it can be inferred than in Longleng district majority (56.00 %) had income between Rs.100000 to Rs.120000, whereas Mon district had majority (48.67 %) respondents who had an annual income between Rs.80000 to Rs.100000.

Table 4.1.10(a): Distribution of respondents based on total annual income including income from Large Cardamom

N = 250

Sl. No	**Total Annual Income including income from Large Cardamom**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Less than Rs. 80000	6	6.00	15	10.00	21	8.40
2.	Between Rs. 80000 to Rs. 100000	30	30.00	**73**	**48.67**	**102**	**40.80**
3.	Between Rs. 100000 to Rs. 120000	**56**	**56.00**	44	29.33	101	40.40
4.	More than Rs. 120000	8	8.00	18	12.00	26	10.40
	Total	100	100	150	100	250	100

Z =1.7218*

*Significant at 5% level of probability

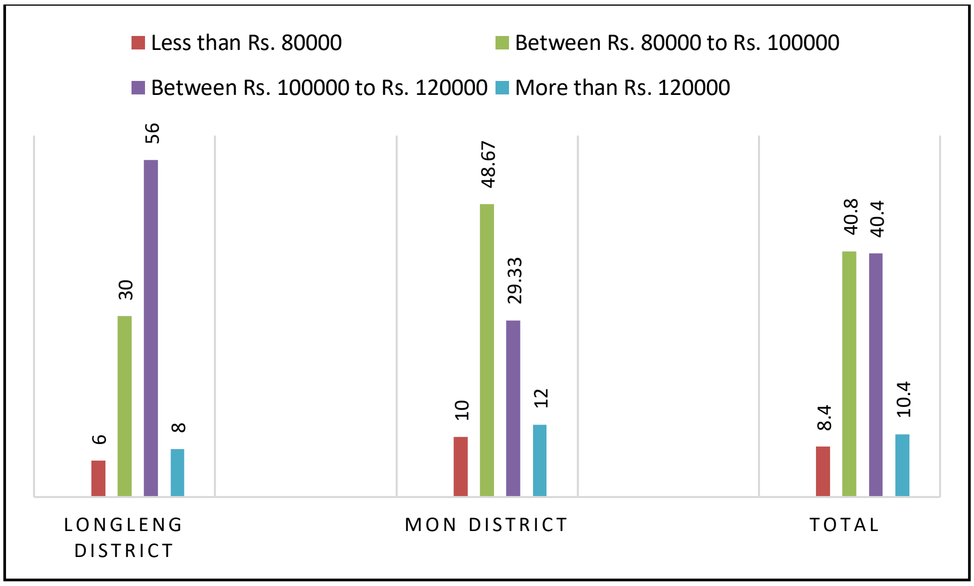


Fig 4.1.10(a): Distribution of respondents based on total annual income including income from Large Cardamom

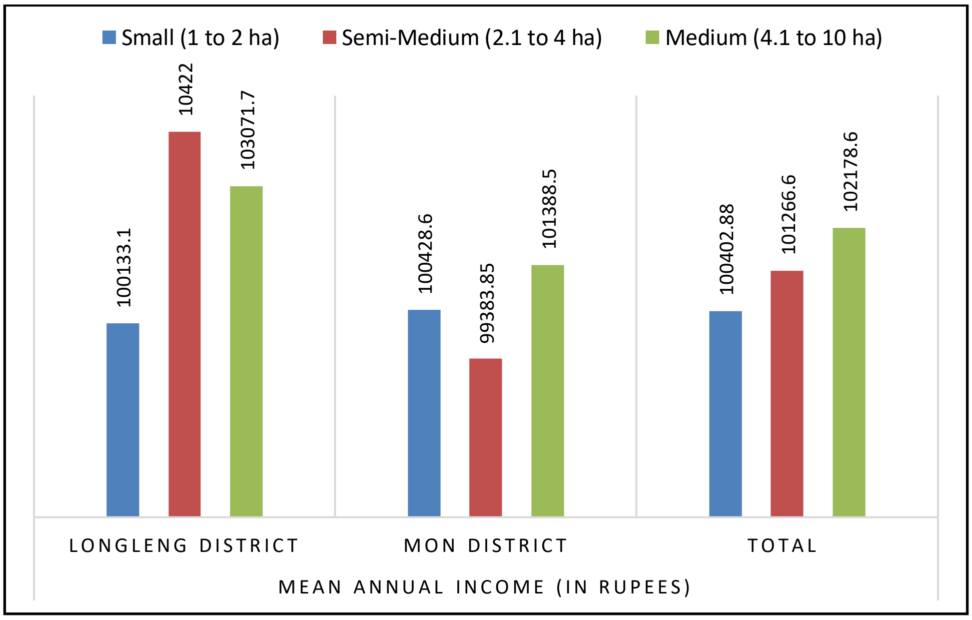


Fig 4.1.10(b): Distribution of respondents based on mean annual income from Agriculture

Plate 3. Large cardamom field under Longleng district

Based on the given data in Table 4.1.10(b) and Fig 4.1.10(b), the distribution of respondents based on mean annual income from agriculture (including large cardamom), we can see that the overall mean annual income for respondents with small land holdings (1 to 2 ha) across both districts is Rs. 100,402.88; for respondents with semi-medium land holdings (2.1 to 4 ha) across both districts is Rs. 101,266.60 and income for respondents with medium land holdings (4.1 to 10 Ha) across both districts is Rs. 102,178.60.

In Longleng district the mean annual income for respondents with small land holdings is Rs. 100,133.10; for respondents with semi-medium land holdings is Rs. 104,229.50 and for respondents with medium land holdings is Rs. 103,071.70.

The mean annual income for respondents with small land holdings in Mon district is Rs. 100,428.60; for respondents with semi-medium land holdings is Rs. 99,383.85 and for respondents with medium land holdings is Rs. 101,388.50. These figures provide an overview of respondents' average annual income in Longleng and Mon districts based on the size of their agricultural landholdings. It should be noted that the data only represents the mean income and may not reflect the full income distribution or variations within each landholding category.

Table 4.1.10(b): Distribution of respondents based on mean annual income from Agriculture

N = 250

Sl. No	Land Holding under Agriculture	Mean Annual Income (In Rupees)		
		Longleng district	Mon district	Total
1.	Small (1.01 to 2 ha)	100133.10	100428.60	100402.88
2.	Semi-Medium (2.1 to 4 ha)	104229.50	99383.85	101266.60
3.	Medium (4.1 to 10 ha)	103071.70	101388.50	102178.60

4.1.11. Income from Large Cardamom

The data presented in Table 4.1.11(a) and Fig 4.1.11(a), includes the annual income from large cardamom reported by respondents, which shows that 58.00 per cent had yearly earnings ranging between Rs. 50,000 to Rs. 80,000, followed by 34.00 per cent of the respondents were having their annual income less than Rs. 50,000. Whereas only 8.00 per cent of the respondents were having their annual income from large cardamom more than Rs. 80,000 respectively.

From the table we it can be also inferred than in Longleng district majority (62.00 %) had yearly revenue from large cardamom less than Rs. 50,000, whereas Mon district had majority (55.33 %) respondents who had an annual income between Rs. 50,000 to 80,000.

Table 4.1.11(a): Distribution of respondents based on total annual income from Large Cardamom

N = 250

Sl. No	Total Annual Income from Large Cardamom	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Less than Rs. 50000	62	62.00	47	31.33	85	34.00
2.	Between Rs. 50000 to 80000	35	35.00	83	55.33	145	58.00
3.	More than Rs. 80000	3	3.00	20	13.33	20	8.00

It was also indicated from Table 4.1.11(b) and Fig 4.1.11(b), that in case of large cardamom growers, mean annual income was found highest (Rs.72411.00) in respondents with more than 2 ha land holding under large cardamom, followed by Rs.60284.29 in case of respondents with land holding

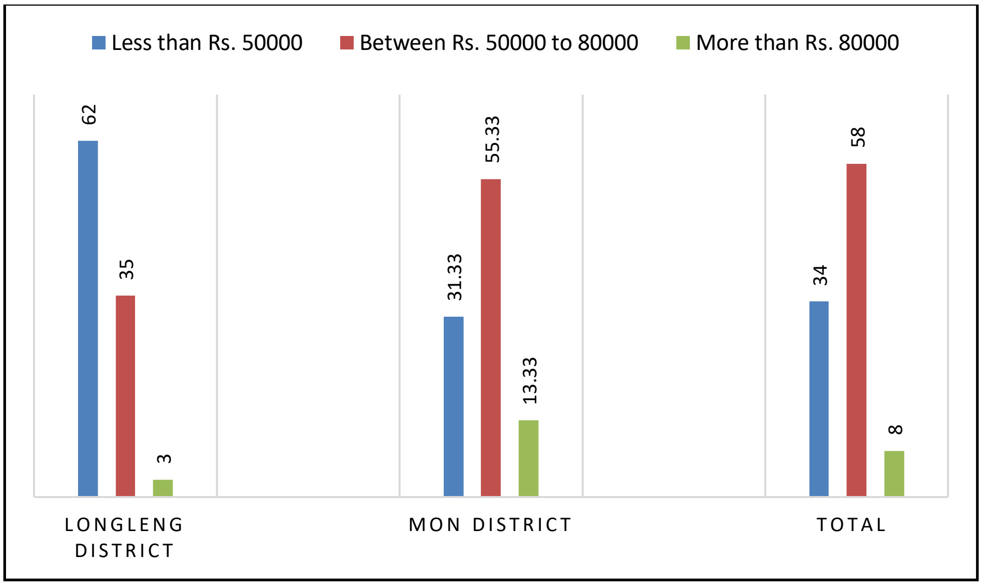


Fig 4.1.11(a): Distribution of respondents based on total annual income from Large Cardamom

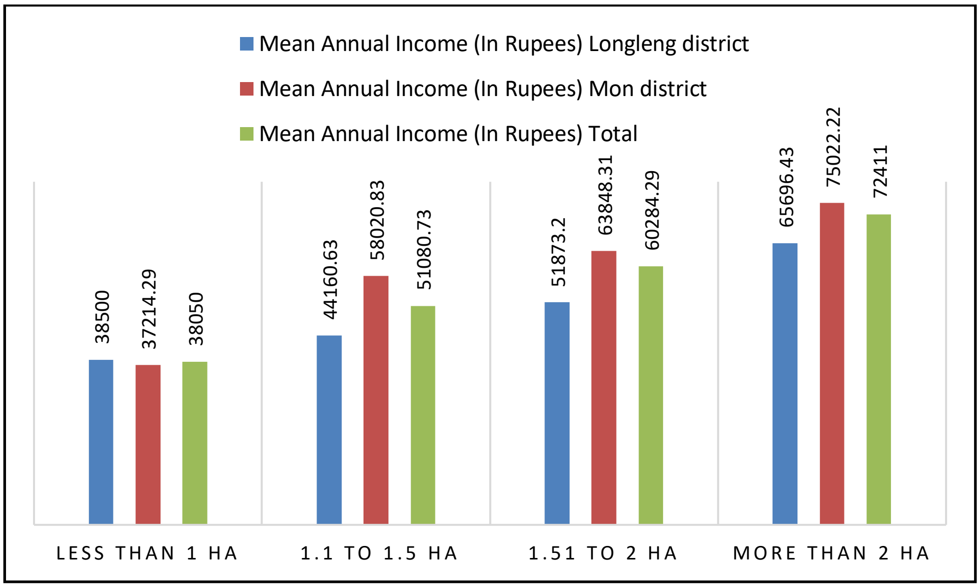


Fig 4.1.11(b): Distribution of respondents based Mean Annual Income from Large Cardamom Farming

of 1.51 to 2 ha, Rs.51080.73 in case with land holding of 1.1 to 1.5 ha and Rs.38050.00 with land holding of less than 1 ha.

Table 4.1.11(b): Distribution of respondents based Mean Annual Income from Large Cardamom Farming

N = 250

Sl. No	Land Holding under Large Cardamom	Mean Annual Income (In Rupees)		
		Longleng district	Mon district	Total
1.	Less than 1 ha	38500	37214.29	38050.00
2.	1.01 to 1.5 ha	44160.63	58020.83	51080.73
3.	1.51 to 2 ha	51873.20	63848.31	60284.29
4.	More than 2 ha	65696.43	75022.22	**72411.00**

Z = -7.4518**

**Significant at 1% level of probability

4.1.12 Farming experience in Large Cardamom

It is observed from Table 4.1.12 and Fig 4.1.12 that 64.00 per cent of the large cardamom growers in Longleng district and 72.00 per cent in Mon district were found to have 6 to 8 years of experience in large cardamom farming. Exactly equal respondents in Longleng had less than 6 years (18.00 %) and more than 8 years (18.00 %) of farming experience. Where as in Mon 17.33 per cent had less than 6 years of farming experience, followed by more than 8 years (10.67 %) of experience.

In pooled data, 68.80 per cent of the large cardamom cultivators had 6 to 8 years of experience and 17.60 per cent had less than 6 years of experience, followed by more than 8 years (13.60 %) of experience in large cardamom farming.

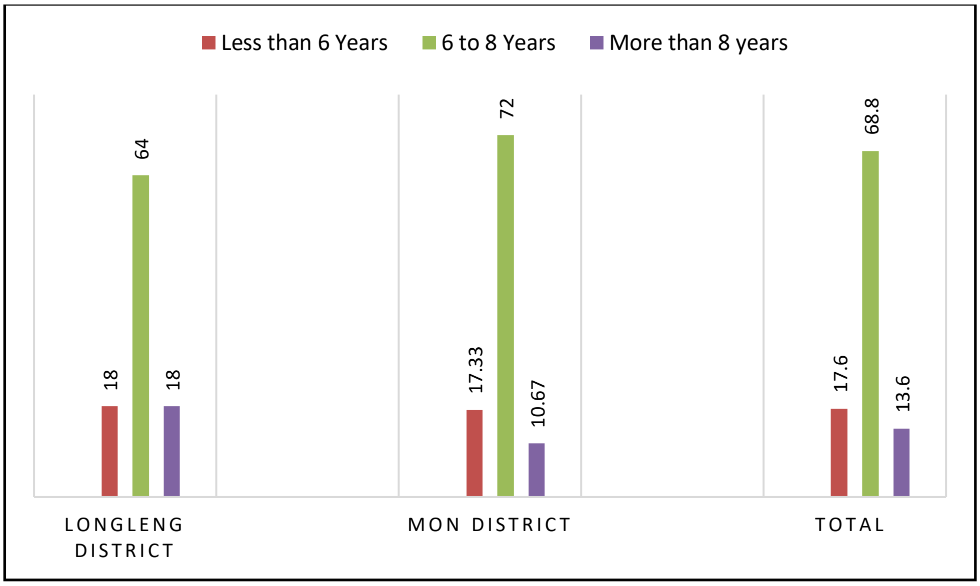


Fig 4.1.12: Distribution of respondents based on farming experience in Large Cardamom

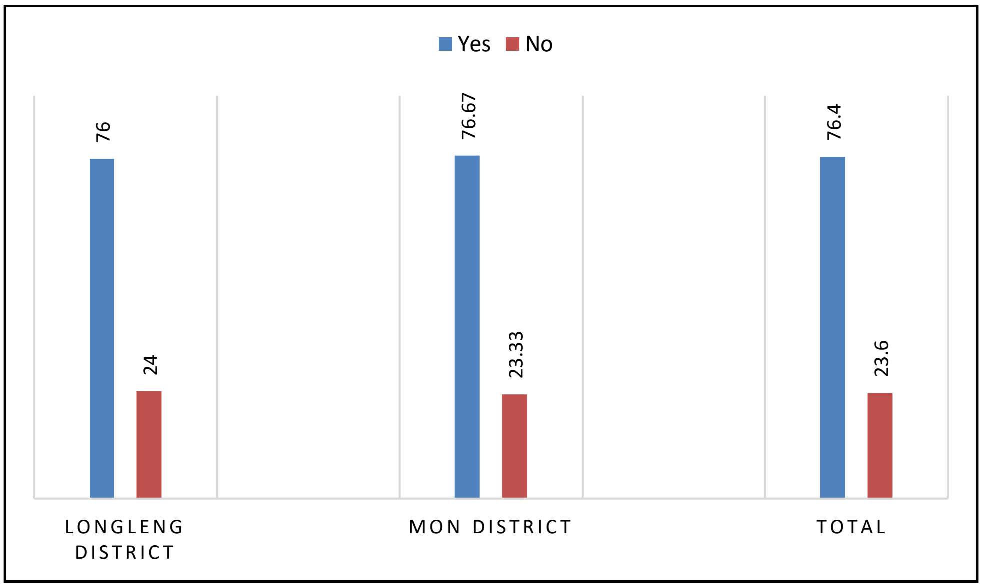


Fig 4.1.13: Distribution of respondents based on Training Exposure on Large Cardamom

Table 4.1.12: Distribution of respondents based on farming experience in Large Cardamom

N = 250

Sl. No	Farming Experience	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Less than 6 Years	18	18.00	26	17.33	44	17.60
2.	6 to 8 Years	**64**	**64.00**	**108**	**72.00**	**172**	**68.80**
3.	More than 8 years	18	18.00	16	10.67	34	13.60
	Total	100	100	150	100	250	100
	Mean	7.07		6.95		7.00	
	S.D	1.46		1.35		1.39	

Z = 0.6023[NS]

4.1.13. Training exposure

The variable training exposure was concerned with training related to improved large cardamom cultivation during the last five years. Table 4.1.13 and Fig. 4.1.13 revealed that 76.40 per cent of the respondents attended training, while 23.60 per cent of the respondents did not attend any training during the last five years.

Table 4.1.13: Distribution of respondents based on Training Exposure on Large Cardamom

N = 250

Sl. No	Training Exposure on Large Cardamom	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Yes	76	76.00	115	76.67	191	76.40
2.	No	24	24.00	35	23.33	59	23.60
	Total	100	100	150	100	250	100

Z = -0.0930[NS]

4.1.14.Training Need

To make better use of improved large cardamom cultivation technology and practices, equipping large cardamom growers with specialised knowledge and skills necessitates the organisation of need-based training. We can say that the best way to make use of large cardamom growers' natural and potential capabilities is to provide them with opportunities for need-based training, which means transferring technology for improving existing knowledge and skills, enhancing capabilities, improving competency, and assisting them in ensuring income from agricultural enterprises, particularly large cardamom production. It is a well-known fact that training programmes are only effective and purposeful when they are based on trainees' perceived needs.

The current study attempted to assess large cardamom growers' training needs regarding improved large cardamom production technology. For research, 15 major technological areas of large cardamom production were chosen. Large cardamom growers were polled to determine which technological statues of large cardamom production training activity they considered "most needed," "needed," and "not needed."

Table 4.1.14(a) and Fig 4.1.14(a) represents the distribution of respondents based on training need on improved cultivation practices of large cardamom of Longleng district. It was apparant that majority of the farmers with mean score of 2.00, needed training in integrated pest management and integrated disease management, and least/no training need was found in the areas of pit preparation and weed management.

Table 4.1.14(a):Distribution of respondents based on Training needs on improved cultivation practices of Large Cardamom in Longleng district

N = 100

Sl. No	Recommended Practices	Trainings Needed			Mean Score	Rank
		Most Needed	Needed	Not Needed		
1.	Integrated Pest Management	100 (100)	0	0	2	I
2.	Integrated Disease Management	100 (100)	0	0	2	II
3.	Fertilizer Application	31 (31.00)	69 (69.00)	0	1.31	III
4.	Roguing and Gap filling	29 (29.00)	71 (71.00)	0	1.29	IV
5.	Shade Regulation	29 (29.00)	71 (71.00)	0	1.29	V
6.	Varieties	28 (28.00)	72 (72.00)	0	1.28	VI
7.	Curing	6 (6.00)	85 (85.00)	9 (9.00)	0.97	VII
8.	Packing	2 (2.00)	84 (84.00)	14 (14.00)	0.88	VIII
9.	Harvesting	0	74 (74.00)	26 (26.00)	0.74	IX
10.	Irrigation	0	37 (37.00)	63 (63.00)	0.37	X
11.	Time of Planting	0	36 (36.00)	64 (64.00)	0.36	XI
12.	Pit Manuring	0	36 (36.00)	64 (64.00)	0.36	XII
13.	Mulching	0	30 (30.00)	70 (70.00)	0.30	XIII
14.	Pit Preparation	0	0	100 (100)	0	XIV
15.	Weed Management	0	0	100 (100)	0	XV

Table 4.1.14(b) and Fig 4.1.14(b) represents the distribution of respondents based on training need on improved cultivation practices of large cardamom of Mon district. It has been determined that majority of the farmers with mean score of 2.00, needed training in integrated pest management and integrated disease management, and least/no training need was found in the areas of pit preparation and weed management.

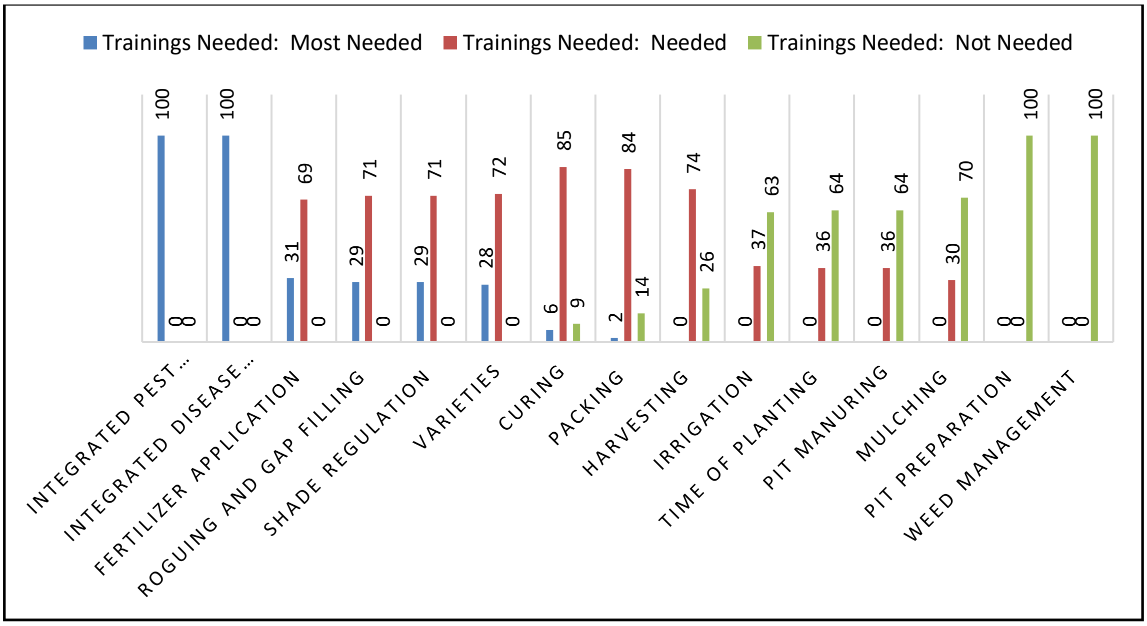


Fig 4.1.14(a) Distribution of respondents based on Training needs on improved cultivation practices of Large Cardamom in Longleng district

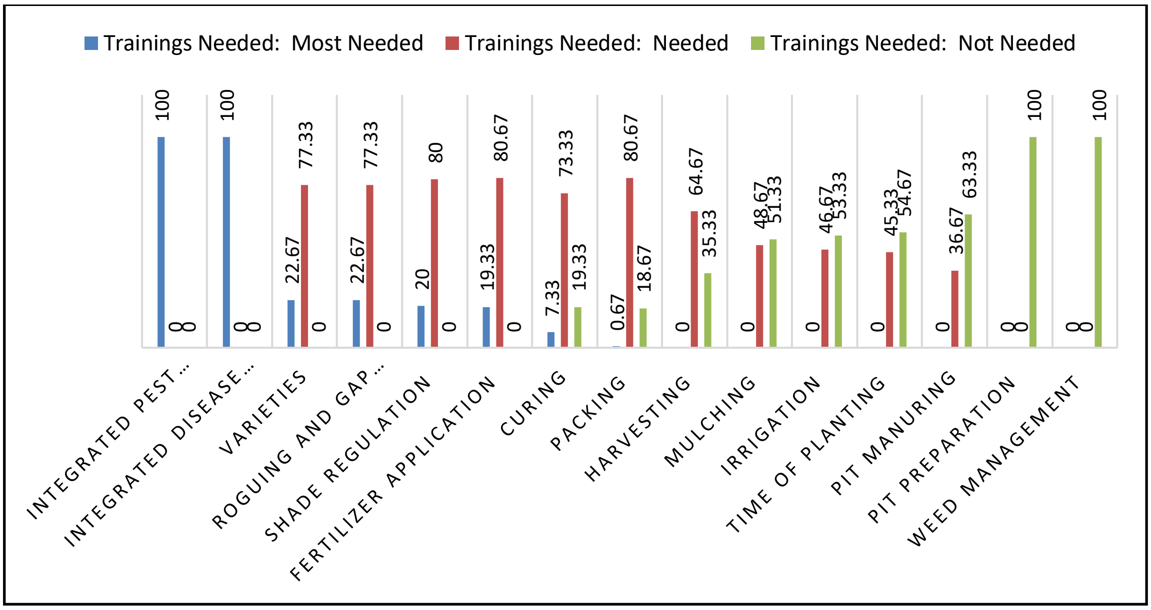


Fig 4.1.14(b) Distribution of respondents based on training needs on improved cultivation practices of Large Cardamom in Mon district

Table 4.1.14(b):Distribution of respondents based on Training needs on improved cultivation practices of Large Cardamom in Mon district

N = 150

Sl. No	Recommended Practices	Trainings Needed			Mean Score	Rank
		Most Needed	Needed	Not Needed		
1.	Integrated Pest Management	150 (100)	0	0	2.00	I
2.	Integrated Disease Management	150 (100)	0	0	2.00	II
3.	Varieties	34 (22.67)	116 (77.33)	0	1.23	III
4.	Roguing and Gap filling	34 (22.67)	116 (77.33)	0	1.23	III
5.	Shade Regulation	30 (20.00)	120 (80.00)	0	1.2	V
6.	Fertilizer Application	29 (19.33)	121 (80.67)	0	1.19	VI
7.	Curing	11 (7.33)	110 (73.33)	29 (19.33)	0.88	VII
8.	Packing	1 (0.67)	121 (80.67)	28 (18.67)	0.82	VIII
9.	Harvesting	0	97 (64.67)	53 (35.33)	0.65	IX
10.	Mulching	0	73 (48.67)	77 (51.33)	0.49	X
11.	Irrigation	0	70 (46.67)	80 (53.33)	0.47	XI
12.	Time of Planting	0	68 (45.33)	82 (54.67)	0.45	XII
13.	Pit Manuring	0	55 (36.67)	95 (63.33)	0.37	XIII
14	Pit Preparation	0	0	150 (100)	0.00	XIV
15	Weed Management	0	0	150 (100)	0.00	XV

It is evident from Table 4.1.14(c) and Fig 4.1.14(c), that 15 (fifteen) preferred needs of the overall respondents of large cardamom were analysed by calculating the Weighted Mean Score and made their ranking. Out of which integrated pest management had first rank with score 2.00 followed by Integrated Disease Management with score of 2.00. The other training needs were varieties (1.25), followed by roguing and gap filling (1.25) and shade

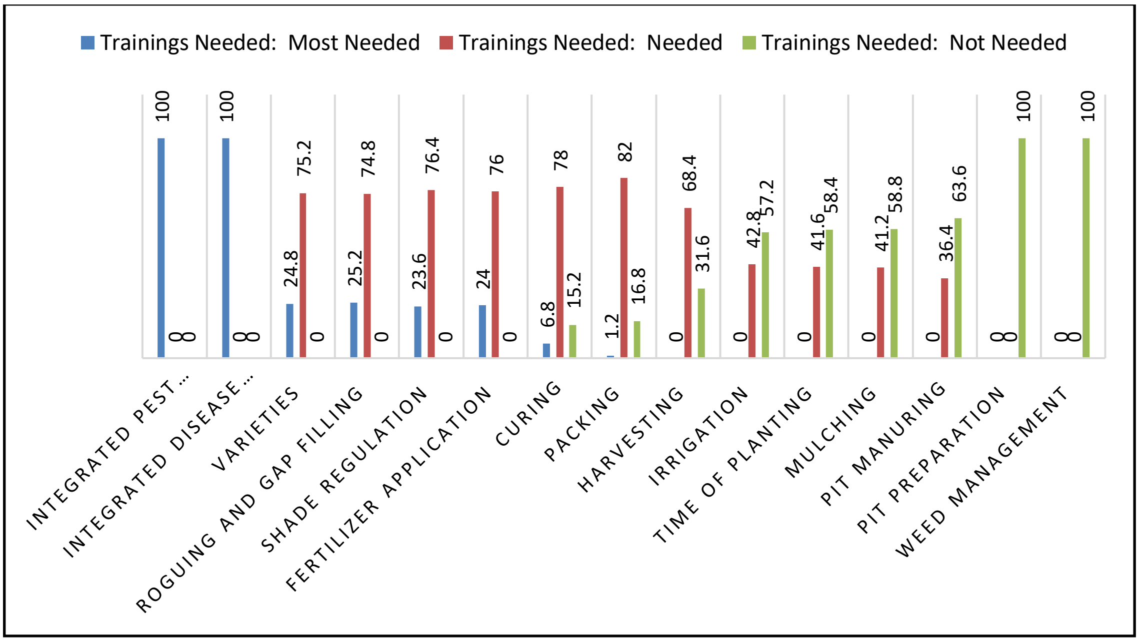


Fig 4.1.14(c): Distribution of respondents based on overall training needs on improved cultivation practices of Large Cardamom

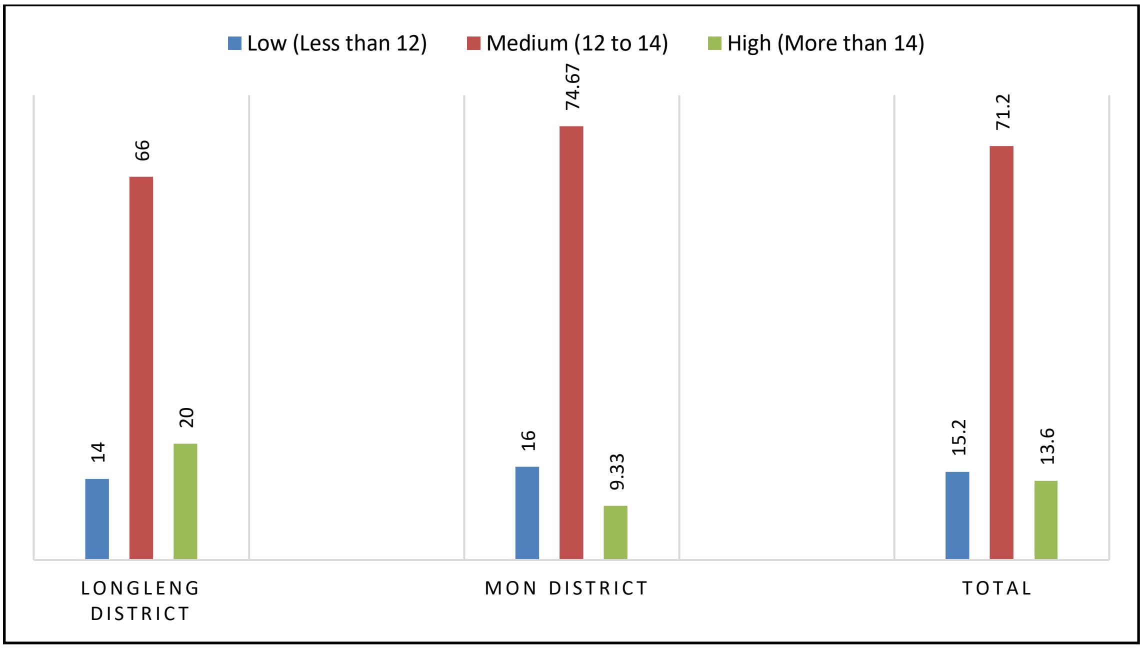


Fig 4.1.14(d): Distribution of respondents on overall training needs

regulation (1.24). Most of the respondent perceived that fertilizer application (1.24) were also training need area. Curing, packing and harvesting were ranked VII, VIII and IX with mean score of 0.92, 0.84 and 0.68 respectively. The area of irrigation having mean score of 0.43 was ranked X. The areas of time of planting (0.42), mulching (0.41) and pit manuring (0.36) were ranked XI, XII and XIII respectively. The least important training need areas was identified as pit preparation and weed management having mean score of 0 and was ranked at XIV and XV position with respect to other training need areas. Thus, the highest rank in terms of training need areas was found in integrated pest management and integrated disease management, while the lowest rank was found in pit preparation and weed management.

Table 4.1.14(c): Distribution of respondents based on Training needs on improved cultivation practices of Large Cardamom

N = 250

Sl. No	Recommended Practices	Trainings Needed			Mean Score	Rank
		Most Needed	Needed	Not Needed		
1.	Integrated Pest Management	250 (100)	0 (0)	0 (0)	2.00	I
2.	Integrated Disease Management	250 (100)	0 (0)	0 (0)	2.00	II
3.	Varieties	62 (24.80)	188(75.20)	0(0)	1.25	III
4.	Roguing and Gap filling	63 (25.20)	187 (74.80)	0 (0)	1.25	IV
5.	Shade Regulation	59 (23.60)	191 (76.40)	0 (0)	1.24	V
6.	Fertilizer Application	60 (24.00)	190 (76.00)	0 (0)	1.24	VI
7.	Curing	17 (6.80)	195 (78.00)	38 (15.20)	0.92	VII
8.	Packing	3 (1.20)	205 (82.00)	42 (16.80)	0.84	VIII
9.	Harvesting	0 (0)	171 (68.40)	79 (31.60)	0.68	IX
10.	Irrigation	0 (0)	107 (42.80)	143 (57.20)	0.43	X
11.	Time of Planting	0 (0)	104 (41.60)	146 (58.40)	0.42	XI
12.	Mulching	0 (0)	103 (41.20)	147 (58.80)	0.41	XII
13.	Pit Manuring	0 (0)	91 (36.40)	159 (63.60)	0.36	XIII
14.	Pit Preparation	0 (0)	0 (0)	250 (100)	0.00	XIV
15.	Weed Management	0 (0)	0 (0)	250 (100)	0.00	XV

A perusal of result in Table 4.1.14(d) and Fig 4.1.14(d) indicates that majority (71.20 %) of the respondents had medium level of training need about improved large cardamom cultivation practices, whereas 15.20 per cent and 13.60 per cent had low and high level of training need respectively. The plausible reason is that huge cardamom is badly infected with chirkey and fookrey, resulting in substantial output reductions, hence the majority of growers required integrated insect pest and disease control training.

Table 4.1.14(d): Distribution of respondents on overall Training Needs

N = 250

Sl. No	Overall Training Needs	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Low (Less than 12)	14	14.00	24	16.00	38	15.20
2.	Medium (12 to 14)	**66**	**66.00**	**112**	**74.67**	**178**	**71.20**
3.	High (More than 14)	20	20.00	14	9.33	34	13.60
	Total	100	100	150	100	250	100
	Mean	13.15		12.97		13.04	
	S.D	1.47		1.37		1.41	

4.1.15 Information Sources Utilization

From Table 4.1.15(a)it was found that formal information sources ranked first with a mean score of 4.27, followed by formal information sources with a mean score of 3.73, and mass-media sources with a mean score of 3.16. When it came to formal information sources, the majority (44.00%) of them contacted KVK the most. Furthermore, 61.00% of respondents had interacted with AFA/HFA, whereas 98.00% had no engagement with NGOs.

When it came to using official information sources, 42.00% of respondents contacted friends the most, followed by most (92.00%) of farmers who contacted relatives, while 76.00% of them never contacted progressive farmers. In terms of mass media information sources, radio was the most frequently used (17.00%) by the majority (17.00%). Furthermore, the majority

(58.00%) of them read newspapers on occasion, whereas 77.00% never watched television.

Table 4.1.15(a). Distribution of respondents of Longleng district based on their utilization of information sources

N = 100

Sl. No	**Formal Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	AFA/HFA	8 (8.00)	61 (61.00)	31 (31.00)	4.27	I
2.	AO/SDAO/HO	31 (31.00)	59 (59.00)	10 (10.00)		
3.	KVK	26 (26.00)	30 (30.00)	44 (44.00)		
4.	ATMA	8 (8.00)	79 (79.00)	13 (13.00)		
5.	NGOs	98 (98.00)	2 (2.00)	0		
Sl. No	**Informal Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	Friends	1 (1.00)	57 (57.00)	42 (42.00)	3.73	II
2.	Relatives	0	92 (92.00)	8 (8.00)		
3.	Neighbours	11 (11.00)	79 (79.00)	10 (10.00)		
4.	Progressive Farmers	76 (76.00)	23 (23.00)	1 (1.00)		
Sl. No	**Mass Media Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	Radio	56 (56.00)	27 (27.00)	17 (17.00)	3.16	III
2.	Television	77 (77.00)	23 (23.00)	0		
3.	Exhibition	66 (66.00)	29 (29.00)	5 (5.00)		
4.	Extension Publications	64 (64.00)	36 (36.00)	0		
5.	Newspaper	42 (42.00)	58 (58.00)	0		
6.	Mobile	56 (56.00)	44 (44.00)	0		
7.	Internet	45 (45.00)	56 (56.00)	0		

Table 4.1.15(b) and shows the information sources used by the Mon district's significant cardamom growers. It was discovered that formal sources of information rated best (4.85) among the various sources of information utilisation, followed by informal sources of information (3.99) and mass-media information sources (3.47). When it came to formal information sources, the majority (58.00%) contacted KVK the most. Furthermore, 68.67% of them contacted ATMA on occasion, whereas 100.00% had never contacted NGOs.

In terms of informal information sources, only 34.00 per cent contacted friends most frequently, 83.33 % contacted neighbours occasionally, and 66.67 per cent farmers never contacted progressive farmers. In terms of accessing various mass media sources, the majority (20.00 %) have attended exhibitions on several occasions and 58.67 per cent have used the internet on occasion, while 70.00 per cent have never used extension publications.

Table 4.1.15(b). Distribution of respondents of Mon district based on their utilization of information sources

N = 150

Sl. No	**Formal Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	AFA/HFA	15 (10.00)	55 (36.67)	80 (53.33)	4.85	I
2.	AO/SDAO/HO	73 (48.67)	58 (38.67)	19 (12.67)		
3.	KVK	3 (2.00)	60 (40.00)	87 (58.00)		
4.	ATMA	7 (4.67)	103 (68.67)	0		
5.	NGOs	150 (100)	0	0		
Sl. No	**Informal Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	Friends	0	99 (66.00)	51 (34.00)	3.99	II
2.	Relatives	0	122 (81.33)	28 (18.67)		
3.	Neighbours	3 (2.00)	125 (83.33)	22 (14.67)		
4.	Progressive Farmers	100 (66.67)	50 (33.33)	0		
Sl. No	**Mass Media Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	Radio	82 (54.67)	47 (31.33)	21 (14.00)	3.47	III
2.	Television	95 (63.33)	55 (36.67)	0		
3.	Exhibition	85 (56.67)	35 (23.33)	30 (20.00)		
4.	Extension Publications	105 (70.00)	44 (29.33)	1 (0.67)		
5.	Newspaper	89 (59.33)	56 (37.33)	5 (3.33)		
6.	Mobile	68 (45.33)	82 (54.67)	0		
7.	Internet	62 (41.33)	88 (58.67)	0		

According to Table 4.1.15(c) and Fig 4.1.15(c), overall analysis revealed that the mean score for using informal information sources was the highest (4.62) among the formal sources of information used by farmers, followed by mass media sources (3.90) and informal sources (3.88). When it came to formal information sources, the majority (52.40 %) of respondents contacted KVK the most. Furthermore, 72.80 per cent of them contacted ATMA on occasion, whereas 99.20 per cent had never contacted NGOs.

In terms of utilising various mass media sources, the majority (15.20 %) of farmers preferred radio as their primary source of information. Furthermore, the majority (57.20%) of them used the internet occasionally, while 68.80 per cent never used television as a source of mass media information. In terms of informal information sources, only 38.20 per cent of respondents contacted acquaintances the most frequently, followed by the majority (85.60 %) of farmers contacting relatives, while 70.40 per cent never contacted progressive farmers for their informal information needs.

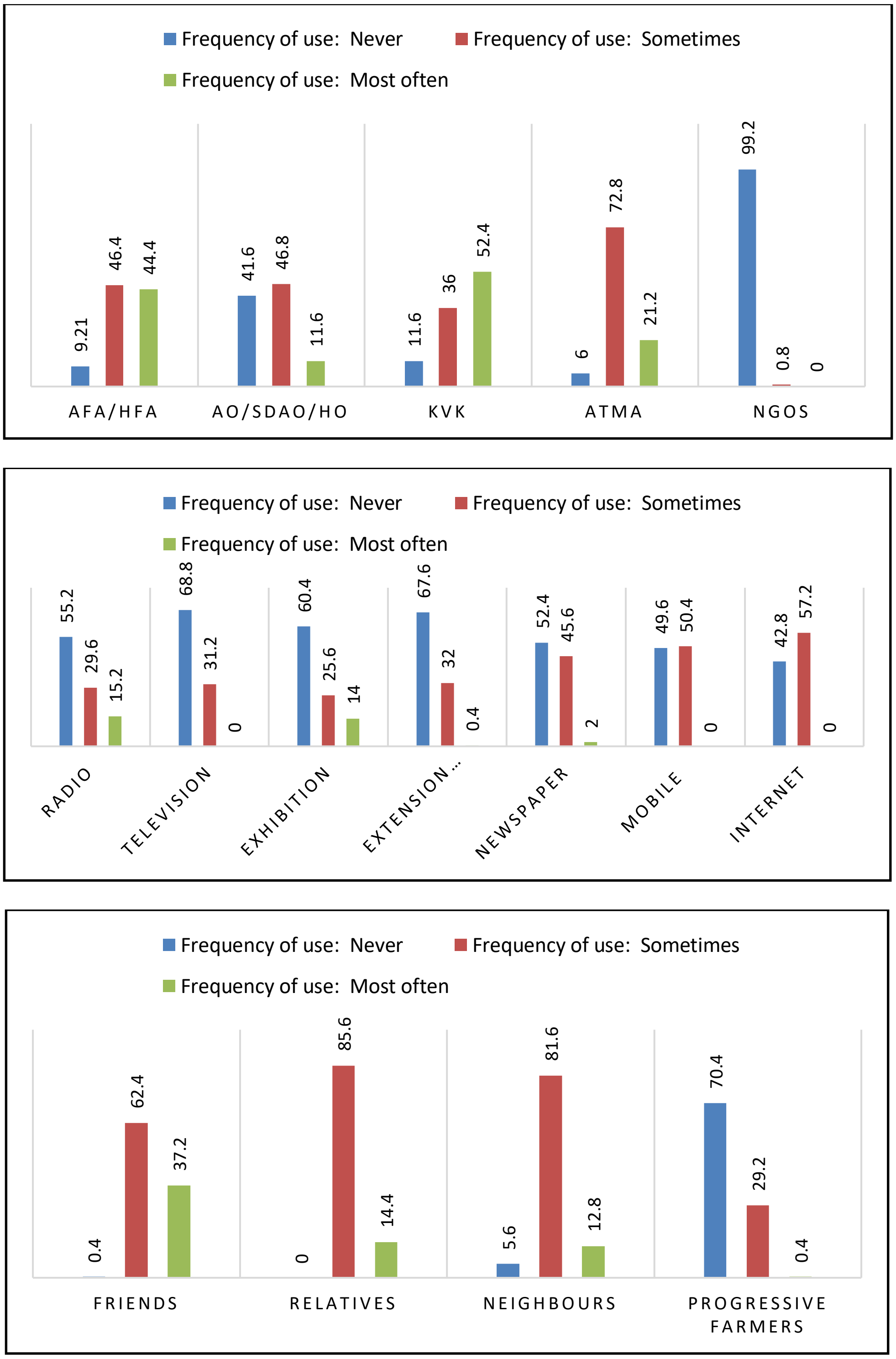


Fig 4.1.15(c). Distribution of respondents based on their utilization of information sources for Large cardamom growers

Table 4.1.15(c). Distribution of respondents based on their utilization of information sources for Large cardamom growers

N = 250

Sl. No	Formal Sources	Frequency of use			Mean Score	Rank
		Never	Sometimes	Most often		
1.	AFA/HFA	23 (9.20)	116 (46.40)	11 (44.40)	4.62	I
2.	AO/SDAO/HO	104 (41.60)	117 (46.80)	29 (11.60)		
3.	KVK	29 (11.60)	90 (36.00)	131 (52.40)		
4.	ATMA	15 (6.00)	182 (72.80)	53 (21.20)		
5.	NGOs	248 (99.20)	2 (0.80)	0 (0)		
Sl. No	**Mass Media Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	Radio	138 (55.20)	74 (29.60)	38 (15.20)	3.90	II
2.	Television	172 (68.80)	78 (31.20)	0 (0.00)		
3.	Exhibition	151 (60.40)	64 (25.60)	35 (14.00)		
4.	Extension Publications	169 (67.60)	80 (32.00)	1 (0.40)		
5.	Newspaper	131 (52.40)	114 (45.60)	5 (2.00)		
6.	Mobile	124 (49.60)	126 (50.40)	0 (0)		
7.	Internet	107 (42.80)	143 (57.20)	0 (0)		
Sl. No	**Informal Sources**	**Frequency of use**			**Mean Score**	**Rank**
		Never	**Sometimes**	**Most often**		
1.	Friends	1 (0.40)	156 (62.40)	93 (37.20)	3.88	III
2.	Relatives	0 (0)	214 (85.60)	36 (14.40)		
3.	Neighbours	14 (5.60)	204 (81.60)	32 (12.80)		
4.	Progressive Farmers	176 (70.40)	73 (29.20)	1 (0.40)		

Table 4.1.15(d) and Fig 4.1.15(d) revealed that 84.00 per cent of the large cardamom growers of Longleng district had medium level of information sources utilization; followed by 12.00 per cent of them had low and 4.00 had high level of information sources utilization respectively. In case of large cardamom growers of Mon district, majority (88.67 %) of them had medium

level of information sources utilization, followed by 7.33 per cent and 4.00 per cent of them having high and minimal level of information sources utilization respectively.

In case of overall large cardamom grower, 86.80 per cent of them had medium level of information sources utilization, while 7.20 per cent of them had low and 6.00 per cent of them had high level of information sources utilization.

Table 4.1.15(d). Distribution of respondents based on overall utilization of information sources for Large Cardamom cultivation

N = 250

Sl. No	Overall Utilization of Information Sources	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Low (Less than 10)	12	12.00	6	4.00	18	7.20
2.	Medium (10 to 14)	84	84.00	133	88.67	217	86.80
3.	High (More than 14)	4	4.00	11	7.33	15	6.00
	Total	100	100	150	100	250	100
	Mean	11.16		12.31		11.85	
	S.D	1.72		1.75		1.83	

Z = -5.1936**

** Significant at 1% level of probability

4.1.16 Social participation

The extent to which an individual is actively involved in community affairs is referred to as social participation. It also has a significant impact on farmers'/farm women's adoption behaviour. Those with a broader social contract are likely to be more knowledgeable and resourceful, and as a result, they may aid in the diffusion of innovations and adopt new practises, ideas, and methods before others. With this in mind, the social participation of large cardamom growers was investigated, the outcomes of which are shown in Table 4.1.16 and Fig 4.1.16.

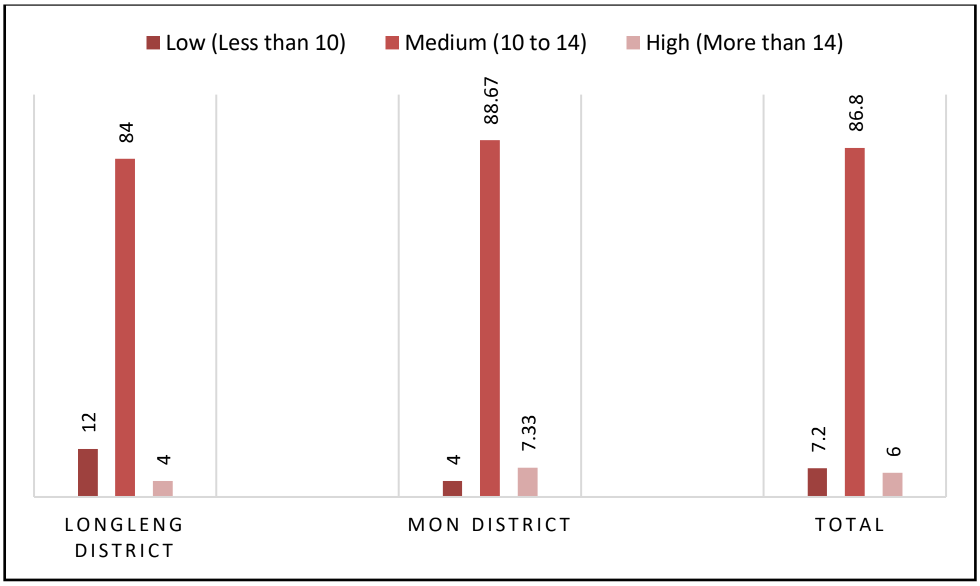


Fig 4.1.15(d). Distribution of respondents based on overall utilization of information sources for Large Cardamom cultivation

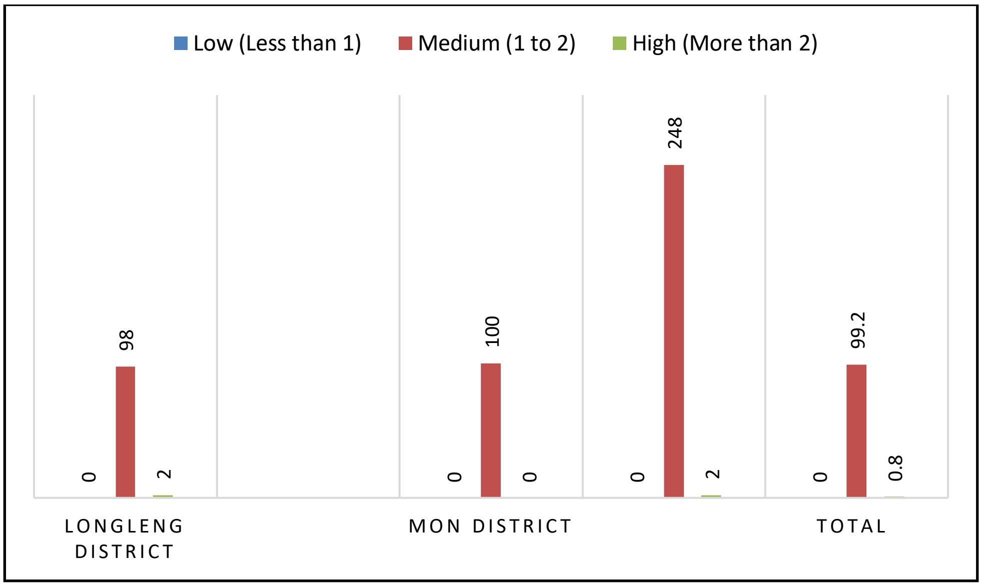


Fig 4.1.16: Distribution of respondents based on their level of social participation

Table 4.1.16 revealed that majority of the large cardamom growers of Longleng had medium level (98.00 %) of social participation, followed by high level of social participation (2.00 %) and none of the respondents had low level of social participation. It is also revealed that in Mon district 100 per cent of the respondents had medium level of social participation.

In pooled data of both the districts, it was observed that majority (98.20 %) of the respondents had medium level of social participation, followed by 0.80 per cent of them having high level of social participation and none having low level of social participation.

Table 4.1.16: Distribution of respondents based on their level of Social Participation

N = 250

Sl. No	Level of Social Participation	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Low (Less than 1)	0	0	0	0	0	0
2.	Medium (1 to 2)	**98**	**98.00**	**150**	**100**	**248**	**99.20**
3.	High (More than 2)	2	2.00	0	0	2	0.80
	Total	100	100	150	100	250	100
	Mean	1.58		1.54		1.56	
	S.D	0.54		0.50		0.51	

$Z = 0.6368^{NS}$

4 .1.17 Marketing Pattern

It could be seen from the Table 4.1.17(a) and Fig 4.1.17(a) that 100 per cent of the respondents from both the districts cultivate large cardamom to sell in the nearest market at whatever price is available, as it was laborious and lacked sufficient finance for transportation to other market. However, it can be also seen that 27.00 per cent of the large cardamom growers of Longleng and 30.00 per cent of Mon, sell their produce to distant markets for higher profit, when there is bountiful production.

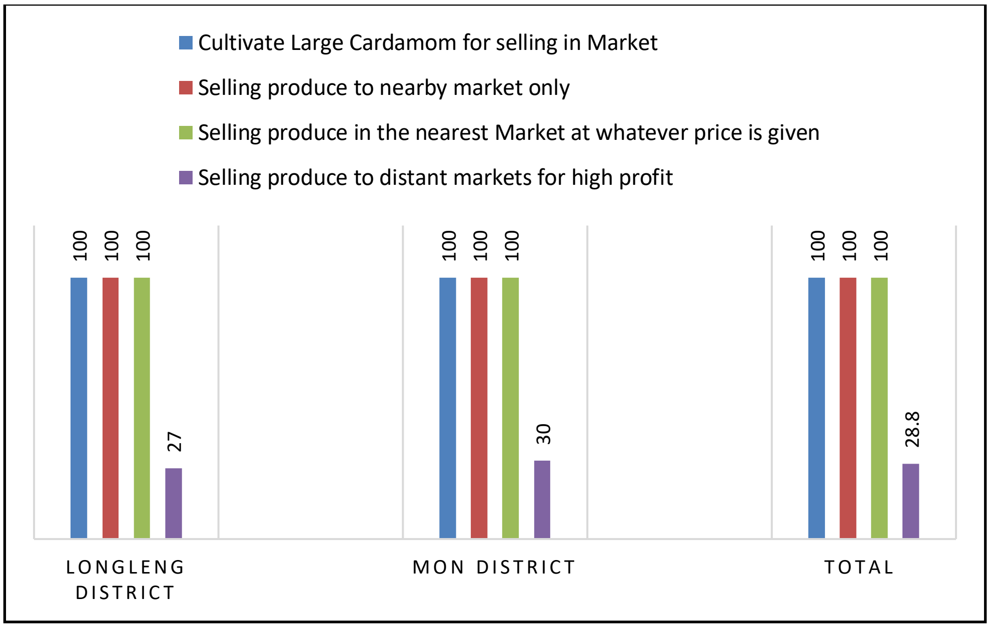


Fig 4.1.17(a). Distribution of respondents based on their Marketing Pattern

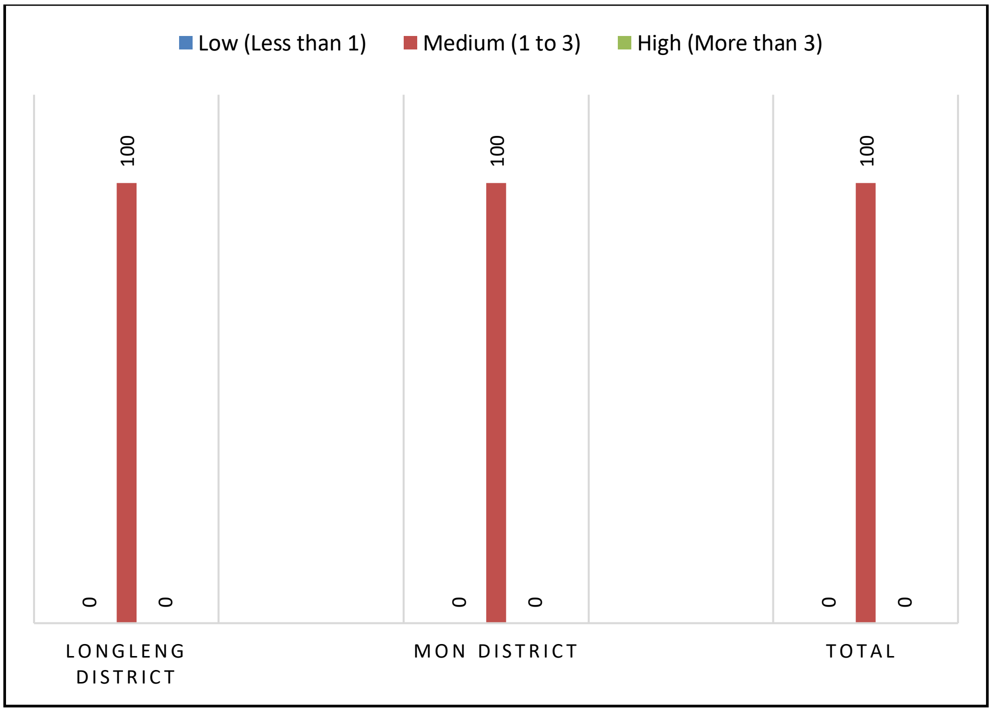


Fig 4.1.18. Distribution of Respondents based on their Extension Contact

Table 4.1.17(a). Distribution of respondents based on their Marketing Pattern

N = 250

Sl. No	Marketing Pattern	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Cultivate Large Cardamom for selling in Market	100	100	150	100	250	100
2.	Selling produce to nearby market only	100	100	150	100	250	100
3.	Selling produce in the nearest Market at whatever price is given	100	100	150	100	250	100
4.	Selling produce to distant markets for high profit	27	27.00	45	30.00	72	28.80

Table 4.1.17(b) depicts the marketing channels utilised by the large cardamom growers, where it was observed that 100 per cent of the respondents utilised the marketing channel, Producer – Commission Agent – Wholesale Agent – Consumer.

Table 4.1.17(b). Distribution of respondents based on their Marketing Channels utilised

Sl. No	Marketing Channels utilised	Frequency	Percentage (%)
1.	Producer → Commission Agent Wholesale Agent → Consumer	250	100
2.	Any other channel	0	0

4.1.18 Extension Contact

From Table 4.1.18 and Fig 4.1.18 it could be seen that 100 per cent of the farmers from both Longleng and Mon district had medium level of extension contact.

One possible explanation for this is that the majority of respondents in their middle and senior years were unable to contact extension personnel on a regular basis due to lack of interest, time, or health issues. As a result, they were unable to travel to extension agencies located far from their villages. Respondents felt that extension personnel were frequently assigned duties other than agriculture, which limited their contact with extension personnel.

Table 4.1.18.Distribution of respondents based on their Extension Contact

N = 250

Sl. No	Level of Extension Contact	Longleng district		Mon district		Total	
		f	%	f	%	f	%
1.	Low (Less than 1)	0	0	0	0	0	0
2.	Medium (1 to 3)	**100**	**100**	**150**	**100**	**250**	**100**
3.	High (More than 3)	0	0	0	0	0	0
	Total	100	100	150	100	250	100
	Mean	2.01		2.06		2.04	
	S.D	0.63		0.66		0.65	

$Z = -0.6866^{NS}$

4.1.19 Economic Motivation

Economic motivation is one of the motivators for engaging in risky activities. Every farmer is driven by the desire to make more money. Relevant data were collected in order to understand the level of economic motivation, and the details are presented below in Table 4.1.19 and Fig 4.1.19.

It could be inferred that majority (86.80 %) of the respondents had medium level of economic motivation followed by 7.20 per cent of high and

6.00 per cent low level of economic motivation. Similar trend was also observed in both Longleng and Mon district with 89.00 per cent and 85.33 per cent medium level of economic motivation, respectively. This medium to high level of economic motivation indicates that the respondents had a basic desire to earn more money, which would have naturally induced farmers to adopt improved cultivation practices of large cardamom. This desire to compete with others in raising their standard of living in order to pay off old debts and fulfil family obligations resulted in medium to high economic motivation.

Table 4.1.19. Distribution of respondents based on their level of Economic Motivation

N = 250

Sl. No	**Level of Economic Motivation**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Low (Less than 1)	5	5.00	10	6.67	15	6.00
2.	Medium (1 to 2)	**89**	**89.00**	**128**	**85.33**	**217**	**86.80**
3.	High (More than 2)	6	6.00	12	8.00	18	7.20
	Total	100	100	150	100	250	100
	Mean	14.23		14.43		14.35	
	S.D	1.27		1.40		1.35	

Z = -1.0521*

* Significant at 5% level of probability

4.1.20 Scientific orientation

Using scientific methods in farming and decision-making depends on how inclined a person is to do so. Scientific orientation is a psychological factor. It was believed that large cardamom growers with a more advanced scientific perspective would use more improved cultivation practices. It is observed from Table 4.1.20 and Fig 4.1.20 that under Longleng district majority (91.00 %) had medium level of scientific orientation and under Mon district majority (84.67 %) had moderate level of scientific orientation.

The overall data shows that more majority (87.20 %) had average level of scientific orientation, followed by low level (12.80 %). It was perceived that there was no respondent who had high level of scientific orientation. It might be because of the complexity of the technology, and the low level of scientific orientation in the farming community may be explained by illiteracy. The education level and extension contact directly influence the large cardamom growers' orientation towards scientific knowledge.

Table 4.1.20: Distribution of respondents based on their level of Scientific Orientation

N=250

Sl. No	Level of Scientific Orientation	Longleng district		Mon district		Total	
		f	**%**	**f**	**%**	**f**	**%**
1.	Low (Less than 13)	9	9.00	23	15.33	32	12.80
2.	Medium (13 to 16)	**91**	**91.00**	**127**	**84.67**	**218**	**87.20**
3.	High (More than 16)	0	0	0	0	0	0
	Total	100	100	150	100	250	100
	Mean	14.17		14.25		14.22	
	S.D	1.30		1.56		1.46	

Z = -0.5017^{NS}

4.1.21 Marketing orientation

The data in Table 4.1.21 and Fig 4.1.21 concluded that the majority indicated that, more than half of respondent 74.40 per cent had medium level of market orientation, whereas 15.60 per cent of respondent had high market orientation and 10.00 per cent of respondent found high market orientation. The reason behind such findings may be the large cardamom grower were having medium farming experience might be also due to moderate social participation and medium sources of information.

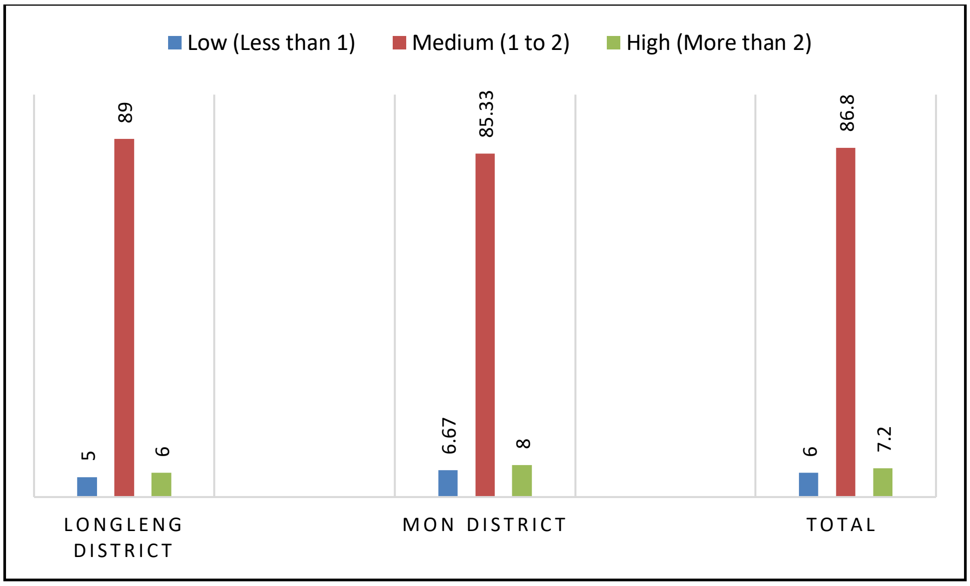


Fig 4.1.19. Distribution of respondents based on their level of Economic Motivation

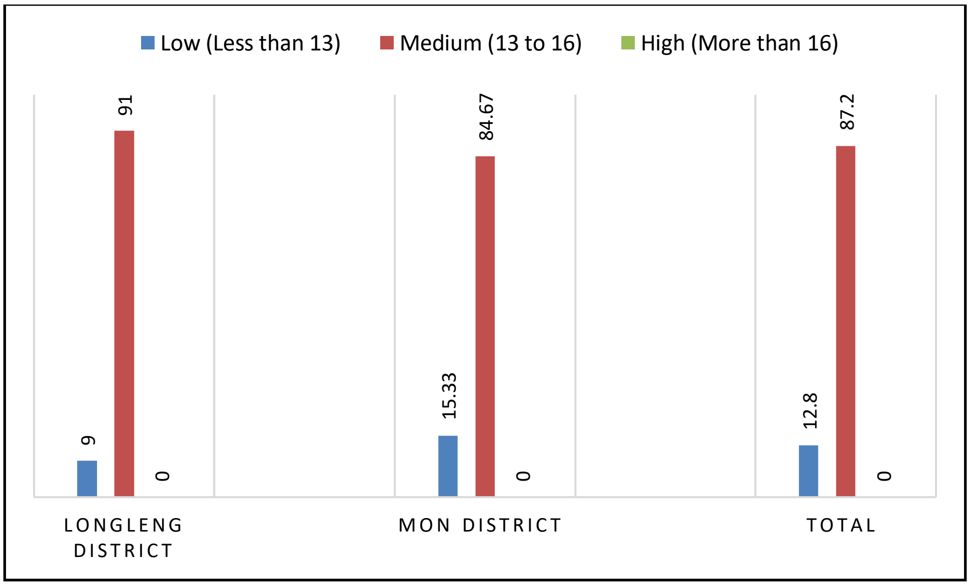


Fig 4.1.20: Distribution of respondents based on their level of Scientific Orientation

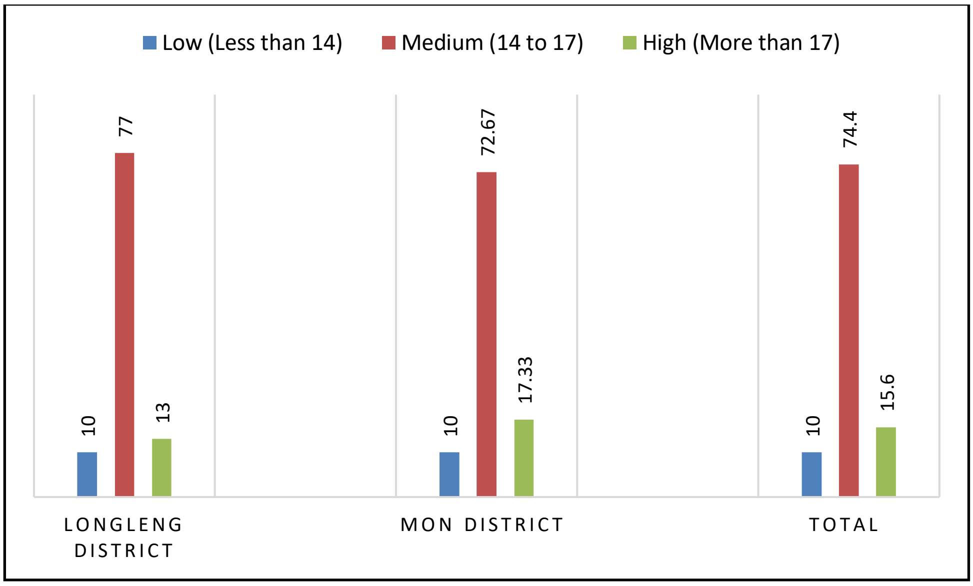


Fig 4.1.21: Distribution of respondents based on their level of Marketing Orientation

Table 4.1.21: Distribution of respondents based on their level of Marketing Orientation

N=250

Sl. No	**Level of marketing orientation**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Low (Less than 14)	10	10.00	15	10.00	25	10.00
2.	Medium (14 to 17)	**77**	**77.00**	**109**	**72.67**	**186**	**74.40**
3.	High (More than 17)	13	13.00	26	17.33	39	15.60
	Total	100	100	150	100	250	100
	Mean	15.69		15.74		15.72	
	S.D	1.69		1.62		1.65	

$Z = -0.1934^{NS}$

4.2 Knowledge, attitude and extent of adoption of improved cultivation practices of large cardamom

4.2.1. Knowledge of improved cultivation practices of large cardamom

Table 4.2.1(a) disclosed that majority 100 per cent of the large cardamom growers of Longleng district had very high knowledge on climate and harvesting, followed by 47.00 per cent of the with high knowledge on mulching, 79.00 per cent of them had medium knowledge on curing, 58.00 per cent of them had low knowledge on planting and 100 per cent had no knowledge on irrigation.

Table 4.2.1(a). Knowledge level on improved cultivation practices of Large Cardamom in Longleng district

N = 100

Sl. No	Recommended Practices	Knowledge Level				
		Very high knowledge (76 to 100 %)	High knowledge (51 to 75 %)	Medium knowledge (26 to 50 %)	Low knowledge (1 to 25 %)	No knowledge (0 %)
1.	Climate	**100 (100 %)**	0	0	0	0
2.	Soil	50 (50.00 %)	0	44 (44.00 %)	0	6 (6.00 %)
3.	Varieties	97 (97.00 %)	0	0	0	3 (3.00 %)
4.	Propagation	91 (91.00 %)	0	0	0	9 (9.00 %)
5.	Planting	0	3 (3.00 %)	39 (39.00 %)	**58 (58.00 %)**	0
6.	Mulching	26 (26.00 %)	**47 (47.00 %)**	27 (27.00 %)	0	0
7.	Irrigation	0	0	0	0	**100 (100 %)**
8.	Weed Management	58 (58.00 %)	24 (24.00 %)	3 (3.00 %)	15 (15.00 %)	0
9.	Shade Regulation	68 (68.00 %)	5 (5.00 %)	15 (15.00 %)	0	12 (12.00 %)
10.	Roguing& Gap Filling	83 (83.00 %)	0	17 (17.00 %)	0	0
11.	IDM	0	7 (7.00 %)	65 (65.00 %)	28 (28.00 %)	0
12.	IPM	0	3 (3.00 %)	39 (39.00 %)	38 (38.00 %)	20 (20.00 %)
13.	Harvesting	**100 (100 %)**	0	0	0	0
14.	Curing	0	0	**79 (79.00 %)**	0	21 (21.00 %)
15.	Packing	23 (23.00 %)	0	77 (77.00 %)	0	0

Table 4.2.1(b) revealed that majority 100 per cent of the large cardamom growers of Mon district had very high knowledge on climate and harvesting, followed by 48.67 per cent of the with high knowledge on mulching, 84.00 per cent of them had medium knowledge on curing, 72.67 per cent of them had low knowledge on planting and 100 per cent had no knowledge on irrigation.

Table4.2.1(b). Knowledge level on improved cultivation practices of Large Cardamom in Mon district

N = 150

Sl. No	**Recommended Practices**	**Knowledge Level**				
		Very high knowledge (76 to 100 %)	**High knowledge (51 to 75 %)**	**Medium knowledge (26 to 50 %)**	**Low knowledge (1 to 25 %)**	**No knowledge (0 %)**
1.	Climate	**150 (100 %)**	0	0	0	0
2.	Soil	84 (56.00 %)	0	58 (38.67 %)	0	8 (5.33 %)
3.	Varieties	145 (96.67 %)	0	0	0	5 (3.33 %)
4.	Propagation	135 (90.00 %)	0	0	0	15 (10.00 %)
5.	Planting	5 (3.33 %)	4 (2.67 %)	32 (21.33 %)	**109 (72.67 %)**	0
6.	Mulching	35 (23.33 %)	**73 (48.67 %)**	42 (28.00 %)	0	0
7.	Irrigation	0	0	0	0	**150 (100 %)**
8.	Weed Management	98 (65.33 %)	28 (18.67 %)	3 (2.00 %)	21 (14.00 %)	0
9.	Shade Regulation	90 (60.00 %)	10 (6.67 %)	21 (14.00 %)	0	29 (19.33 %)
10.	Roguing& Gap Filling	131 (87.33 %)	0	19 (12.67 %)	0	0
11.	IDM	0	7 (4.67 %)	103 (68.67 %)	38 (25.33 %)	2 (1.33 %)
12.	IPM	3 (2.00 %)	14 (9.33 %)	85 (56.67 %)	10 (6.67 %)	38 (25.33 %)
13.	Harvesting	**150 (100 %)**	0	0	0	0
14.	Curing	0	0	**126 (84.00 %)**	0	24 (16.00 %)
15.	Packing	37 (24.67 %)	0	113 (75.33 %)	0	0

Woodman *et al.* (1993) defined knowledge as "information, ideas, and skills obtained from a specific process through a new idea." It entails learning and developing intellectual abilities. This includes remembering or recognising facts, procedural patterns, and concepts that help to develop intellectual abilities and skills. Farmers who were knowledgeable were willing to accept technological innovation, and vice versa. The below Table 4.2.1(c) describes the distribution of large cardamom growers as per their practice-wise knowledge level of large cardamom growers about improved large cardamom cultivation practices.

1. **Climate**

Large cardamom grows successfully on slopes under the canopy of lofty evergreen forest trees from 600-1800 m above MSL. High humidity and a cool environment with moderate shade are required for healthy growth. Temperatures between 6 and 25 °C are ideal. The annual average rainfall ranges between 2000 and 3500 mm. Climate and planting time knowledge revealed that the majority (100 %) of large cardamom growers had very high knowledge.

2. **Soil**

Large cardamom cultivation requires a well-drained, rich forest soil with plenty of humus and leaf moulds. Waterlogged conditions are not appropriate. A pH range of 5.8 to 6.5 is ideal for soil. According to the table, 53.60 percent had very high knowledge of soil, 41.20 percent had medium knowledge, and only 5.20 percent had no knowledge.

3. **Varieties**

Knowledge of recommended varieties of large cardamom (Ramsey, Sawney and Golsey) showed that 96.80 per cent of the respondents exhibited extensive familiarity with the recommended varieties, with only 3.20% reporting no knowledge of them.

4. **Propagation**

Both vegetative and seed propagation are used to propagate large cardamom. Planting a section of the rhizome called a slip from an established clump is the most common method of vegetative propagation. It produces two seasons earlier than those grown from seeds. Seed propagation is accomplished by sowing seeds in a nursery and transplanting seedlings to the main field. Planting material should be disease-free and high-yielding. The data in the Table showed that majority (90.40 %) of the large cardamom growers had very high knowledge about propagation and 9.60 per cent had no knowledge regarding propagation. Correct knowledge about propagation by the farmers was due to their interaction with experienced farmers, more extension contacts and frequent contacts with agriculture and allied department and also their experience in farming.

5. **Planting**

For the main planting, the chosen land is cleared of all growth, weeds, and so on. Pits of 1x1x1 ft are prepared for planting at a distance of 1.5x1.5 m. Top soil and 2-4 kgs FYM or 10 gm compost inoculated with Trichoderma should be added to the pit. Planting is done from May to July, when there is adequate soil moisture, atmospheric humidity, and optimal temperature. It was found that majority (66.60 %) had low knowledge, followed by 28.40 per cent with medium knowledge, 2.80 per cent with significant knowledge and 2.00 per cent with very high knowledge.

6. **Mulching**

Mulching has been shown to effectively conserve soil moisture and control weed growth. Soon after planting, the plant's base should be mulched with dried leaves. It was found that 48.00 per cent had high knowledge regarding mulching, 27.20 per cent has moderate knowledge and 24.80 has very high knowledge regarding mulching. Mulching is widely used by farmers because it produces higher yields due to the increased nutrient content of mulch.

7. Irrigation

Irrigation on large cardamom field should be done from December to April at an interval of 10 days. It was witnessed that 100 per cent of the respondents had no knowledge regarding recommended irrigation, the probable reason was that the growers were dependent on rain and it was tasking for them to make irrigation facilities like harvesting unit or bore wells in their field.

8. Weed Management

Weeding is necessary on a regular basis during the first and second years of planting, but the problem lessens as foliage covers the entire field. Weeding is done throughout the year, depending on the weed population. Weeding should be done at least twice a year, in May and June, and before harvesting. Weeding by scraping the soil is a common practise that should be avoided because it harms the soil structure. Weeds that have been uprooted can be used as organic compost and mulch. It was found that majority (61.60 %) had very high knowledge regarding weed management, 20.80 per cent had high knowledge, 15.20 per cent had low knowledge and 2.40 per cent has medium knowledge regarding weed management.

9. Shade Regulation

Large cardamom does not tolerate direct sunlight, and either too much or too little shade hinders its growth and development. The shade trees keep the soil and air moist, which is essential for cardamom cultivation. Shade requirements vary depending on land, soil, rainfall patterns, crop combination, and other factors. Tall-growing trees are pruned regularly at a height of 4-5 m. it was found that 63.20 per cent of the respondents had very high knowledge regarding shade regulation, while 16.40 per cent, 14.40 per cent and 6.00 per cent had no knowledge, medium knowledge and high knowledge respectively.

10. Roguing and Gap Filling

Large cardamom begins bearing in the main field after the third year of transplanting. The economic production period lasts from the fifth to the tenth year, after which the yield decreases. After the ninth year, replanting is required. When virus diseases are detected, it is recommended that the entire plantation is removed and replaced with healthy plants. May and June are ideal months for gap filling. It was determined that 85.60 percent had extremely high understanding, while 14.40 per cent had mid knowledge concerning roguing and gap filling.

11. Integrated Disease Management

Respondents could identify the various diseases (Foorkey, leaf spot, clump rot and damping off) prevailing in their field, on the other hand, they have no knowledge of the disease's cause or management. Furthermore, viral disease management necessitates the incineration of infected plants, which is difficult to persuade growers to do. It was found that 67.20 per cent had medium knowledge regarding IDM, followed by 26.40 per cent with low knowledge, 5.60 per cent with high knowledge and only 0.80 per cent with no knowledge.

12. Integrated Pest Management

It was found that 49.60 per cent had medium knowledge, followed by 23.30 per cent with no knowledge, 19.20 per cent with low knowledge, 6.80 per cent with high knowledge and 1.20 per cent with very high knowledge. It was observed that the respondents know about stem borer and cardamom weevil, and were correctly aware or come across these pests, but had very low knowledge regarding its management.

13. Harvesting

Plants raised from seeds bear fruit after 5 years, and vegetative propagated plants bear fruit after 3 years. Flowering begins in February, and the best period to harvest is from August through September. Harvesting is done by cutting ripe panicles when the seeds of the capsules turn brown. It was observed that 100 per cent of the respondent had correct knowledge about maturity of large cardamom and indicators of maturity.

14. Curing

The freshly harvested capsules are immediately cured to retain only 10-13 % moisture on dry weight basis. Curing technique involves direct heating with optimum temperature range (50-55 °C). It was found that 82.00 per cent had medium knowledge and 18.99 per cent has no knowledge.

15. Packing

The cured produce needs to be packed in insect proof bags. Coal tar coated and polythene lined gunny bags are effective. It could be inferred from the data that 76.00 per cent of the respondents had medium knowledge, followed by 24.00 per cent with very high knowledge.

Table 4.2.1(c).Overall knowledge level on improved cultivation practices of Large Cardamom

N = 250

Sl. No	Recommended Practices	Knowledge Level				
		Very high knowledge (76 to 100 %)	**High knowledge (51 to 75 %)**	**Medium knowledge (26 to 50 %)**	**Low knowledge (1 to 25 %)**	**No knowledge (0 %)**
1.	Climate	**250 (100 %)**	0	0	0	0
2.	Soil	134 (53.60 %)	0	103 (41.20 %)	0	13 (5.20 %)
3.	Varieties	242 (96.80 %)	0	0	0	8 (3.20 %)
4.	Propagation	226 (90.40 %)	0	0	0	24 (9.60 %)
5.	Planting	5 (2.00 %)	7 (2.80 %)	71 (28.40 %)	**160 (66.80 %)**	0
6.	Mulching	62 (24.80 %)	**120 (48.00 %)**	68 (27.20 %)	0	0
7.	Irrigation	0	0	0	0	**250 (100 %)**
8.	Weed Management	154 (61.60 %)	52 (20.80 %)	6 (2.40 %)	38 (15.20 %)	0
9.	Shade Regulation	158 (63.20 %)	15 (6.00 %)	36 (14.40 %)	0	41 (16.40 %)
10.	Roguing& Gap Filling	214 (85.60 %)	0	36 (14.40 %)	0	0
11.	IDM	0	14 (5.60 %)	168 (67.20 %)	66 (26.40 %)	2 (0.80 %)
12.	IPM	3 (1.20 %)	17 (6.80 %)	124 (49.60 %)	48 (19.20 %)	58 (23.20 %)
13.	Harvesting	**250 (100 %)**	0	0	0	0
14.	Curing	0	0	**205 (82.00 %)**	0	45 (18.00 %)
15.	Packing	60 (24.00 %)	0	190 (76.00 %)	0	0

It is observed from the Table 4.2.1(d) and Fig 4.2.1(d) that majority (71.20 %) of the large cardamom farmers had medium level of knowledge about improved cultivation practices followed by high (16.40 %) level and low (12.40 %) level of knowledge about improved large cardamom cultivation practices. The increase in medium knowledge is due to the fact that the majority of large cardamom growers had medium economic motivation, more extension contacts, and frequent participation in extension educational activities, and they could gain information about improved cultivation practises in large cardamom with the help of KVK and other related institutions that provided information on a regular basis. Due to the excellent yields of huge cardamom, farmers sought knowledge on enhanced practises. As a result, farmers planning to grow significant amounts of cardamom will seek as much current knowledge about large cardamom production as possible from all accessible sites.

Table 4.2.1(d). Overall Knowledge Index on recommended practices for cultivation of Large Cardamom

N = 250

Sl. No	**Knowledge level**	**Longleng district**		**Mon district**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
1.	Low (Less than 47)	16	16.00	25	16.67	41	16.40
2.	Medium (47 to 58)	**74**	**74.00**	**104**	**69.33**	**178**	**71.20**
3.	High (More than 58)	10	10.00	21	14.00	31	12.40
	Total	100	100	150	100	250	100
	Mean	51.95		52.31		52.16	
	SD	5.10		5.72		5.47	

$Z = -0.3809^{NS}$

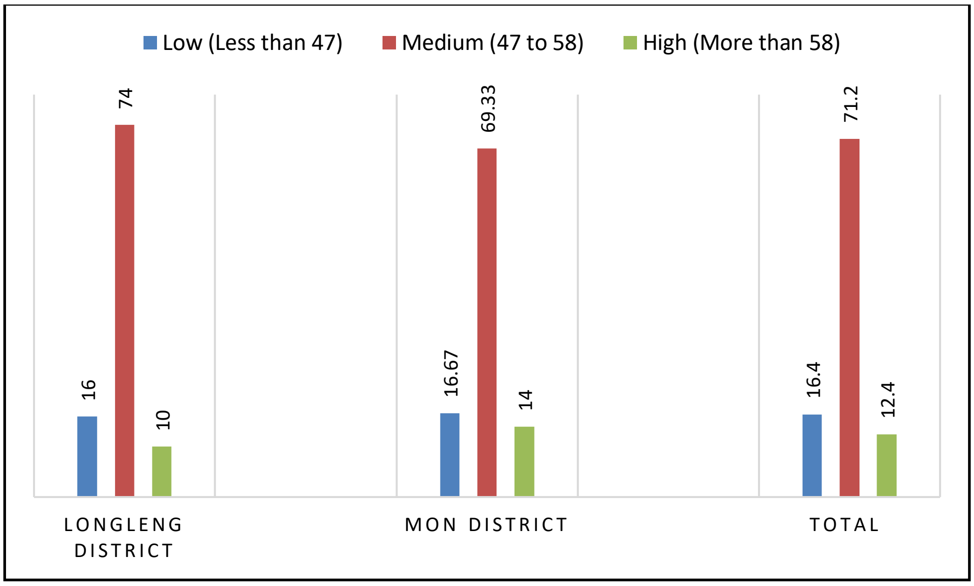


Fig 4.2.1(d). Overall Knowledge Index on Recommended practices for cultivation of Large Cardamom

4.2.2.Attitude towards Adoption of Improved Large Cardamom Cultivation Practices

The prerequisite for any action, which plays a dominant role in technology adoption, is attitude as a component of human behaviour. Adoption of any technology is determined by individual development, and acceptance of modern agricultural technology is the most important factor in increasing crop production. It was observed from Table 4.2.2(a) and Fig 4.2.2(a) that least favourable attitude towards adoption on improved large cardamom cultivation practices was found most in farmers with land holding size of 1-1.5 ha and 1.51-2.0 ha in both Longleng and Mon district with 7.0 per cent and 4.67 per cent respectively. Favourable attitude was observed more in 1-1.5 ha land holding under Longleng district and under Mon district it was observed in 1.51-2.0 ha with 26.67 per cent. Further most favourable attitude was recorded in respondents with size of land holding under large cardamom in 1-1.5 ha under Longleng district with 10.00 per cent and under Mon district it was found 8.00 per cent in 1.51-2.0 ha.

From the data we can see that the majority 65.60 percent of the large cardamom growers were found with medium level of attitude towards adoption on improved cultivation practices, while 18.00 percent and 16.40 percent large cardamom growers had high and low level of attitude respectively.

Table 4.2.2(a): Distribution of respondents based on their Attitude towards Adoption on Improved Large Cardamom Cultivation Practices

N = 250

Level of Attitude	**Size of Land Holding under Large Cardamom**	**Longleng**		**Mon**		**Total**	
		f	**%**	**f**	**%**	**f**	**%**
Least favourable (Less than 59)		16	16.00	25	16.66	41	16.40
	Less than 1	0	0	2	1.33	2	0.8
	1 to 1.5	7	7.0	7	4.67	14	5.6
	1.51 to 2.0	7	7.0	7	4.67	14	5.6
	Above 2	2	2.0	9	6.00	11	4.4
Favourable (59 to 72)		**64**	**64.00**	**100**	**66.66**	**164**	**65.60**
	Less than 1	9	9.0	5	3.33	14	5.6
	1 to 1.5	31	31.0	33	22.00	64	25.6
	1.51 to 2.0	15	15.0	40	26.67	55	22
	Above 2	9	9.0	22	14.67	31	12.4
Most favourable (Above 72)		20	20.00	25	16.66	45	18.00
	Less than 1	4	4.0	0	0	4	1.6
	1 to 1.5	10	10.0	8	5.33	18	7.2
	1.51 to 2.0	3	3.0	12	8.00	15	6
	Above 2	3	3.0	5	3.33	8	3.2
Total		100		150		250	
Mean		65.25		65.22		65.23	
S.D		6.92		6.50		6.66	

Z = 0.1249^{NS}

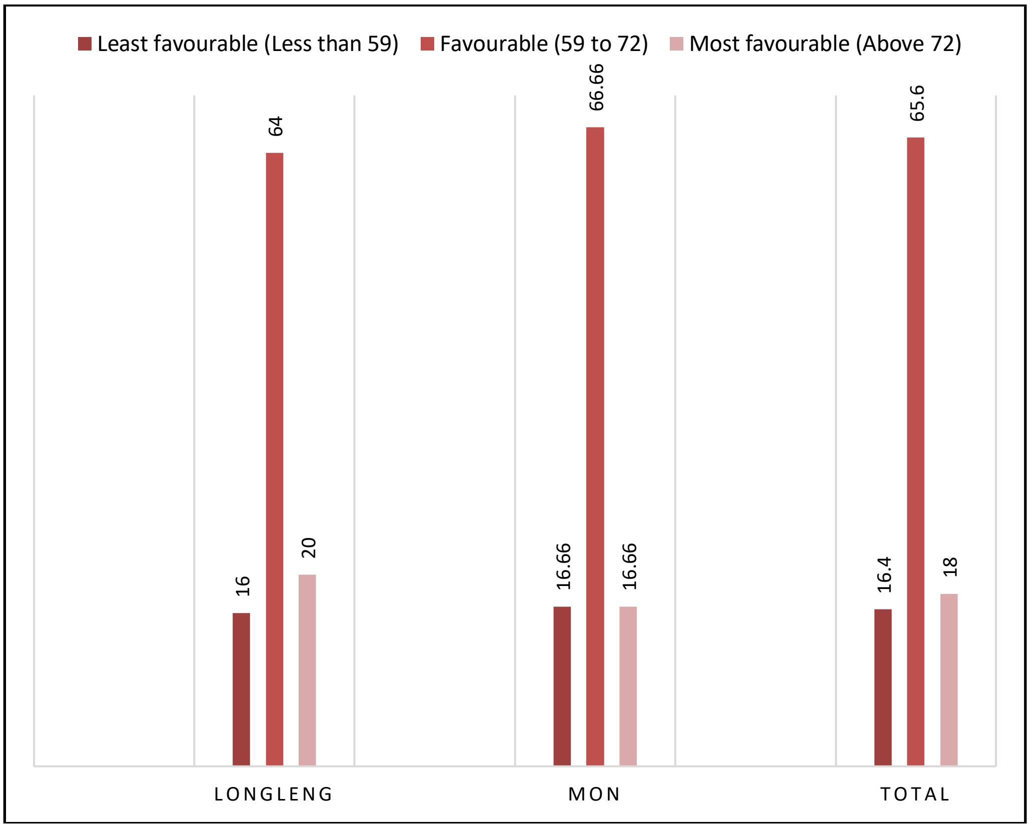


Fig 4.2.2(a): Distribution of respondents based on their Attitude towards Adoption on Improved Large Cardamom Cultivation Practices

The statement wise attitude of farmers towards adoption on improved Large Cardamom cultivation practices as measured on five point continuum scale has been presented in Table 4.2.2(b). The data indicates that that respondents possessed most favourable attitude regarding “It is recommended to remove the entire plant when virus diseases are noticed” which secured highest mean per cent score (93.04 MPS), hence this statement was ranked first. The second highest mean per cent score (91.28 MPS) was secured by the statement “For preservation of planting material, diseased and unhealthy plants can also be stored” followed by “I believe that improved cultivation practice of large cardamom is worth to adopt though it is laborious and complicated” (88.64 MPS), and “Adoption of improved large cardamom cultivation opens the door of progressive aspiration” (87.04 MPS) ranked third and fourth, respectively.

“Though it takes lot of time for a farmer to learn improved production technologies, it is worth the efforts” (85.52 MPS) ranking 5th, “Recommended large cardamom production technology can’t bring significant change in cultivation practices of farmers” (83.60 MPS) 6th rank, “The improved cultivation practices of large cardamom can improve the social status of the farmers” (81.04 MPS) 7th rank, “Maintaining soil moisture and optimum temperature is not required for planting’ (80.32 MPS) ranked 8th, “I believe that improved cultivation practices of large cardamom help to produce quality production” (78.32 MPS) 9th rank, “Land preparation, planting time and spacing as per recommendation have no effect on LC production” (77.12 MPS) 10th rank, “I think that improved cultivation practices of large cardamom is possible to adopt for all farmers” (73.44 MPS) 11th rank, “The risk of cultivation is minimized with the adoption of improved production technology” (70.88 MPS) 12th rank, “Improved large cardamom cultivation is difficult to do for inexperienced farmers” (69.20 MPS) 13th rank, “Large cardamom cultivation is also possible by untrained farmers” (64.64 MPS)

14thrank, "Large cardamom cultivation is not being properly promoted by the Government" (61.60 MPS) 15th rank, "Processing and marketing of LC can be best done at local and regional level" (60.40 MPS) 16th rank and "There is no surety of getting the highest price from large cardamom even if a farmer adopts improved production technology" (58.56 MPS) 17th rank.

Table 4.2.2(b): Statement wise attitude of farmers towards adoption on improved Large Cardamom cultivation practices

Sl. No.	STATEMENTS	MPS	't' value
1.	It is recommended to remove the entire plant when virus diseases are noticed. +	93.04	6.00
2.	For preservation of planting material, diseased and unhealthy plants can also be stored. -	91.28	6.00
3.	I believe that improved cultivation practice of large cardamom is worth to adopt though it is laborious and complicated. +	88.64	4.42
4.	Adoption of improved large cardamom cultivation opens the door of progressive aspiration. +	87.04	4.00
5.	Though it takes lot of time for a farmer to learn improved production technologies, it is worth the efforts. +	85.52	4.00
6.	Recommended large cardamom production technology can't bring significant change in cultivation practices of farmers. -	83.60	4.00
7.	The improved cultivation practices of large cardamom can improve the social status of the farmers. +	81.04	4.00
8.	Maintaining soil moisture and optimum temperature is not required for planting. -	80.32	4.00
9.	I believe that improved cultivation practices of large cardamom help to produce quality production. +	78.32	2.88
10.	Land preparation, planting time and spacing as per recommendation have no effect on LC production. -	77.12	2.55
11.	I think that improved cultivation practices of large cardamom are possible to adopt for all farmers. +	73.44	2.52
12.	The risk of cultivation is minimized with the adoption of improved production technology. +	70.88	2.44
13.	Improved large cardamom cultivation is difficult to do for inexperienced farmers. -	69.20	2.44
14.	Large cardamom cultivation is also possible by untrained farmers. +	64.64	2.23
15.	Large cardamom cultivation is not being properly promoted by the Government. -	61.60	2.13
16.	Processing and marketing of LC can be best done at local and regional level. +	60.40	2.13
17.	There is no surety of getting the highest price from large cardamom even if a farmer adopts improved production technology. -	58.56	2.13

4.2.2(c) Relationship between independent variables and attitude towards improved cultivation practices of large cardamom

It was evident from Table 4.2.2(c) that annual income, information source utilization, scientific orientation, marketing orientation, economic motivation, productivity, profitability and knowledge had positive significant association with attitude of the respondents at 1 % level of probability. Knowledge of large cardamom cultivation technology is a variable that can influence profit earning, the current study found that the knowledge level of large cardamom growers included in the sample was positively and significantly correlated with attitude.

Income from large cardamom and farming experience had positive significant association with attitude of the respondents at 5 % level of probability. This clearly shows that large cardamom growers with a higher income from earned a higher profit per unit area under large cardamom cultivation. In other words, those who earn more are more likely to use modern production technology, resulting in higher yields and higher quality produce. As a result, it is understandable that the greater the annual income, information source utilization, scientific orientation, marketing orientation, economic motivation, productivity, profitability, knowledge, income from large cardamom and farming experience the greater the attitude of large cardamom growers towards improved cultivation practices

The primary determinant of whether a family's demands are met on an individual or family level may be the family's income. An individual's financial viability, stability, and sane behaviour are directly influenced by their annual income, hence a rise in income levels will lead to an increase in their entrepreneurial behaviour.

Family size was found negative and significant correlation with the attitude of the respondents at 1 % level of probability. Age was also found negative and significant correlation with the attitude of the respondents at 5 % level of probability. This indicates younger the large cardamom growers, better was their attitude towards improved large cardamom cultivation practices. Therefore,

H_o1: There is no association between variables viz., annual income, information source utilization, scientific orientation, marketing orientation, economic motivation, productivity, profitability, knowledge, income from large cardamom, farming experience, family size and age with the *attitude* of large cardamom growers was rejected.

Further, other variables of large cardamom growers, such as gender, education, size of total land holding, area under large cardamom, training exposure, social participation and extension contact, did not significantly influence their entrepreneurial behaviour. Therefore, it was determined that these attributes were not connected with entrepreneurial behaviour and that the null hypothesis was accepted with regard to them.

Therefore,

H_o1_a: There is no association between variables viz., gender, education, size of total land holding, area under large cardamom, training exposure, social participation and extension contact with the *attitude* of large cardamom growers was accepted.

Table 4.2.2(c): Correlation of Independent Variables with Attitude of farmers towards Adoption of Improved Large Cardamom Practices

Sl. No	Independent Variables	Coefficient of correlation (r)	P value
1.	Age	-.304**	0.000
2.	Gender	-0.037	0.560
3.	Family Size	-0.150*	0.018
4.	Education	-0.010	0.871
5.	Size of Total Land Holding	0.001	0.990
6.	Area under Large Cardamom	-0.100	0.115
7.	Annual Income	0.181**	0.004
8.	Income from Large Cardamom	0.155*	0.014
9.	Training Exposure	0.041	0.522
10.	Farming Experience	0.142*	0.024
11.	Information Source utilization	0.326**	0.522
12.	Social participation	0.027	0.674
13.	Scientific Orientation	0.243**	0.000
14.	Marketing orientation	0.227**	0.000
15.	Extension Contact	0.070	0.269
16.	Economic Motivation	0.224**	0.000
17.	Productivity	0.248**	0.000
18.	Profitability	0.278**	0.000
19.	Knowledge	0.255**	0.000

**Correlation is Significant at 0.01 level (2 tailed)
* Correlation is Significant at 0.05 level (2 tailed)

4.4.2(d).Multiple regression analysis of the predictor variables with attitude of respondents towards improved cultivation of large cardamom

The correlation coefficients ("r values") were used to determine the relationship between attitude and the independent variables. The "r" value only indicates the strength and direction of the association and does not consider the predictive ability of independent variables over attitude towards improved cultivation of large cardamom. As a result, multiple regressions were performed to determine the predictive abilities of independent variables on farmers' attitudes towards improved cultivation of large cardamom, and the regression equation was derived accordingly.

The independent variables show a significant contribution in zero order correlation for large cardamom growers, which were analysed using a multiple regression technique to determine and predict their relative contribution. The coefficient of multiple determinations (R^2) was used to estimate the predictive power of each multiple regression equation. The significance of multiple regression coefficients was determined by calculating "t" values. As a result, a multiple regression analysis was performed, and the results obtained are given in Table 4.2.2(d).

The R^2 value (0.226) in Table 4.2.2(d) indicates that the independent variables contributed to 22.60 per cent of the variation in farmers' attitudes towards improved large cardamom cultivation and the remaining 77.40 % being explained by variables outside the scope of the study model. The data in the Table also show that the calculated "t" values for the multiple regression coefficients of predictor variables information sources utilisation, productivity, and knowledge were significant at the 1% level of significance, as were predictor variables age and family size at the 5% level of significance. The fact that the F-ratio is 10.066 indicates that the overall regression model statistically significantly predicts farmer attitudes and is a good fit for the data at the 1% level of significance ($p = 0.0002$). As a result, it was possible to conclude that these variables were significant in predicting farmers' attitudes towards improved large cardamom cultivation.

Table 4.2.2(d): Multiple regression analysis of the predictor variables with attitude of respondents towards improved cultivation of large cardamom

Sl. No	Predictor Variables	Regression coefficient (b)	SE (b) value	't' value	'p' value
1.	Age	-0.088	0.043	-2.042*	0.042
2.	Gender	-1.528	0.872	-1.752	0.081
3.	Family size	-0.404	0.174	-2.324*	0.021
4.	Information sources utilization	0.66	0.23	2.87**	0.004
5.	Marketing orientation	0.433	0.245	1.768	0.078
6.	Productivity	0.043	0.015	2.83**	0.005
7.	Knowledge	0.19	0.072	2.629**	0.009

F=10.066; $\mathbf{R^2}$**=** 0.226

** Significant at 1% level of probability
* Significant at 5% level of probability

4.2.2(e). Direct and indirect effect of independent variables on attitude of large cardamom growers

Path analysis is a technique that aims to determine the direct and indirect effects of a number of variables, allowing for a quantitative interpretation of the interrelationships that exist in a known or assumed casual system in a specific population. The basic theorem of path analysis states that the sum of the products of the paths and correlations between all variables in the system equals the zero-order correlation between any two variables. Path analysis was employed with respect to independent variables on attitude towards adoption of large cardamom growers towards improved cultivation practices, and the results are given below:

Direct effect

It can be observed from the Table 4.2.2(e) that productivity (0.1848), information sources utilization (0.1798), income from large cardamom (0.1789), knowledge (0.1461), land holding under agriculture (0.1054) were the major independent variables exerting highest direct positive influence on attitude of large cardamom growers towards improved cultivation practices, whereas remaining variables have relatively lower direct effects (less than 0.1).

Total indirect effect

The data showed that highest total indirect effect on attitude of large cardamom growers towards improved cultivation practices was recorded by profitability (0.4525), economic motivation (0.2276), scientific orientation (0.2227), Annual income (0.1613), Marketing orientation (0.1351), Land holding under large cardamom (0.132), Information sources utilization (0.132), Extension contact (0.1121), Knowledge (0.1095), Farming experience (0.0873), Training exposure (0.0747), Gender (0.066), Productivity (0.0631) andFamily size (0.0075).Education (-0.0044), Income from large cardamom (-0.0243), Social participation (-0.0413), Land holding under agriculture (-0.1042) andAge (-0.1803) exerted a negative and total indirect effect on attitude of large cardamom growers towards improved cultivation practices.

Substantial largest indirect effect through single variable:

It can be noticed from the Table 4.2.2(e) that the largest indirect effect was channelled through income from large cardamom (X7) in 5 variables, information utilization sources (X12) each in four variables, age (X1) in 3 variables, land holding under large cardamom (X6) and gender (X2) in 2 variables, family size (X3), training exposure (X10), farming experience (X9) in one variable. The residual effect was found to be 0.75321.

Table 4.2.2(e): Direct and indirect effect of independent variables on attitude of large cardamom growers

Variable no.	Independent variables	Effect over Attitude				
		Direct	Rank	Total Indirect	Rank	Largest indirect through single variable
X1	Age	-0.1239	XVI	-0.1803	XIX	0.0431 (X18)
X2	Gender	-0.1028	XV	0.0660	XII	0.0182 (X3)
X3	Family size	-0.1573	XVII	0.0075	XIV	0.0150 (X13)
X4	Education	-0.0061	XII	-0.0044	XV	0.1054 (X6)
X5	Land holding under agriculture	0.1054	V	-0.1042	XVIII	0.0266 (X7)
X6	Land holding under large cardamom	-0.2319	XIX	0.1320	VI	0.0994 (X7)
X7	Income from large cardamom	0.1789	III	-0.0243	XVI	0.0268 (X1)
X8	Annual income	0.0200	IX	0.1613	IV	0.0982 (X7)
X9	Farming experience	0.0549	VIII	0.0873	X	0.0562 (X7)
X10	Training exposure	-0.0339	XIII	0.0747	XI	0.0392 (X1)
X11	Extension contact	-0.0418	XIV	0.1121	VIII	0.0305 (X7)
X12	Information sources utilization	0.1798	II	0.1320	VII	0.0679 (X7)
X13	Social participation	0.0683	VII	-0.0413	XVII	0.0084 (X2)
X14	Marketing orientation	0.0918	VI	0.1351	V	0.0378 (X1)
X15	Scientific orientation	0.0196	X	0.2227	III	0.0511 (X12)
X16	Economic motivation	-0.0043	XI	0.2276	II	0.0585 (X12)
X17	Productivity	0.1848	I	0.0631	XIII	0.1551 (X6)
X18	Profitability	-0.1749	XVIII	0.4525	I	0.1551 (X7)
X19	Knowledge	0.1461	IV	0.1095	IX	0.0395 (X12)

Residual effect = 0.75321

4.2.3. Adoption level of improved cultivation practices of large cardamom

Adoption in this study refers to use of improved cultivation practices of large cardamom. The adoption level of selected large cardamom growers was assessed related to improved practices of large cardamom cultivation as per their adoption level of sub component sand presented in Table 4.2.3(a).

Table 4.2.3(a): Adoption level of improved cultivation practices of large cardamom

Sl. No.	Recommended Practices	LONGLENG DISTRICT (n1=100)			MON DISTRICT (n2=150)			Total (N = 250)		
		Level of Adoption			Level of Adoption			Level of Adoption		
		Full Adoption F (%)	Partial Adoption F (%)	No Adoption F (%)	Full Adoption F (%)	Partial Adoption F (%)	No Adoption F (%)	Full Adoption F (%)	Partial Adoption F (%)	No Adoption F (%)
1.	**Suitable varieties:**									
	a. Ramsey	100 (100)	0	0	150 (100)	0	0	**250 (100)**	0 (0)	0 (0)
	b. Golsey	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
	c. Sawney	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
2.	**Pit preparation:**									
	a. Pit size of 1x1x1 ft.	19 (19.00)	19 (19.00)	36 (36.00)	85 (56.67)	4 (2.67)	61 (40.67)	**130 (52.00)**	23 (9.20)	97 (38.80)
	b. Pit distance of 1.5x1.5 m	16 (16.00)	72 (72.00)	12 (12.00)	13 (8.67)	112 (74.67)	25 (16.67)	29 (11.60)	**184 (73.60)**	37 (14.80)
3.	**Pit manuring:** Add 25 kg neem cake, 2-4 kgs FYM or 10 gm compost inoculated with *Trichoderma*	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
4.	**Time of planting:** May to early July	100 (100)	0	0	150 (100)	0	0	**250 (100)**	0 (0)	0 (0)
5.	**Intercultural operations:**									
	Mulching									
	a. The base of the plant or the collar region of the	65 (65.00)	46 (46.00)	0	117 (78.00)	33 (22.00)	0	**171 (68.40)**	79 (31.60)	0 (0)

	clumps should be mulched with dried leaves during November to April									
	b. It is done to conserve soil moisture and check the weed growth	35 (35.00)	54 (54.00)	0	70 (46.67)	80 (53.33)	0	105 (42.00)	**145 (58.00)**	0 (0)
	Weed Management									
	a. It is done twice a year, during May to June and before harvesting	36 (36.00)	64 (64.00)	0	54 (36.00)	96 (64.00)	0	90 (36.00)	**160 (64.00)**	0 (0)
	b. Weeding is practiced throughout the year depending upon the population of the weeds	32 (32.00)	47 (47.00)	21 (21.00)	47 (31.33)	55 (36.67)	48 (32.00)	79 (31.60)	**102 (40.80)**	69 (27.60)
	c. Uprooted weeds can be used as organic compost and mulch	50 (50.00)	50 (50.00)	0	117 (78.00)	33 (22.00)	0	**167 (66.80)**	83 (33.20)	0 (0)
	Irrigation									
	a. The optimum time of irrigation is from Dec to April	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
	b. The field is irrigated at an interval of 10 days during the dry period	0	0	100 (100)	0	0	150 (100)	0(0)	(0)	**250 (100)**
6.	**Shade regulation:** Tall-growing trees are pruned regularly at a height of 4-5 m	1 (1.00)	37 (37.00)	62 (62.00)	0	69 (46.00)	81 (54.00)	1 (0.40)	106 (42.40)	**143 (57.20)**

7.	**Nutrient Management:** NPK @20:30:40 kg along with 10-15 tonnes of FYM or compost per hectare, every once a year	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
8.	**Roguing and gap filling:** Removal of affected plant and replace them by healthy ones. The ideal time for gap filling is May-June	26 (26.00)	74 (74.00)	0	5 (3.33)	145 (96.67)	0	31 (12.40)	**219 (87.60)**	0 (0)
9.	**Integrated Disease Management (IDM)**									
	i. Leaf spot:									
	a. Maintain good drainage	1 (1.00)	19 (19.00)	80 (80.00)	0	31 (20.67)	119 (79.33)	1 (0.40)	50 (20.00)	**199 (79.60)**
	b. Apply *Trichoderma*	0	0	100 (100)	0	0	150 (100)	0 (0)	1 (0.40)	**249 (99.60)**
	c. Spray Bordeaux mixture (1.0 %)	0	18 (18.00)	82 (82.00)	0	31 (20.67)	119 (79.33)	0 (0)	49 (19.60)	**201 (80.40)**
	ii. Foorkey:									
	a. Diseased free certified rhizomes	1 (1.00)	73 (73.00)	26 (26.00)	0	97 (64.67)	53 (35.33)	1 (0.40)	**170 (68.00)**	79 (31.60)
	b. Dimecron/ Rogor (0.1%)	0	13 (13.00)	87 (87.00)	0	34 (22.67)	116 (77.33)	0 (0)	47 (18.80)	**203 (81.20)**
	c. Collateral host plant is destroyed	1 (1.00)	60 (60.00)	39 (39.00)	0	79 (52.67)	71 (47.33)	1 (0.40)	**139 (55.60)**	**110 (44.00)**
	d. Infected land is kept fallow for a year	0	28 (28.00)	72 (72.00)	0	65 (43.33)	85 (56.67)	0 (0)	93 (37.20)	**157 (37.20)**

	iii. Clump rot:									
	a. Mulching during summer	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
	b. Suckers dipped in *Trichoderma* or neem extract	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
	c. Spray fungicide at fortnightly interval	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
10.	**Integrated Pest Management (IPM)**									
	i. Stem borer:									
	a. Remove the plant with caterpillars	0	15 (15.00)	85 (85.00)	0	41 (27.33)	109 (72.67)	0 (0)	56 (22.40)	**194 (77.60)**
	b. Destroy dried shoots	0	52 (52.00)	48 (48.00)	0	105 (70.00)	45 (30.00)	0 (0)	**157 (62.80)**	93 (37.20)
	ii. Cardamom weevil:									
	a. Destroy plants along with weevil	0	20 (20.00)	80 (80.00)	0	29 (19.33)	121 (80.67)	0 (0)	49 (19.60)	**201 (80.40)**
	b.Base of clumps drench in malathion	0	0	100 (100)	0	0	150 (100)	0 (0)	0 (0)	**250 (100)**
11.	**Harvesting:**									
	a. Appropriate time: 5 years (seeds) 3 years (suckers)	100 (100)	0	0	150 (100)	0	0	**250 (100)**	0 (0)	0 (0)
	b. Physiological stage of maturity: When seeds of topmost capsules turn brown	100 (100)	0	0	150 (100)	0	0	**250 (100)**	0 (0)	0 (0)

	c. Time of harvest: August to September	100 (100)	0	0	150 (100)	0	0	**250 (100)**	0 (0)	0 (0)
12.	**Curing:**									
	a. Curing is done immediately after harvesting, to retain only about 10-13 % moisture on dry-weight basis	86 (86.00)	14 (14.00)	0	125 (83.33)	25 (16.67)	0	**211 (84.40)**	39 (15.60)	0 (0)
	b. Heating temperature for curing should be 50-55ºC	47 (47.00)	51 (51.00)	2 (2.00)	43 (28.67)	102 (68.00)	5 (3.33)	90 (36.00)	**153 (61.20)**	7 (2.80)
13.	**Packing:**									
	a. Coal tar coated and polythene lined gunny bags are effective during storage	99 (99.00)	1 (1.00)	0	148 (98.67)	2 (1.33)	0	**247 (98.80)**	3 (1.20)	0 (0)
	b. The cured produce needs to be packed in insect proof bags and in air tight containers	99 (99.00)	1 (1.00)	0	148 (98.67)	2 (1.33)	0	**247 (98.80)**	3 (1.20)	0 (0)

Table 4.2.3(a) revealed that majority 100 per cent of the large cardamom growers of Longleng district had full adoption on variety Ramsey, time of planting and harvesting, followed by 99.00 per cent on packing, curing (86.00 %), mulching during November to April (65.00 %) and uprooted weeds used as organic compost and mulch (50.00 %).Further, roguing and gap filling (74.00 %), management of foorkey (73.00 %), pit distance (72.00 %) and weeding before harvesting (64.00 %) had partial adoption. Whereas majority of the respondents had not fully adopted the varieties (golsey and sawney), pit manuring, irrigation, nutrient management, integrated disease management and integrated pest management.

Table 4.2.3(a) alsorevealed that majority 100 per cent of the large cardamom growers of Mon district had had full adoption on variety Ramsey, time of planting and harvesting, followed by 98.67 per cent on packing, curing (83.33 %), mulching during November to April and uprooted weeds used as mulch (78.00 %). Further, roguing and gap filling (96.67 %), pit distance (74.67 %) and weeding before harvesting (64.00 %) had partial adoption. Whereas majority of the respondents had not fully adopted the varieties (golsey and sawney), pit manuring, pit distance, irrigation, shade regulation, nutrient management, integrated disease management and integrated pest management. Lack of exposure to and awareness of the suggested practises for growing large cardamom were the main impediments to their adoption.

The Table 4.2.3(a) describes the distribution of large cardamom growers as per their practice-wise knowledge level of large cardamom growers about improved large cardamom cultivation practices.

1. Adoption of varieties:

Adoption of recommended varieties of large cardamom showed that 100 per cent of the respondents full adopted that variety Ramsey and 100 per cent of the growers did not adopt the varieties Sawney and Golsey as per the recommendation.

2. Adoption of pit preparation:

Adoption of pit preparation of pit size (1x1x1 ft.) showed that higher number of respondents 52.00 per cent fully adopted, followed by 38.80 per cent of no adoption and 9.20 per cent partial adopted. Adoption of maintaining pit distance (1.5x1.5 m), only 11.60 per cent fully adopted the recommendation, with majority of 73.60 per cent partially adopted and 14.80 per cent of no adoption respectively.

3. Adoption of pit manuring:

Adoption of pit manuring (25 kg neem cake, 2-4 kgs FYM inoculated with *Trichoderma*) showed that 100 per cent of respondents did not adopted the improved recommendation.

4. Adoption of time of planting:

Adoption of proper time of planting (May to early June) showed that 100 per cent of the respondents fully adopted time of planting as per recommendation.

5. Adoption of intercultural operations (mulching, weed management and irrigation):

Adoption of intercultural operation, mulching showed that higher percentage of respondents 68.40 per cent fully adopted followed by 31.60 per cent partial adopted. Weed management showed that 64.00 per cent partial adopted and 36.00 per cent full adopted weeding before harvesting. Intercultural operation, irrigation showed that 100 per cent of the respondents did not adopt the practice as per recommendation.

6. Adoption of shade regulation:

Adoption of shade regulation of pruning tall growing trees regularly at the height of 4 to 5 m. showed that 57.20 per cent did not practice it followed by 42.40 per cent partial adopted and 0.40 per cent full adopted by the respondents.

7. Adoption of nutrient management:

Adoption of nutrient management (NPK @20:30:40) along with 10 to 15 tonnes of FYM or compost per hectare, every once a year, showed that 100 per cent of the respondents did not adopt nutrient application on large cardamom farm.

8. Adoption of roguing and gap filling:

Adoption of roguing and gap filling (May to June) showed that 87.60 per cent partial adopted and 12.40 per cent had full adoption of removing the affected plants and replacing them with healthy plants.

9. Adoption of integrated disease management:

i. Leaf spot: Adoption of management of leaf spot showed that majority of the respondent have no adoption of maintaining good drainage (79.60 %), applying *Trichoderma* (99.60 %) and spraying of Bordeaux mixture (80.40 %). Incase of partial adoption, respondent have partially adopted maintaining good drainage (20.00 %), applying *Trichoderma* (0.40 %) and spraying of Bordeaux mixture (19.60 %). With regard to full adoption, only 0.40 per cent of the respondent fully adopted maintaining good drainage.

ii. Foorkey: In adoption of management practices of foorkey, it was found that only 0.40 per cent fully adopted disease free certified rhizomes and destroying of collateral host plant (Refer plate 4). Incase of partial adoption,

Plate 4. Foorkey infected large cardamom plant in Longleng district

Plate 5. Respondents from Mon district, Nagaland

Plate 6. Large cardamom field in Mon district, Nagaland

majority (68.00 %) of the respondent partially adopted using disease free certified rhizomes, followed by destroying collateral host plant (55.60 %), keeping infected land fallow for a year (37.20 %) and applying dimecron/ rogor (18.80 %). With regard to no adoption, majority (81.20 %) did not apply dimecron/ rogor, followed by keeping infected land fallow for a year (37.20 %), using disease free certified rhizomes (31.60 %) and destroying collateral host plant (44.00 %).

iii. Clump rot: In adoption of management practices of clump rot, it was found that majority (100 %) of the respondent have no adoption of mulching during summer, suckers dipped in *Trichoderma* or neem extract and spraying fungicide at fortnightly interval.

10. Adoption of integrated pest management:

i. Stem borer: Adoption of integrated pest management of stem borer (Refer plate 7) showed that in partial adoption, 22.40 per cent of respondent followed removal of plants infested with caterpillars and majority (62.80 %) partially adopted destroying of dry shoots of large cardamom plant. With regard to no adoption, majority (77.60 %) did not adopt removal of plants infested with caterpillars and only 37.30 per cent did not adopt destroying of dry shoots.

ii. Cardamom weevil: With regard to adoption of management practices of cardamom weevil, it was found that only 19.60 per cent of the respondent partially adopted destroying of plants along with weevil. In case of no adoption, majority (80.40 %) did not adopt destroying of plants along with weevil and 100 per cent of the respondent did not adopt the practice of drenching the base of clumps in malathion.

Plate 7. Abandoned large cardamom field due to stem borer infestation in Mon district

11. Adoption of harvesting:

Adoption of proper method of harvesting showed that 100 per cent of the respondents full adoption the proper time of harvest, August to September, when the seeds of topmost capsules turn brown (Refer plate 9).

12. Adoption of curing:

Adoption of curing immediately after harvest showed that 84.40 full adopted and 15.60 partial adopted this recommendation (Refer plate 8). Curing temperature of 50-55ºC showed that 61.20 partial adopted, 36.00 per cent full adopted and 2.80 per cent not adopted respectively.

13. Adoption of packing:

Adoption of method of packing with coal tar coated or polythene line gunny bags, and insect proof bags and air tight containers showed that 98.80 full adopted this recommendation followed by 1.20 per cent partial adopted.

Table 4.2.3(b): Distribution of respondents on Overall Adoption Index

N = 250

Sl. No	Overall Adoption Index	Longleng district		Mon district		Total	
		F	%	F	%	F	%
1.	Low (Less than 36)	26	26.00	20	13.33	46	18.40
2.	Medium (36 to 42)	**49**	**49.00**	**93**	**62.00**	**142**	**56.80**
3.	High (More than 42)	25	25.00	37	24.67	62	24.80
	Total	100	100	150	100	250	100
	Mean	38.66		39.39		39.09	
	S.D	3.60		3.11		3.33	

Z = -1.6894*

*Significant at 5 % level of probability

It is apparent from Table 4.2.3(b) and Fig 4.2.3(b) that 49.00 per cent of the large cardamom growers of Longleng district were found to have medium level adoption of improved cultivation practices followed by low (26.00 %)

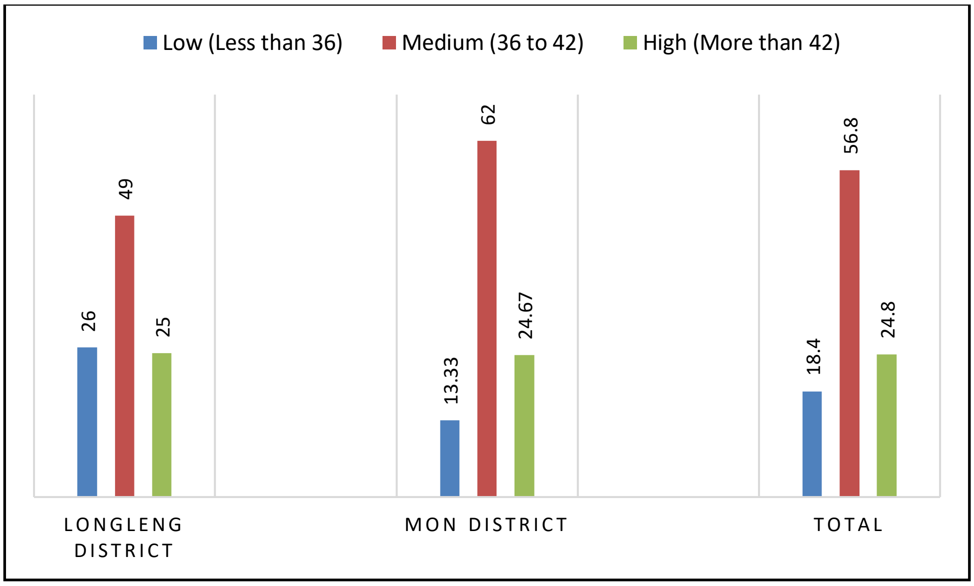


Fig 4.2.3(b): Distribution of respondents on Overall Adoption Index

Plate 8. Drying of large cardamom after harvesting

Plate 9. Harvesting of large cardamom and the produce after harvest

Plate 10. Segregation of large cardamom and commodity ready for market

and high (25.00 %) level adoption of improved cultivation practices of large cardamom. Among Mon district large cardamom growers more than half (62.00 %) had medium level adoption followed by high (24.67 %) and low (13.33 %) level adoption of improved cultivation practices of large cardamom respectively.

In overall, large cardamom growers had medium (56.80 %) level adoption followed by high (24.80 %) and low (18.40 %) level adoption of improved cultivation practices of large cardamom improved respectively. Knowledge limits the action of the individual; hence, probable reason for majority of the respondents to fall under medium adoption category might be due to the medium to high knowledge possessed by majority of the respondents and since it is a new venture and it is stabilizing, it needs some more time to improve and to adopt it. The finding is in conformity with the results of Divya and Sivakumar (2014).

4.3. Entrepreneurial behaviour of large cardamom farmers

4.3.1 Overall entrepreneurial behaviour of large cardamom farmers

It is evident from Table 4.3.1(a) and Fig 4.3.1(a) that 62.00 per cent of the respondents from Longleng district had medium entrepreneurial behaviour, while 19.00 had low and high level of entrepreneurial behaviour.

In Mon district majority (56.67 %) had medium level of entrepreneurial behaviour, 28.00 had high level of entrepreneurial behaviour followed by low (15.33 %) level of entrepreneurial behaviour.

In pooled situation majority (58.80 %) had medium entrepreneurial behaviour, 24.40 per cent belonged to high level of entrepreneurial behaviour followed by low (16.80 %) level of entrepreneurial behaviour. The possible reason for the medium entrepreneurial behaviour of the respondents might be

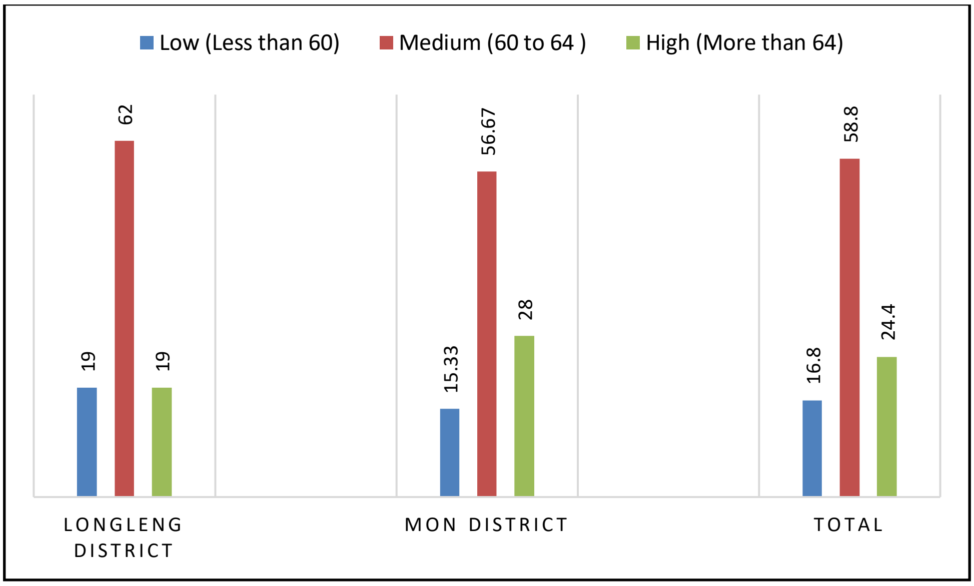


Fig 4.3.1(a): Distribution of respondents based on their overall Entrepreneurial Behaviour Index

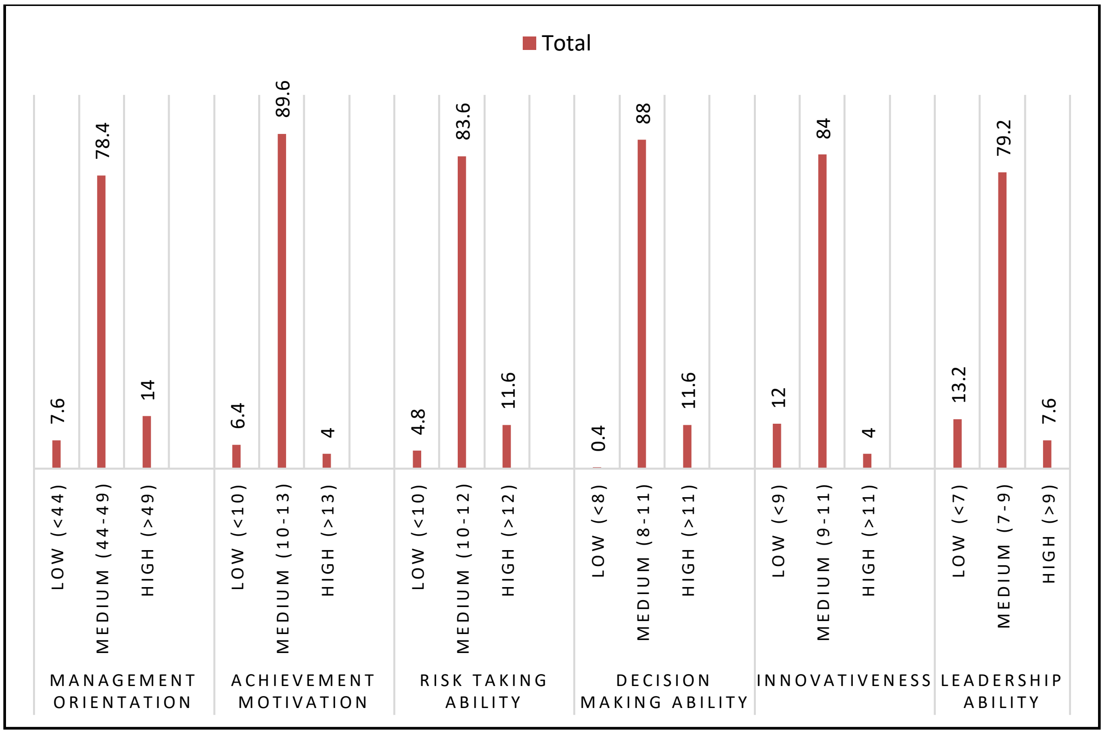


Fig 4.3.2(a): Distribution of Respondents based on their level of Entrepreneurial Behaviour Attributes

due to the fact that majority of them belonged to medium level in majority of components like innovativeness, achievement motivation, risk taking ability, leadership ability and management orientation.

Table 4.3.1(a): Distribution of respondents based on their overall Entrepreneurial Behaviour Index

N = 250

Sl. No	Entrepreneurial Behaviour Index	Longleng district		Mon district		Total	
		f	**%**	**f**	**%**	**f**	**%**
1.	Low (Less than 60)	19	19.00	23	15.33	42	16.80
2.	Medium (60 to 64)	**62**	**62.00**	**85**	**56.67**	**147**	**58.80**
3.	High (More than 64)	19	19.00	42	28.00	61	24.40
	Total	100	100	150	100	250	100
	Mean	61.86		62.23		62.08	
	S.D	2.32		2.43		2.39	

Z = -1.2447*

*Significant at 5% level of probability

4.3.2 Attributes wise entrepreneurial behaviour of large cardamom growers

The six factors management orientation, achievement motivation, risk taking ability, decision making ability, innovativeness and leadership ability make up the entrepreneurial behaviour of large cardamom growers in the current study. Three kinds of respondents, small, medium, and high large cardamom producers, were used in the analysis of all the chosen entrepreneurial behaviour components. The profiles of entrepreneurs on these six aspects were examined by combining the results. Detailed information regarding attribute-wise has been provided in Table 4.3.2(a) and Fig 4.3.2(a), and each component's interpretation and in-depth discussion may be found in the following paragraphs.

Management Orientation

Operationally, it relates to how much a producer of large cardamom is focused on scientific farm management, which includes planning, production, and marketing tasks on the farm. The results in table 4.3.2(a) brought to the focus that among the different entrepreneurial behaviour attributes, management orientation ranked 1^{st} , the data indicated that 78.40 per cent , 14.00 per cent and 7.60 per cent had medium, high and low level of management orientation respectively. The probable reason may be attributed to their exposure to various trainings and extension contact, which might have motivated the growers with the available resources (land, labour and capital), to attain higher yield in terms of profit.

Achievement Motivation

Operationally, it is defined by the drive for excellence to achieve a sense of self-fulfilment. It could be inferred from the table that achievement motivation ranked 2^{nd}, a great majority (89.60 %) has medium level, followed by low level (6.40 %) and high (4.00 %). This may be due to moderate organizational effort from all the family members to achieve the determined goal since achievement motivation is more of a psychological variable which differs from individual to individual. The possible reason for low achievement motivation might be that the respondents had low education level and small land holding size, and their social and economic condition might not have permitted to have higher achievement motivation. Inner will, impulse, and intention are what motivate people to take action.

Risk Taking Ability

Operationally, risk orientation is the degree to which a large cardamom producer is focused on risk and uncertainty while dealing with issues related to large cardamom production. It could be seen in table that risk taking ability ranked 3^{rd}, 83.60 per cent had medium level, followed by high level (11.60 %)

and low level (4.80 %). This shows that, the respondents take moderate risk to take up any new ideas/ innovations as it involves involve certain degree of risks and uncertainties to invest in the production.

Decision Making Ability

The ability of a farmer to make decisions is operationally defined as the degree to which he can weigh the available options in terms of their desirability and likelihoods and select the most appropriate one to get the most possible profit from his farming. The data in table indicates that decision making ranked 4th, 88.00 per cent, 11.60 per cent and 0.40 per cent had medium, high and low level of decision making respectively. Decision making in farming, especially in Indian conditions is very difficult due to gambling monsoons and lack of stabilized price policy. Decision making ability is based on the foresight and confidence of an individual. The reason for the above fact is that majority of respondents are middle aged, who has comparatively free hands in making decisions about to adopt or reject the innovation. Other plausible reason might be their mulberry cultivation experience which helped them to choose right decision at right time and at right place. These factors might have facilitated the respondents to make wise decisions among available alternatives.

Innovativeness

This describes the behaviour of a person who is willing to implement new agricultural methods into his operations whenever it is practicable and practical and who has an interest in doing so. Innovativeness ranked 5th, and it was observed that majority 84.00 per cent had medium level of innovativeness, followed by low (12.00 %) level and 4.00 high level of innovativeness. This might be that the respondents are mostly influenced by peer group and would adopt new technologies only after others succeed and have moderate participation in extension programmes.

Leadership Ability

An operational definition of leadership capacity is the extent to which a producer of large cardamom personally initiates or influences the behaviour of others. Leadership ability ranked 6th, having 79.20 per cent medium level, 13.20 per cent low level and 7.60 per cent high level of leadership ability respectively. The majority having medium level might be due to the fact that they belong to medium age group and have moderate leadership qualities.

Table 4.3.2(a): Distribution of respondents based on their level of Entrepreneurial Behaviour Attributes

N = 250

Sl. No	Entrepreneurial Attributes	Category	Longleng district		Mon district		Total		Mean Score	Rank
			F	%	F	%	F	%		
1.	**Management Orientation** Mean= 46.78 S.D= 2.32	Low (<44)	12	12.00	7	4.67	19	7.60	46.78	I
		Medium (44-49)	77	77.00	119	79.33	**196**	**78.40**		
		High (>49)	11	11.00	24	16.00	35	14.00		
2.	**Achievement Motivation** Mean= 11.50 S.D= 1.27	Low (<10)	4	4.00	12	8.00	16	6.40	11.50	II
		Medium (10-13)	95	95.00	129	86.00	**224**	**89.60**		
		High (>13)	1	1.00	9	6.00	10	4.00		
3.	**Risk Taking Ability** Mean= 11.31 S.D= 1.04	Low (<10)	2	2.00	10	6.67	12	4.80	11.31	III
		Medium (10-12)	86	86.00	123	82.00	**209**	**83.60**		
		High (>12)	12	12.00	17	11.33	29	11.60		
4.	**Decision Making Ability** Mean= 9.78 S.D= 1.43	Low (<8)	1	1.00	0	0	1	0.40	9.78	IV
		Medium (8-11)	90	90.00	130	86.67	**220**	**88.00**		
		High (>11)	9	9.00	20	13.33	29	11.60		

5.	**Innovativeness** Mean= 9.62 S.D= 1.06	Low (<9)	14	14.00	16	10.67	30	12.00	9.62	V
		Medium (9-11)	78	78.00	124	82.67	**210**	**84.00**		
		High (>11)	8	8.00	10	6.67	10	4.00		
6.	**Leadership Ability** Mean= 7.86 S.D= 1.18	Low (<7)	16	16.00	17	11.33	33	13.20	7.86	VI
		Medium (7-9)	72	72.00	126	84.00	**198**	**79.20**		
		High (>9)	12	12.00	7	4.67	19	7.60		

4.3.2 Association between Independent Variables and Entrepreneurial Behaviour of the Respondents

It is evident from Table 4.3.2 that annual income, income from large cardamom, farming experience, information source utilization, scientific orientation, marketing orientation, extension contact, economic motivation, productivity, profitability, knowledge and adoption had positive significant association with entrepreneurial behaviour of the respondents at 1 % level of probability. The primary determinant of whether a family's demands are met on an individual or family level may be the family's income. An individual's financial viability, stability, and sane behaviour are directly influenced by their annual income, hence a rise in income levels will lead to an increase in their entrepreneurial behaviour.

Age was found negative and significant correlation with the entrepreneurial behaviour of the respondents at 1 % level of probability. This indicates that as people aged, there was a less entrepreneurial behaviour in the large cardamom growers. Therefore,

H_o2: There is no association between variables viz., Age, annual income, income from large cardamom, farming experience, information source utilization, scientific orientation, marketing orientation, extension contact, economic motivation, productivity, profitability, knowledge and adoption with the *entrepreneurial behaviour* of large cardamom farmers was rejected.

Further, other variables of large cardamom growers, such as gender, family size, education, size of total land holding, area under large cardamom, training exposure and social participation, did not significantly influence their entrepreneurial behaviour. Thus, it was determined that these attributes were not associated with their entrepreneurial behaviour. Therefore,

H_o2_a: There is no association between variables viz., gender, family size, education, size of total land holding, area under large cardamom, training exposure and social participation with the *entrepreneurial behaviour* of large cardamom farmers was accepted.

Table 4.3.2: Correlation of Independent Variables with Entrepreneurial Behaviour of Large Cardamom farmers

Sl. No	Independent Variables	Coefficient of correlation (r)	P value
1.	Age	-.595**	0.000
2.	Gender	0.096	0.130
3.	Family Size	-0.043	0.503
4.	Education	0.022	0.732
5.	Size of Total Land Holding	-0.090	0.156
6.	Area under Large Cardamom	-0.116	0.067
7.	Annual Income	0.247**	0.000
8.	Income from Large Cardamom	0.254**	0.000
9.	Training Exposure	0.083	0.191
10.	Farming Experience	0.389**	0.000
11.	Information Source utilization	0.499**	0.000
12.	Social participation	-0.005	0.939
13.	Scientific Orientation	0.457**	0.000
14.	Marketing orientation	0.466**	0.000
15.	Extension Contact	0.247**	0.000
16.	Economic Motivation	0.508**	0.000
17.	Productivity	0.307**	0.000
18.	Profitability	0.414**	0.000
19.	Knowledge	0.333**	0.000
20.	Adoption	0.332**	0.000

**Correlation is Significant at 0.01 level (2 tailed)

* Correlation is Significant at 0.05 level (2 tailed)

4.3.3 Multiple regression of independent variables with the entrepreneurial behaviour

Multiple regression analysis of independent variables with entrepreneurial behaviour in Table 4.3.3, indicated that variables *viz.*, income from large cardamom, farming experience, information utilization sources, marketing orientation, economic motivation and adoption were positively significant at 1 per cent level, whereas age and land holding under large cardamom was negatively significant at 1 per cent level and training exposure was negatively significant at 5 per cent level. The R^2 value (0.649) indicated that the independent variables contributed to 64.90 per cent of variation in entrepreneurial behaviour of large cardamom growers towards improved cultivation practices.

The fact that the F-ratio is 49.343 indicates that the overall regression model statistically significantly predicts farmer attitudes and is a good fit for the data at the 1% level of significance (p = 0.0002). As a result, it was possible to conclude that these variables were significant in predicting farmers' entrepreneurial behaviour towards large cardamom cultivation.

Table 4.3.3: Multiple regression analysis of the predictor variables with entrepreneurial behaviour of large cardamom growers

Sl. No	Predictor Variables	Regression coefficient (b)	SE (b) value	't' value	'p' value
1.	Age	-0.077	0.011	-6.853**	0
2.	Size of land holding under large cardamom	-0.891	0.188	-4.745**	0
3.	Income from large cardamom	0.019	0.007	2.642**	0.009
4.	Farming experience	0.3	0.076	3.962**	0
5.	Training exposure	-0.532	0.231	-2.304*	0.022
6.	Information sources utilization	0.198	0.061	3.23**	0.001
7.	Marketing orientation	0.295	0.061	4.879**	0
8.	Economic motivation	0.421	0.076	5.568**	0
9.	Adoption	0.099	0.029	3.383**	0.001

F=49.343; R^2= 0.649

** Significant at 1% level of probability
* Significant at 5% level of probability

4.3.4 Factor analysis of dimensions of entrepreneurial behaviour

Factor analysis is multivariate data analysis technique which is used for the data reduction, it identify the small number of factors that explain most of the variance observed in a much larger number of manifest variable. Two tests were performed to ensure that the appropriate data for factor analysis was used. i. Bartlett's sphericity test; and ii. Kaiser- Meyer- Olkin (KMO) sampling adequacy measures.

Generally, the value of KMO measures of sampling adequacy falls between 0.5 to 1.0, which indicates factor analysis is appropriate and value below 0.5 indicates inappropriateness of the analysis. For the present study, it was observed that, the Kaiser-Mayer-Olkin measure of sampling adequacy of 0.545 indicated that all the variables were necessarily measuring different components (Kaiser and Rice, 1974) and also there is presence of multicollinearity among some of the dimensions of entrepreneurial behaviour, so, it can be inferred that data are appropriate for factor analysis. Barlett's test is another indication of the strength of the relationship among variables. The Barlett's test of Sphericity was found to be significant (0.000) for entrepreneurial behaviour of large cardamom growers. So, it can be inferred that the variables in population are correlated.

Table 4.3.4(a): KMO and Barlett's test for entrepreneurial behaviour of large cardamom growers

Kaiser-Meyer-Olkin measure of sampling adequacy	.545
Bartlett's Test of Sphericity	
Approx. Chi-Square	41.069
Df	15
Sig.	0.000

To do the factor analysis the "principal component method" was selected and eigen value greater than 1 is considered. Further, the Varimax with Kaiser Normalization rotation method was employed. The rotated component matrix was presented sorted by size and the coefficients were suppressed having value below 0.4. The factor analysis yielded 3 factors which explain 60.611 percent of total variance which is shown in Table 4.3.4(b).

Table4.3.4(b): Extraction Method: Principal Component Analysis

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1.	1.429	23.814	23.814	1.429	23.814	23.814
2.	1.143	19.046	42.860	1.143	19.046	42.860
3.	1.065	17.751	60.611	1.065	17.751	60.611
4.	.850	14.164	74.775			
5.	.760	12.671	87.446			
6.	.753	12.554	100.000			

Extraction Method: Principal Component Analysis.

The factor analysis yielded with three factors are presented in Table 4.3.4(c) and the first factor termed as "Innovativeness" due to high loading to factors like achievement motivation (0.742) and decision-making ability (0.702) which explain 23.814 percent of total variance. The second factor termed as "Achievement motivation" due to high loading to factors such as risk-taking ability (0.804) and leadership ability (0.522) which explain 19.046 percent of total variance. The third factor termed as "Decision making ability" due to high loading to the factors like innovativeness (0.567) and management orientation (0.853) which explain 17.751 percent of total variance.

Table 4.3.4(c): Rotated Component Matrix

Items	Components		
	PC1	**PC2**	**PC3**
Innovativeness	.178	-.462	**-.567**
Achievement motivation	**.742**	-.106	.215
Decision-making ability	**.702**	.238	-.169
Risk-taking abilty	.256	**.804**	-.071
Leadership ability	.368	**-.522**	-.019
Management orientation	.135	-.138	**.853**

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

4.3.5. Direct and indirect effect of independent variables on entrepreneurial behaviour of large cardamom growers

Path analysis was employed with respect to independent variables on entrepreneurial behaviour of large cardamom, and the results are given below:

Direct effect

It can be observed from the Table 4.3.5 that marketing orientation (0.2132), economic motivation (0.2079), farming experience (0.1688), information sources utilization (0.1503), income from large cardamom (0.1382) were the major independent variables exerting highest direct positive influence on attitude of large cardamom growers towards improved cultivation practices, whereas remaining variables have relatively lower direct effects (less than 0.1).

Total indirect effect

The data showed that highest total indirect effect on attitude of large cardamom growers towards entrepreneurial behaviour was recorded highest by profitability (0.4927), scientific orientation (0.3954) and information sources utilization (0.3492) has been second and third respectively. Education (-

0.0013), land holding under agriculture (-0.0511),age(-0.2887) and family size (-0.0636) exerted a negative and total indirect effect on entrepreneurial behaviour of large cardamom growers towards improved cultivation practices.

Substantial largest indirect effect through single variable:

It can be noticed from the Table 4.3.5 that the largest indirect effect was channelled through age (X1) in 11 variables, training exposure (X10) and income from large cardamom (X7) in 2 variables, profitability (X18), landholding under large cardamom (X6), marketing orientation (X14) and economic motivation (X16) in one variable each. The residual effect was found to be 0.34139.

Table 4.3.5: Direct and indirect effect of independent variables on entrepreneurial behaviour of large cardamom growers

Variable no.	Independent variables	Effect over Entrepreneurial behaviour				
		Direct	Rank	Total Indirect	Rank	Largest indirect through single variable
X1	Age	-0.3059	XIX	-0.2887	XIX	0.0313 (X10)
X2	Gender	0.0230	IX	0.0729	XIV	0.0233 (X1)
X3	Family size	0.0210	XII	-0.0636	XVIII	0.0199 (X10)
X4	Education	0.0226	X	-0.0013	XVI	0.0132 (X6)
X5	Land holding under agriculture	-0.0393	XIV	-0.0511	XVII	0.0264 (X18)
X6	Land holding under large cardamom	-0.2014	XVIII	0.0850	XIII	0.0768 (X7)
X7	Income from large cardamom	0.1382	V	0.1157	XII	0.0661 (X1)
X8	Annual income	0.0214	XI	0.2265	IX	0.0758 (X7)
X9	Farming experience	0.1688	III	0.2203	X	0.1106 (X1)
X10	Training exposure	-0.0991	XVII	0.1820	XI	0.0967 (X1)
X11	Extension contact	0.0128	XIII	0.2342	VIII	0.0679 (X1)
X12	Information sources utilization	0.1503	IV	0.3492	III	0.1097 (X1)
X13	Social participation	-0.0497	XV	0.0452	XV	0.0181 (X14)
X14	Marketing orientation	0.2132	I	0.2530	VI	0.0933 (X1)
X15	Scientific orientation	0.0619	VI	0.3954	II	0.1118 (X16)
X16	Economic motivation	0.2079	II	0.2999	IV	0.0915 (X1)
X17	Productivity	0.0599	VII	0.2470	VII	0.0451 (X1)
X18	Profitability	-0.0786	XVI	0.4927	I	0.0753 (X1)
X19	Knowledge	0.0374	VIII	0.2957	V	0.0656 (X1)

Residual effect = 0.34139

4.4 Technological gap in adoption of improved cultivation practices among large cardamom growers

4.4.1 Distribution of respondents based on overall technological gap index in adoption of improved cultivation practices of large cardamom

It is evident from Table 4.4.1 and Fig 4.4.1 that 49.00 per cent of the respondent in Longleng district were found to have medium technological gap followed by high (26.00 %) technological gap while 25.00 per cent had low technological gap index.

In Mon district majority (62.00 %) had medium technological gap, 24.67 per cent had low level of technological gap followed by high (13.33 %) level of technological gap index.

It can be inferred that 56.80 per cent of the respondents had medium technological gap followed by low technological gap (24.80 %), while 18.40 per cent of them possessed high overall technological gap index. Because it is essential for anyone considering adopting or rejecting a practise to weigh the pros and cons, knowledge is a limiting factor in an individual's ability to act. For this reason, it is likely that the majority of respondents fall into the category of medium adoption.

Table 4.4.1: Technological Gap Index in adoption of improved cultivation practices of Large Cardamom

N= 250

Overall Technological Gap index	Size of land holding under Large Cardamom	Longleng district		Mon district		Total	
		f	%	f	%	f	%
Low (Less than 58)		25	25.00	37	24.66	62	24.80
	Less than 1	4	4.00	3	2.00	7	2.80
	1 to 1.5	11	11.00	14	9.33	25	10.00
	1.51 to 2.0	6	6.00	12	8.00	18	7.20
	Above 2	4	4.00	8	5.33	12	4.80
Medium (58 to 64)		**49**	**49.00**	**93**	**62.00**	**142**	**56.80**
	Less than 1	6	6.00	3	2.00	9	3.60
	1 to 1.5	21	21.00	30	20.00	51	20.40
	1.51 to 2.0	15	15.00	40	26.67	55	22.00
	Above 2	7	7.00	20	13.33	27	10.80
High (Above 64)		26	26.00	20	13.34	46	18.40
	Less than 1	3	3.00	1	0.67	4	1.60
	1 to 1.5	16	16.00	4	2.67	20	8.00
	1.51 to 2.0	4	4.00	7	4.67	11	4.40
	Above 2	3	3.00	8	5.33	11	4.40
Total		100	100	150	100	250	100
Mean		61.34		60.61		60.91	
S.D		3.60		3.11		3.33	

Z = 1.6894*

*Significant at 5% level of probability

4.4.2 Practice wise technological gap in adoption of improved cultivation practices among large cardamom growers in Longleng and Mon district

It was observed that in Longleng district high (100 %) technological gap was observed in pit manuring, irrigation and nutrient application. Relatively high technological gap was also observed in IPM (89.13 %), IDM (89.10 %) and shade regulation (80.50 %). Further technological gap of 66.67 per cent was perceived in varieties, followed by pit preparation, roguing and gap filling, weed management and mulching with 45.50 per cent, 37.00 per cent, 33.84 per cent and 27.75 per cent respectively. It was also seen that curing had 17.25 per cent and packaging had 0.50 per cent of technological gap. However, there was no technological gap found in time of planting and harvesting.

It could be inferred from Table 4.4.2 that in Mon district there was high (100 %) technological gap in pit manuring, irrigation and nutrient application, followed by IDM (88.77 %) and IPM (85.42 %). It was also seen that 77.00 per cent technological gap was found in shade regulation and 66.67 per cent in varieties. Technological gap in roguing and gap filling (48.33 %), pit preparation (48.00 %), weed management (31.11 %), curing (22.83 %), mulching (18.83 %) and packaging (0.67 %) were observed. There was no technological gap in time of planting and harvesting observed.

Table 4.4.2: Practice wise Technological Gap in adoption of improved cultivation practices of Large Cardamom

N = 250

Sl. No	Recommended Practices	Longleng district (n_1 = 100)		Recommended Practices	Mon district (n_2=150)	
		Per cent Technology Gap (%)	Rank		Per cent Technology Gap (%)	Rank
1.	Pit Manuring	100	I	Pit Manuring	100	I
2.	Irrigation	100	II	Irrigation	100	II
3.	Nutrient application	100	III	Nutrient Application	100	III
4.	IPM	89.13	IV	IDM	88.77	IV
5.	IDM	89.10	V	IPM	85.42	V
6.	Shade Regulation	80.50	VI	Shade Regulation	77.00	VI
7.	Varieties	66.67	VII	Varieties	66.67	VII
8.	Pit Preparation	45.50	VIII	Roguing& Gap filling	48.33	VIII
9.	Roguing& Gap filling	37.00	IX	Pit Preparation	48.00	IX
10.	Weed Management	33.84	X	Weed Management	31.11	X
11.	Mulching	27.75	XI	Curing	22.83	XI
12.	Curing	17.25	XII	Mulching	18.83	XII
13.	Packaging	0.50	XIII	Packaging	0.67	XIII
14.	Time of Planting	0.00	XIV	Time of Planting	0.00	XIV
15.	Harvesting	0.00	XV	Harvesting	0.00	XV

4.4.3 Practice wise technological gap in adoption of improved cultivation practices among large cardamom growers

From Table 4.4.3 and Fig 4.4.3 we can observe that there is 100 per cent technological gap in the recommended pit manuring, irrigation and nutrient application. The reason attributed was lack of technical know-how of pit manuring and non-availability of required FYM near the field though the

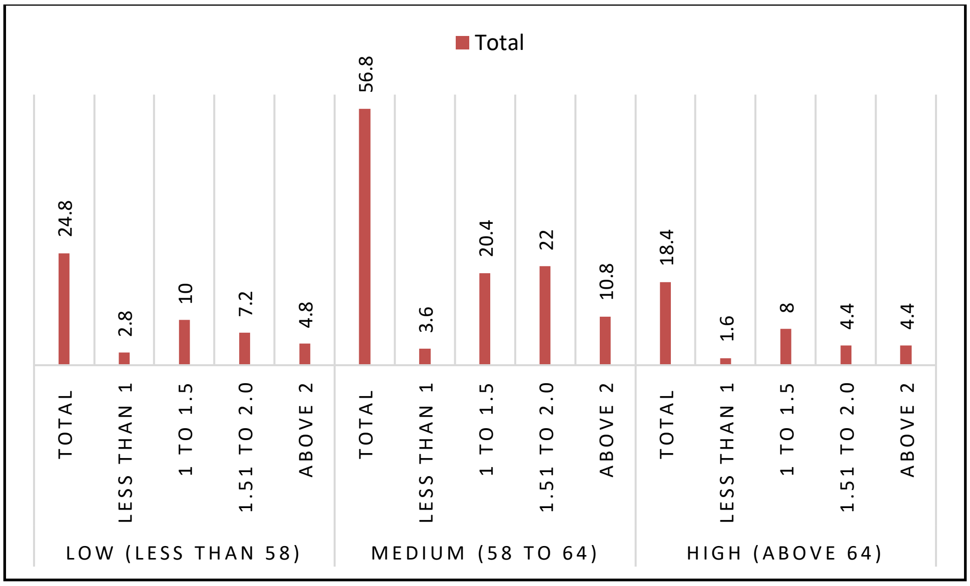


Fig 4.4.1: Technological Gap Index in adoption of improved cultivation practices of Large Cardamom

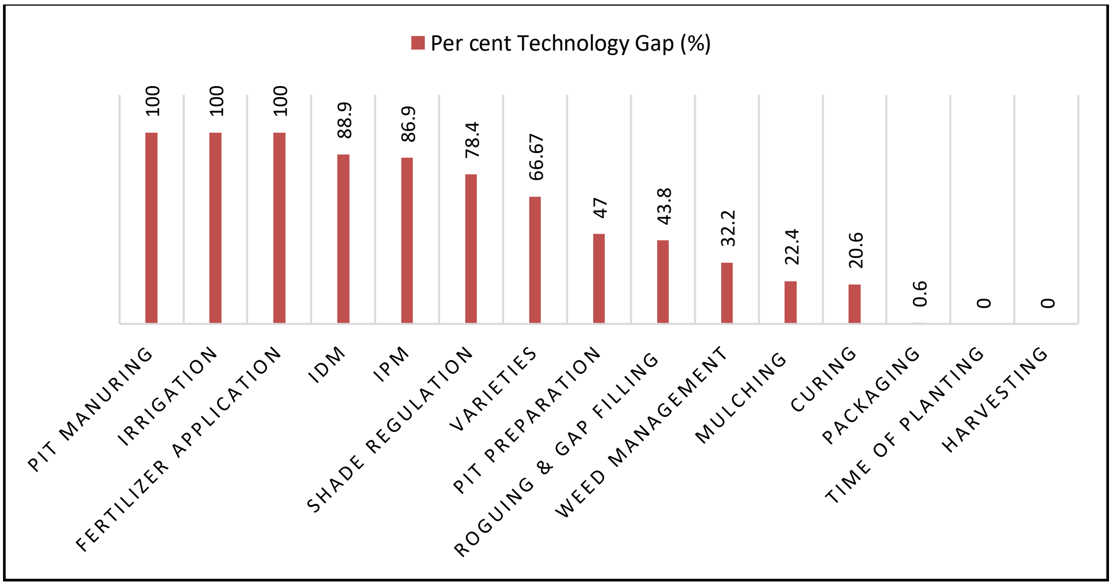


Fig 4.4.3: Practice Wise Technological Gap on Recommended practices for cultivation of Large Cardamom

farmers are willing to incorporate their field with FYM, and majority of the respondent did not have correct knowledge about the recommended nutrient application. It was found that (88.90 %) of technological gap in IDM and (86.90 %) in IPM, the major reasons expressed were lack of knowledge to identification of diseases and insect pest and subsequently its control measures.

There was gap found in shade regulation (78.40 %) and varieties (66.67 %). Technological gap in pit preparation (47.00 %), reason were lack of knowledge and lack of conviction. It was also observed that roguing and gap filling had technological gap of 43.80 per cent. The possible reason might be that respondents were unaware of the disease and pest which affect the field in no time and for that the only solution is to uproot the whole crop, which they fear of yield loss. There was technological gap found in intercultural operations like weed management (33.20 %) and mulching (22.40 %). Since these are very important operations for higher yield, the farmers were following it. In curing there was (20.60 %) of gap observed as maximum of the farmers were curing the seeds according to their convenience, and in packaging only (0.60 %) were observed as the farmers were packing their produce in the required packaging material. There was no technological gap in time of planting and harvesting observed as it was followed easily by the farmers.

Table 4.4.3: Practice Wise Technological Gap on Recommended practices for cultivation of Large Cardamom

Sl. No	Recommended Practices	Per cent Technology Gap (%)	Rank
1.	Pit Manuring	100	I
2.	Irrigation	100	II
3.	Fertilizer Application	100	III
4.	IDM	88.90	IV
5.	IPM	86.90	V
6.	Shade Regulation	78.40	VI
7.	Varieties	66.67	VII
8.	Pit Preparation	47.00	VIII
9.	Roguing& Gap filling	43.80	IX
10.	Weed Management	32.20	X
11.	Mulching	22.40	XI
12.	Curing	20.60	XII
13.	Packaging	0.60	XIII
14.	Time of Planting	0	XIV
15.	Harvesting	0	XV

4.4.4 Relationship between independent variables and Technological gap

Table 4.4.4 revealed that independent variable age had positive and significant correlation with the technological gap of the respondents at 1% level of probability. Age is a significant factor in the acceptance of improved new technologies. This means that the older respondents will tend to have higher level of technological gap. Young and middle-aged farmers will contribute to closing the technology divide. The association between age and technological gap was shown to be both positive and substantial. This could be because young farmers have more exposure to extension contact with various organisations. The extension people must reach all types of large cardamom growers who were not encouraged to use new technology, but the results reveal that young farmers are keener to adopt new technology than the older age group, because the older age group is primarily laggards, only literate.

It was also revealed that independent variables information sources utilization, scientific orientation, marketing orientation, profitability and knowledge had negative and significant correlation with the technological gap of the respondents at 1% level of probability. Large cardamom productivity and agriculture are dependent on farmer understanding of better technologies. This can be attributed to a common observation that knowledgeable people tend to gain more knowledge through continuous contacts with agricultural universities, extension workers, agricultural officers, and so on, which aids in the adoption of new technology at an earlier stage than less knowledgeable people. The result also indicates that higher the information sources utilization, scientific orientation and marketing orientation lesser the technological gap and vice versa.

Training exposure, extension contact and productivity had negative and significant correlation with technological gap at 5% level of probability. This clearly shows that increasing farmers' contact with extension agents encourages them to use modern agricultural technologies to a larger extent.

Therefore,

H_o3: There is no association between variables viz., Age, information sources utilization, scientific orientation, marketing orientation, profitability, knowledge, training exposure, extension contact and productivity with the *technological gap* in adoption of improved large cardamom cultivation practices was rejected.

Other variables like gender, family size, education, size of total land holding, area under large cardamom, annual income, income from large cardamom, farming experience, social participation, economic motivation were

Table 4.4.4: Correlation of Independent Variables with Technological Gap in Adoption of Improved Large Cardamom Practices

Sl. No	Independent Variables	Coefficient of correlation (r)	P value
1.	Age	0.185**	0.003
2.	Gender	-0.063	0.319
3.	Family Size	-0.116	0.067
4.	Education	0.002	0.973
5.	Size of Total Land Holding	0.102	0.973
6.	Area under Large Cardamom	0.069	0.275
7.	Annual Income	-0.060	0.346
8.	Income from Large Cardamom	-0.105	0.097
9.	Training Exposure	-0.146*	0.021
10.	Farming Experience	-0.063	0.323
11.	Information Source utilization	-0.243**	0.000
12.	Social participation	-0.043	0.494
13.	Scientific Orientation	-0.200**	0.002
14.	Marketing orientation	-0.225**	0.000
15.	Extension Contact	-0.146*	0.050
16.	Economic Motivation	-0.107	0.091
17.	Productivity	-0.155*	0.014
18.	Profitability	-0.194**	0.002
19.	Knowledge	-0.220**	0.000

**Correlation is Significant at 0.01 level (2 tailed)
* Correlation is Significant at 0.05 level (2 tailed)

found to be non-significant with technological gap of the farmers. This indicates that gender, family size, education, size of total land holding, area under large cardamom, annual income, income from large cardamom, farming experience, social participation and economic motivation has no influence on the extent of technological gap in adoption of recommended large cardamom production technology by the farmers.

Therefore,

H_o3a: There is no association between variables viz., gender, family size, education, size of total land holding, area under large cardamom, annual income, income from large cardamom, farming experience, social participation, economic motivation with the *technological gap* in adoption of improved large cardamom cultivation practices was accepted.

4.4.5 Direct and indirect effect of independent variables on technological gap of large cardamom growers

Path analysis was used to establish a quantifiable explanation of the direct and indirect effects of independent variables on technological gap of large cardamom growers towards improved cultivation practices, and the results are shown in Table 4.4.5.

Direct effect

It can be observed from the Table 4.4.5 that annual income (0.1110), economic motivation (0.1030), land holding under agriculture (0.0540), farming experience (0.0240), age (0.0190) were the major independent variables exerting highest direct positive influence on technological gap of large cardamom growers towards improved cultivation practices, whereas remaining variables have relatively lower negative direct effects.

Total indirect effect

The data showed that highest total indirect effect on technological gap of large cardamom growers towards improved cultivation practices was recorded by age (0.1661), land holding under large cardamom (0.1584), and holding under agriculture (0.0479), family size (0.0300), and education (0.0102).

Training exposure (-0.0026), gender (-0.0193), social participation (-0.0235), productivity (-0.0249), knowledge (-0.0601), scientific orientation (-0.0656), exerted a negative and total indirect effect on attitude of large cardamom growers towards improved cultivation practices.

Substantial largest indirect effect through single variable:

It can be noticed from the Table 4.4.5 that the largest indirect effect on technological gap of large cardamom growers was channelled through economic motivation (X16) in 7 variables, family size (X3) in 3 variables, land holding under large cardamom (X6), annual income (X8), Productivity (X17) in 2 variables, farming experience (X9), training exposure (X10) and scientific orientation (X15) in 1 variable respectively. The residual effect was found to be 0.81944.

Table4.4.5: Direct and indirect effect of independent variables on technological gap of large cardamom growers

Variable no.	Independent variables	Effect over technological gap				
		Direct	Rank	Total Indirect	Rank	Largest indirect through single variable
X1	Age	0.0190	V	0.1661	I	0.0487 (X15)
X2	Gender	-0.0440	XI	-0.0193	VII	0.0169 (X3)
X3	Family size	-0.1460	XVII	0.0300	IV	0.0287 (X10)
X4	Education	-0.0080	VI	0.0102	V	0.0105 (X3)
X5	Land holding under agriculture	0.0540	III	0.0479	III	0.0541 (X17)
X6	Land holding under large cardamom	-0.0890	XII	0.1584	II	0.0868 (X17)
X7	Income from large cardamom	-0.0110	VII	-0.0943	XV	0.0608 (X8)
X8	Annual income	0.1110	I	-0.1709	XVIII	0.1108 (X16)
X9	Farming experience	0.0240	IV	-0.0868	XIII	0.0304 (X16)
X10	Training exposure	-0.1430	XVI	-0.0026	VI	0.0294 (X3)
X11	Extension contact	-0.0330	IX	-0.0912	XIV	0.0290 (X16)
X12	Information sources utilization	-0.1180	XIII	-0.1252	XVI	0.0336 (X16)
X13	Social participation	-0.0200	VIII	-0.0235	VIII	0.0111 (X16)
X14	Marketing orientation	-0.1480	XVIII	-0.0768	XII	0.0232 (X16)
X15	Scientific orientation	-0.1340	XV	-0.0656	XI	0.0555 (X9)
X16	Economic motivation	0.1030	II	-0.2101	XIX	0.1032 (X8)
X17	Productivity	-0.1300	XIV	-0.0249	IX	0.0596 (X6)
X18	Profitability	-0.0330	X	-0.1609	XVII	0.0478 (X6)
X19	Knowledge	-0.1600	XIX	-0.0601	X	0.0378 (X16)

Residual effect = 0.81944

4.5 Constraints faced by large cardamom farmers in adoption of improved cultivation practices

In the present study, major constraints faced by the sample respondents in the study area were categorized under several aspects, namely, land related, input supply, biophysical, plant protection, technical, labour, economic, marketing, post-harvest, climate change, social, extension and irrigation constraints. The respondents were asked to rank the attributes. The constraints were then ranked based on Garrett ranking technique and the details of the problems confronted by them were discussed in this chapter.

4.5.1 Constraints in land related aspect of large cardamom farmers

From Table 5.1.1, it is revealed that the major land related constraint faced by most of the respondents was unable to use farm machinery undulating land with a score of 63.30 (rank I). Secondly, improper land preparation was expressed as an important constraint with score of 60.72. Low land productivity (57.02), and fragmented and undulated land (51.20) were ranked third and fourth respectively.

Table 4.5.1: Land Related constraints of large cardamom farmers

Sl. No.	Land Related Constraints	Total	Score	Rank
1.	Unable to use farm machinery undulating land	15826	63.30	I
2.	Improper land preparation	15180	60.72	II
3.	Low land productivity	14256	57.02	III
4.	Fragmented and undulated land	12801	51.20	IV

4.5.2 Constraints in input supply aspect of large cardamom farmers

From Table 5.1.2, it was indicated that problem faced due to high requirement of manure and fertilizer for recommended varieties was ranked as the most important constraint with a score of 57.85, followed by insufficient organic manure (55.08). Non-availability of fertilizers at the peak season was ranked third (54.58) and non-availability of improved/recommended varieties of the large cardamom with score of 48.47 was ranked fourth. Further, Non-availability of insecticides and pesticides (46.48), and high price of planting material (37.00) were ranked fifth and sixth respectively. Government agencies distributed inputs in a short period of time, and all farmers were unable to obtain government-supplied inputs. Respondents also felt that when the need was greatest there was no availability of needed inputs, inputs from government agencies and private input agencies were available when not needed, that the quality of inputs was poor.

Table 4.5.2: Input supply constraints of large cardamom farmers

Sl. No.	Input Supply Constraints	Total	Score	Rank
1.	High requirement of manure and fertilizer for recommended varieties	14463	57.85	I
2.	Insufficient organic manure	13770	55.08	II
3.	Non-availability of fertilizers at the peak season	13644	54.58	III
4.	Non-availability of improved/recommended varieties of the large cardamom	12117	48.47	IV
5.	Non-availability of insecticides and pesticides	11620	46.48	V
6.	High price of planting material	9250	37.00	VI

4.5.3 Constraints in biophysical aspect of large cardamom farmers

Flood/drought during crop period was the major biophysical constraint (73.00) faced by the respondents. The other important biophysical constraints were weed infestation (64.64), occurrence of showers during harvest (60.69) and epidemics of pest and diseases (37.62).

Sometimes weed infestation becomes more problematic than pests and diseases, as weeds were interminable and appear every time with the onset of monsoon. The large cardamom field were severely affected in some areas when the summer showers coincided with the harvesting period. The epidemics of pest and diseases, especially stem borer, foorkey and clump rot were making the farmers to bear losses.

Table 4.5.3: Biophysical constraints of large cardamom farmers

Sl. No.	Biophysical Constraints	Total	Score	Rank
1.	Floods/ drought during crop period	18250	73.00	I
2.	Weed infestation	16159	64.64	II
3.	Occurrence of showers during harvest	15173	60.69	III
4.	Epidemics of pest and diseases	9406	37.62	IV

4.5.4 Constraints in Plant protection aspect of large cardamom farmers

In case of plant protection measures, it can be inferred from Table 5.1.4 that damage by insects (58.38), problems in identification of disease and pest (52.04), damage by diseases (45.20), lack of knowledge on proper usage of plant protection measures (43.96) and lack of pest and disease management training (41.78) were the constraints in rank order of their importance.

Foorkey affects the productivity of various large cardamom cultivars in the study area and is a serious problem in terms of yield loss. Hence, the concerned departments and Agricultural University should make every effort to impart knowledge to the large cardamom farmers about identification, knowledge on proper usage of plant protection measures and pest and disease management training.

Table 4.5.4: Plant protection constraints of large cardamom farmers

Sl. No.	Plant protection constraints	Total	Score	Rank
1.	Damage by insects	14595	58.38	I
2.	Problems in identification of disease and pest	13010	52.04	II
3.	Damage by diseases	11300	45.20	III
4.	Lack of knowledge on proper usage of plant protection measures	10990	43.96	IV
5.	Lack of pest and disease management training	10445	41.78	V

4.5.5 Constraints in Technical aspect of large cardamom farmers

From Table 5.1.5 it could be inferred that among technical constraints of large cardamom were in the rank order, Lack of technical know- how about curing(57.02), Inadequate training of farmers on cardamom production and management (53.19), Lack of knowledge about improved varieties (48.60), Lack of know-how about seed treatment (47.20), Insufficient availability of technical guidance (45.41), Lack of knowledge about latest technology (41.06) and Lack of technical know-how about insect-pest and disease management (36.85). This could be due to a lack of technical assistance, up-to-date information, and knowledge from experts, among other things.

Table 4.5.5: Technical constraints of large cardamom farmers

Sl. No.	Technical constraints	Total	Score	Rank
1.	Lack of technical know- how about curing	14255	57.02	I
2.	Inadequate training of farmers on cardamom production and management	13297	53.19	II
3.	Lack of knowledge about improved varieties	12151	48.60	III
4.	Lack of know-how about seed treatment	11800	47.20	IV
5.	Insufficient availability of technical guidance	11352	45.41	V
6.	Lack of knowledge about latest technology	10264	41.06	VI
7.	Lack of technical know-how about insect-pest and disease management	9212	36.85	VII

4.5.6 Constraints in Labour aspect of large cardamom farmers

Large cardamom cultivation is labour intensive and requires skilled labour all year. Not surprisingly, farmers in the study area faced a critical shortage of skilled labour (Table 5.1.6). It was found that the labour constraint were in the rank order unskilled labour (57.24), low labour productivity (56.34), inadequate family labour (55.22), scarcity of labour during peak periods (44.38) and high cost of labour (43.58).

Migration of rural people to nearby town in search of better jobs, alternative employment opportunities at the village level and youth disinterest in agriculture have resulted in a severe shortage of skilled labour, particularly during peak planting/sowing and harvesting seasons. As a result, the wage rates for skilled labour required for large cardamom cultivation have naturally risen. The average per day wage rates in the study area during the peak season of sowing/planting and harvesting were Rs. 150 for women and Rs.200 for men. According to the respondents, the efficiency of manual labour has dropped as compared to only a few years ago, and because of the nuclear family system and younger generations showing more interest in activities other than agriculture, the availability of family labour has become scarce. The manual labour did not know the skills required for large cardamom production, and they came to the farmers when they had no other activities to do and were not engaged in large cardamom production otherwise.

Table 4.5.6: Labour constraints of large cardamom farmers

Sl. No.	Labour constraints	Total	Score	Rank
1.	Unskilled labour	14310	57.24	I
2.	Low labour productivity	14085	56.34	II
3.	Inadequate family labour	13805	55.22	III
4.	Scarcity of labour during peak periods	11095	44.38	IV
5.	High cost of labour	10895	43.58	V

4.5.7 Constraints in Economic aspect of large cardamom farmers

From Table 5.1.7 it can be inferred that in economic constraint of the large cardamom cultivators, Less availability of agricultural credit from financial institutions (60.66), Non availability of agricultural credit from financial institutions (60.54), Rate of interest on loan is high (60.30), High cost of technology (46.86) and Non-availability of Government subsidy (43.16) were the constraints in order of their importance. The lack of access to subsidies, as well as the lack of a pricing policy that includes crop insurance, has increased the risk of large cardamom cultivation.

The large cardamom farmers stated that due to financial constraints, they had to rely on middlemen due to the urgency of money at critical stages of crop growth, as institutional and government agencies took longer to give loans due to more procedures and waiting advances from the government. The middlemen were charging exorbitant interest rates on the loans, causing the farmers to spiral into debt again and again. The government agencies provided very little time for loan repayment. According to the respondents, insurance was not available to farmers during all seasons, and only a few agencies came forward on a few occasions.

Table 4.5.7: Economic constraints of large cardamom farmers

Sl. No.	Economic constraints	Total	Score	Rank
1.	Less availability of agricultural credit from financial institutions	15165	60.66	I
2.	Non availability of agricultural credit from financial institutions	15135	60.54	II
3.	Rate of interest on loan is high	15075	60.30	III
4.	High cost of technology	11715	46.86	IV
5.	Non-availability of Government subsidy	10790	43.16	V

4.5.8 Constraints in Marketing aspect of large cardamom farmers

The marketing constraints were in the following rank order. Poor access of market information (59.04), lack of proper marketing channel (58.26), high fluctuation in market price (50.63), exploitation by middlemen (50.26), costly transportation service (50.14) and lack of reliable market (48.59).

Respondents stated that during harvest, they had to rely on middlemen to sell the produce quickly at the local level because some farmers did not have the capacity to transport their produce to distant markets. Farmers believed that even at market yards, where the majority of farmers sold their produce, the market price was very low. Due to the farmer's reliance on middlemen for initial loans and unfavourable market conditions, they were forced to sell their distressed produce only at the village level. Farmers believed that on most occasions, the middleman dominated price regulation rather than the farmers. They stated that they did not have the price conditions at different times, and no agency was interested in assisting farmers in forecasting the price of their produce at various times. The respondents felt that whenever they took their produce to the market believing that the prices were good, within one or two days the prices had dropped to the bottom and the fluctuation was very high, benefiting the commission agents of the market yards rather than the farmers. The large cardamom farmers believed that there should exist farmers societies, which would help farmers to some extent determine market prices.

Table 4.5.8: Marketing constraints of large cardamom farmers

Sl. No.	Marketing constraints	Total	Score	Rank
1.	Poor access of market information	14760	59.04	I
2.	Lack of proper marketing channel	14565	58.26	II
3.	High fluctuation in market price	12658	50.63	III
4.	Exploitation by middle men	12564	50.26	IV
5.	Costly transportation service	12536	50.14	V
6.	Lack of reliable market	12148	48.59	VI

4.5.9 Constraints in Post-harvest aspect of large cardamom farmers

Lack of proper storage facility (73.00) was ranked 1st, regarding to this, they revealed that they faced the problems like lack of or improper storage facilities and knowledge. The majority of them employ conventional methods, which lower the quality of the produce. Lack of processing facility at local level (67.97) ranked 2nd, It might be because farmers were forced to use manual techniques because there were no sophisticated post-harvest technologies available (harvesting, drying, transport etc.). This has been causing a rise in harvest-related losses and a decline in the grade of large cardamoms. Increasing rate of processing costs (66.47) and lack of knowledge about storage pests and diseases (63.34) ranked 3rd and 4th respectively. Large cardamom farmers reported that extension personnel were always interested in making recommendations for major pests and diseases, but when asked about storage pests and diseases, they were unable to provide accurate information.

Table 4.5.9: Post-harvest constraints of large cardamom farmers

Sl. No.	Post-harvest constraints	Total	Score	Rank
1.	Lack of proper storage facility	18250	73.00	I
2.	Lack of processing facility at local level	16992	67.97	II
3.	Increasing rate of processing costs	16618	66.47	III
4.	Lack of knowledge about storage pests and diseases	15836	63.34	IV

4.5.10 Constraints in climate change aspect of large cardamom farmers

Climate change is referred to as a statistically significant variation in either the mean state or variability of the climate that lasts for an extended period of time (typically decades or longer). The climate change constraints were found in the rank order as given in table. Adverse climatic condition at critical stages of crop (57.21), Fluctuation of temperature during growing season (56.84), Erratic rainfall (56.36) and Soil erosion (53.07). The majority of farmers rely on the monsoons for irrigation because there are no other alternatives. Farmers expressed a high reliance on monsoons, which makes it difficult to adapt to climate change.

Table 4.5.10: Climate change constraints of large cardamom farmers

Sl. No.	Climate change constraints	Total	Score	Rank
1.	Adverse climatic condition at critical stages of crop	14281	57.21	I
2.	Fluctuation of temperature during growing season	14210	56.84	II
3.	Erratic rainfall	14092	56.36	III
4.	Soil erosion	13269	53.07	IV

4.5.11 Constraints in social aspect of large cardamom farmers

It could be inferred from Table 5.1.11 and Fig 5.1.11, that the social constraints of large cardamom farmers were in the rank order. High wages for hired labour (58.44), Scarcity of labour (45.92), Younger generation not interested in farming (33.04), Labour intensive crop (32.62) and Lack of cooperation among farmers (31.48).

This is primarily due to the fact that the majority of agricultural labourers have migrated from agricultural sectors to other locally accessible jobs. People are beginning to migrate from rural to urban areas in search of a more sustainable way of life and education. Due to a lack of labour, all agricultural operations are delayed and fail to meet their potential productivity. Because of a lack of water and labour, most small farmers have left the agricultural sector in recent years.

Table 4.5.11: Social constraints of large cardamom farmers

Sl. No.	Social constraints	Total	Score	Rank
1.	High wages for hired labour	14610	58.44	I
2.	Scarcity of labour	11480	45.92	II
3.	Younger generation not interested in farming	8260	33.04	III
4.	Labour intensive crop	8155	32.62	IV
5.	Lack of cooperation among farmers	7870	31.48	V

4.5.12 Constraints in extension aspect of large cardamom farmers

The marketing constraints were in the following rank order. Lack of contact with extension agents (60.57), Untimely visit of extension agents (54.12), insufficient extension activities like demonstrations, farmers group discussion, kisan melas etc. by extension agencies (51.61), Lack of effective technical supervision (51.12) and Farmers training not conducted (51.09). Regarding extension issues, the respondents stated that the extension staff wasn't always interested in organising trainings related to large cardamom. In certain locations, the field extension crew was also relatively small. The extension staff's efforts as a result were sluggish. Additionally, the farmers believed that the extension staff lacked the technical know-how and training necessary to address their current difficulties. Farmers perceived a very high extension worker to farmer ratio.

Table 4.5.12: Extension constraints of large cardamom farmers

Sl. No.	Extension constraints	Total	Score	Rank
1.	Lack of contact with extension agents	15143	60.57	I
2.	Untimely visit of extension agents	13529	54.12	II
3.	Insufficient extension activities like demonstrations, farmers group discussion, kisan melas etc. by extension agencies	12902	51.61	III
4.	Lack of effective technical supervision	12781	51.12	IV
5.	Farmers training not conducted	12772	51.09	V

4.5.13 Constraints in Irrigation aspect of large cardamom farmers

From Table 5.1.13, it is revealed that the major irrigation constraint faced by most of the respondents was insufficient water for irrigation with a score of 73.00 (rank I). Secondly, lack of proper water harvesting units was expressed as an important constraint with score of 61.30. Inadequate irrigation facilities (52.11), and high cost of irrigation on rent basis (51.10) were ranked third and fourth respectively. This is attributed by fast depletion of ground water level and there is need to develop water harvesting system to recharge water level.

Table 4.5.13: Irrigation constraints of large cardamom farmers

Sl. No.	Irrigation constraints	Total	Score	Rank
1.	Insufficient water for irrigation	18250	73.00	I
2.	Lack of proper water harvesting units	15326	61.30	II
3.	Inadequate irrigation facilities	13028	52.11	III
4.	High cost of irrigation on rent basis	12776	51.10	IV

4.5.14 Overall constraints perceived by the large cardamom growers in adoption of improved cultivation practices

The overall score for each category was pooled in order to gain an overview of the constraints farmers perceive to adopting improved cultivation practices of large cardamom. The results are shown in Table 5.1.14. The data presented in table reveal that among the selected constraints, marketing constraints were up to greatest extent by the large cardamom growers with mean score 12.65 (rank I), followed by technical constraints with mean score 11.76 (rank II), plant protection constraint with mean score 9.78 (rank III), social constraint with mean score 9.12 (rank IV), labour constraint with mean score 7.07 (rank V), extension constraint with mean score 6.96 (rank VI), climate change constraint with mean score 6.63 (rank VII), input supply constraint with mean score 4.42 (rank VIII), economic constraint with mean score 3.98 (rank IX), biophysical constraint with mean score 3.54 (rank X), irrigation constraint with mean score 3.42 (rank XI), land related constraint with mean score 3.20 (rank XII) and post-harvest constraint with mean score 1.25 (rank XIII).

Table 4.5.14: Overall constraints perceived by the large cardamom growers in adoption of improved cultivation practices

Sl. No	Constraints	Overall Mean Score	Overall Rank
1.	Marketing Constraint	12.65	I
2.	Technical Constraint	11.76	II
3.	Plant Protection Constraint	9.78	III
4.	Social Constraint	9.12	IV
5.	Labour Constraint	7.07	V
6.	Extension Constraint	6.96	VI
7.	Climate Change Constraint	6.63	VII
8.	Input Supply Constraint	4.42	VIII
9.	Economic Constraint	3.98	IX
10.	Biophysical Constraint	3.54	X
11.	Irrigation Constraint	3.42	XI
12.	Land Related Constraints	3.20	XII
13.	Post-Harvest Constraint	1.25	XIII

Strategies to overcome the constraints faced by the large cardamom growers:

The term strategy can be used in a variety of contexts, but it is most commonly used to refer to a plan, a "how," or a method of getting from here to there. With the findings and discussions in mind, the strategy/ suggestions for overcoming the issues that persist in large cardamom cultivation are listed below:

1. Through improved research programmes, the State Agriculture department, Agriculture University, Spices Board, and other responsible agencies should together try to introduce new high yielding varieties of large cardamom to the farmers.

2. The cultivation of large cardamom within the study area is entirely manual. As a result, state government agencies or departments should make effort to provide the necessary new techniques and technical knowledge about improved cultivation practices for large cardamom growers.Organize more extension strategies, such as exhibitions, demonstrations, and kisan melas, across different levels.
3. According to the study, large cardamom growers, mostly small growers, are subjected to the involvement of middlemen or brokers. As a result, there should be direct trade with farmers, wholesalers, and exporters. The government should set an average price range to avoid extreme price fluctuations, allowing farmers to earn a consistent income. That implies that there must be an open market for large cardamom marketing. Large cardamom marketing requires immediate institutional intervention due to delayed payment and price instability.
4. Proper farm maintenance and phytosanitary techniques can reduce pests and diseases, minimizing losses for growers. Farmers require pest and disease-resistant cultivars that maintain substantial yields. State agriculture departments or KVKs in respective areas should provide training on proper packaging and practises, as well as pest and disease management, in order to achieve a satisfactory yield.
5. FYM (Farm Yard Manure) schemes should be implemented at the local level by government agencies. Vermicomposting units should be established, or farmers should be trained in the production of vermicomposting. Encourage the cultivation of green manure crops such as daincha, sun hemp, and others to replace FYM.

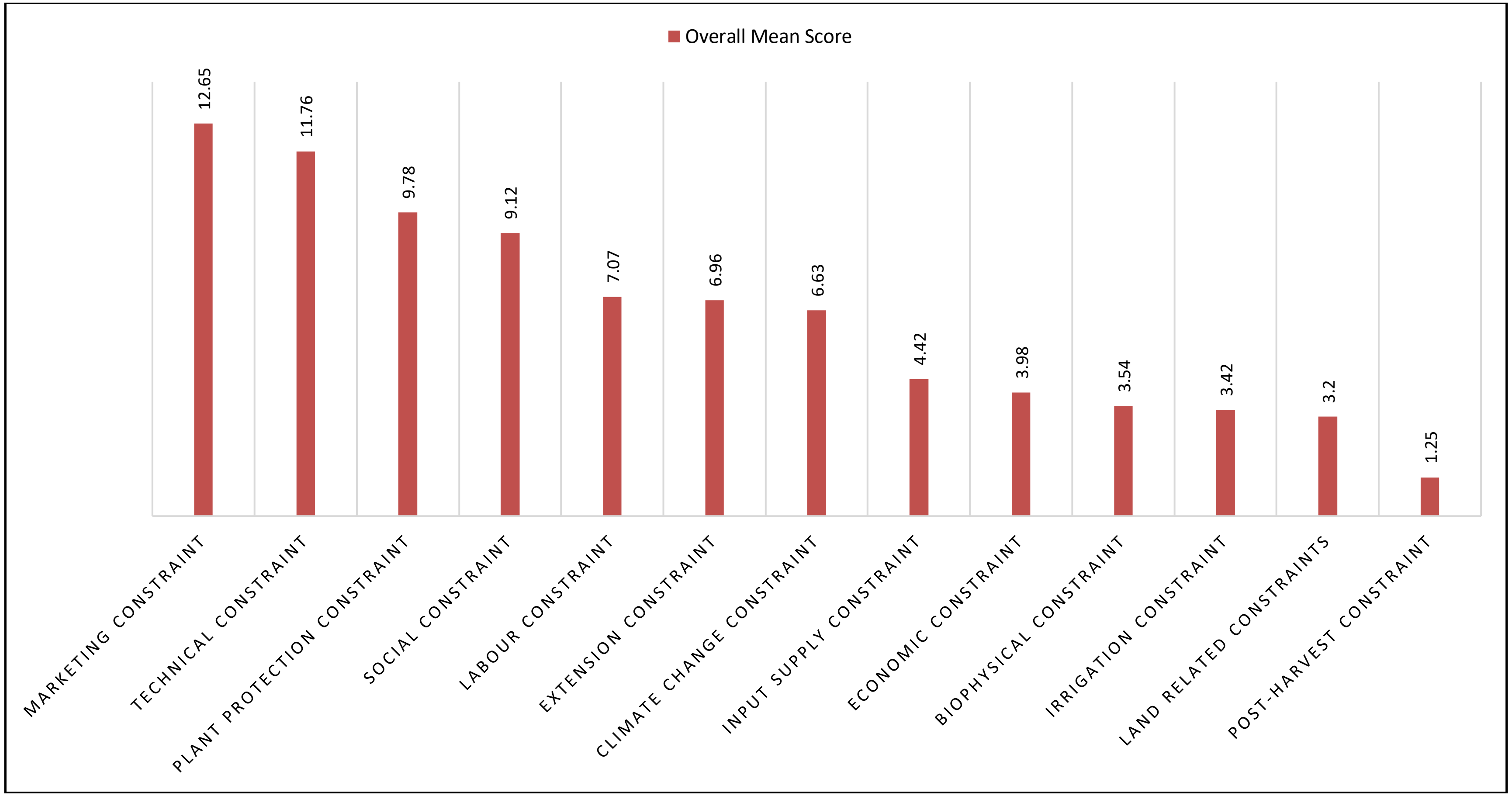


Fig 5.1.14: Overall constraints perceived by the large cardamom growers in adoption of improved cultivation practices

6. Extension professionals should be taught more seriously on specific and relevant plant protection technologies that are appropriate for the local conditions and demands. Extension personnel must get skill-based, consistent, timely, and distinctive training. Scientists, state training agencies, and state level plant protection training institutions should train them to be more prepared for recent plant protection problems.
7. Specialized capacity building programs, from production to marketing, should be performed in the study area due to the great majority of farmers' illiteracy and lack of education beyond high school. Proper training strategies should be developed to improve the technical competence of extension personnel. Subject matter specialists are in charge of specialised knowledge, such as agricultural management and, in particular, rice farming. They should act as extension advisors, passing on technical expertise tailored to local needs as well as the most recent innovations to front-line workers.
8. The extension staff crisis should be addressed by recruiting grass-roots staff and redirecting government funds or budget from other sectors to the needy agricultural sector. Multi-level extension efforts should be used in areas where public sector, non-governmental organisations, and private extension agencies are available. Duplication of efforts should be avoided by establishing separate extension agencies by the agricultural university, the State Department of Agriculture, other NGOs, and private organisations.
9. Distress sales should be avoided by making farmers aware of the situation. Demand for their products and market rates are available in various markets. This can be accomplished through collaboration among government, non-governmental organisations, and the private sector agencies. The solution to distressed sales is also to provide farmers with access to safe and scientific storage.

10. Rural youth should be motivated in the field of agriculture. Youth should be encouraged to see agriculture as a profitable business that can provide employment opportunities not only for rural youth but also for others in society. To avoid selling small holdings, particularly by small and marginal farmers, to real estate business people for commercial ventures they see will be profitable and viable, these farmers should be made aware that agriculture can be more profitable if they join in groups and engage in large-scale cultivation.

CHAPTER - V

SUMMARY AND CONCLUSIONS

SUMMARY AND CONCLUSIONS

5.1 Introduction

Spices are grown in a variety of agro climatic settings, ranging from tropical to temperate. India's diverse climatic conditions allow for the cultivation of many spices, with varying production capacities throughout states. India is a major producer of spices globally. Some other spice growing countries include Indonesia, Malaysia, Madagascar, Vietnam and China. Increase in productivity and tapping of potentiality of nonconventional spice growing areas is gaining importance in India to excel in the global market. Over 100 distinct spices are cultivated in India across 3.4 million hectares, producing 8.2 million tonnes of spices each year and exporting approximately 180 spice products to more than 150 countries (Indian Trade Portal, 2022). Pepper, cardamom, chilli, ginger, turmeric, coriander, cumin, celery, fennel, fenugreek, garlic, nutmeg & mace, curry powder, spice oils, and oleoresins are the most often manufactured and exported spices. Chilli, cumin, turmeric, ginger, and coriander account for around 76% of the overall production. Large cardamom (*Amomum subulatum* Roxburgh) is one of the popular spices that belong to the family Zingiberaceae. Large cardamom is also called black cardamom.

India is the second largest producer of large cardamom after Nepal. Sarkar *et. al*., also quoted, India was the largest producer of cardamom with 54 per cent share in world production. A total of 8.67 thousand MT of large cardamom was produced in the country during 2018-19 and the state of Sikkim was leading in both area (54.42%) and production (58.02%) of large cardamom and followed by Arunachal Pradesh (23.12%), Nagaland (6.31%) and West

Bengal (3.31%). The North Eastern Hill Region (hereafter; NEHR) contributed about 87.66% of the total production of large cardamom in the country (Spice Board of India, 2020).

Nagaland known as one of the culturally vibrant State of North East India, is an agrarian state employing about nine-tenths of its population. The state harbours a rich flora and fauna on account of its varied topography, climate and altitudes and has vast potential for advancement of horticultural crops like spices. Among different spices grown in the state, large cardamom offers a unique advantage to the growers with its rising demand. This crop has become an alternative source of income for the farmers of Nagaland. Spices play a pivotal role in changing the practice of the Naga whose aspiration has gone beyond the earlier subsistence livelihood to income generation. Large cardamom is one of the important spice crops grown in all the districts of Nagaland, except Dimapur district. During 2022-2023, the total area and production in the state accounted for 3879.52 ha and 2159 MT respectively.

Sensing the potential of this crop, economically, farmers have started taking interest in Large cardamom cultivation, and area under cultivation has increased over the years in the two study districts of Mon and Longleng. Mon and Longleng has been endowed with very fertile soil and favourable climatic conditions for Large Cardamom cultivation. Mon ranks 2nd in area (640 Ha) and 1st in production (530 MT). Longleng ranks 7th in area and 8th in production of large cardamom, 245 Ha and 113 MT, respectively.

The study will highlight the entrepreneurial behaviour pattern, technological gap, marketing practices, problems persisting in the industry, especially of growers and the promising future for cardamom in Nagaland. The entrepreneurial behaviour has some specialized characteristics like innovativeness, progressiveness, decision making, risk taking ability, self-confidence, achievement motivation, ability to co-ordinate various available resources etc. Therefore, the higher entrepreneurial behaviour of farmers directly or indirectly leads to higher adoption of any innovation for the profitable and successful running of farming enterprise. Such a study has not been made so far. Still there is ample scope for further inter-disciplinary research in areas such as institutional assistance, intensive cultivation, crop insurance, value addition, developing new end uses, on-line/internet trading and so on.

The present research study shall make an attempt to measure the technological gap and assess entrepreneurial behavioural pattern of large cardamom farmers. The data generated would be helpful to the various research and developmental organisations to understand the knowledge and adoption of large cardamom cultivation practices and problems experienced by the farmers. The findings of the study shall provide valuable information about the gap that exist in the adoption of recommended practices and also provides the information on the entrepreneurial behavioural pattern. The results would help the administrators and policy makers to formulate suitable extension activities/programmes and focused research and use appropriate methods to harness the potentiality of Nagaland for quality cardamom production and also to reduce the technological gap and also helps to increase the entrepreneurial behaviour of farmers. It shall also make an attempt to examine the potential of large cardamom cultivation and entrepreneurial behaviour of the farmers so that cardamom based enterprises can be promoted among the farmers to increase their income and promote livelihood security. The study has been planned with the following objectives:

5.2 Objectives

1. To study the socio-economic, personal and psychological characteristics of the large cardamom growers.

2. To analyse the knowledge, attitude and extent of adoption of improved cultivation practices among large cardamom growers.

3. To analyse the entrepreneurial behaviour of respondents and suggest strategy for promoting large cardamom based agri-enterprises.

4. To measure the technological gap in adoption of improved cultivation practices among large cardamom growers.

5. To find out the constraints faced by the respondents in large cardamom cultivation and management and suggest suitable measures to overcome them.

5.3 Research Methodology

The study was conducted in two districts under Eastern Nagaland *viz*., Longleng and Mon district, which were purposively selected. Mon district contribute major portion of large cardamom production, it ranks 2nd in area (640 ha) and 1st in production (530 MT). Longleng ranks 7th in area and 8th in production of large cardamom, 245 ha and 113 MT, respectively (Statistical Handbook of Nagaland, 2023). Further two RD block under Longleng district and three RD block under Mon district were selected randomly. A total of 10 villages, two villages from each selected RD block were selected randomly. A sample size of 250 respondents was selected from these ten villages by following proportionate random sampling procedure. Attitude, technological gap and entrepreneurial behaviour of the respondent were selected as the dependent variable. The independent variable included age, gender, family size, education, occupation, size of total land holding under agriculture, size of land holding under large cardamom cultivation, annual income, income from large cardamom cultivation, training exposure, extension contact, experience in large cardamom cultivation, information sources utilization, marketing orientation, economic motivation, social participation, scientific orientation, productivity, profitability and knowledge level of improved large cardamom cultivation practices.

The data were collected from the respondents in an informal atmosphere by using a pre-developed interview schedule. Statistical tools like frequencies, percentage, mean, standard deviation, correlation, multiple regression and path analysis were used to deduce relevant inferences.

5.4 Summary and Conclusions

The important findings of the study are as follows:

5.4.1. Socio-economic, personal and psychological characteristics of the large cardamom growers

The study revealed that majority of the respondents (64.40 %) were in 35 to 55 years category, majority (74.40 %) of the respondents were male, belonged to medium (82.80 %) family size ranging from 4 to 9 members. It was also found out that majority (41.60 %) of the respondents were illiterate. Under the total land holding under agriculture and large cardamom cultivation, it was revealed that majority (62.80 %) of the respondents had semi-medium (2 to 4 ha) landholding under agriculture while 38.40 per cent of them had 1 to 1.5 ha of land under large cardamom cultivation. Majority (40.80 %) of the respondents had an annual income ranging Rs. 80000 to Rs. 100000, while 58.00 per cent of the respondents had income of Rs. 50000 to Rs. 80000 from large cardamom cultivation.

It was found that 76.40 per cent of the respondents attended training on improved large cardamom cultivation practices over the past five years and 71.20 per cent had medium level of training need. The training need was found highest in integrated disease management and integrated pest management with mean score of 2.00. It was found that 68.80 per cent of them had medium level of farming experience (6 to 8 years) in large cardamom cultivation. 86.80

per cent of them had medium level of information sources utilization, with formal sources ranked 1st, mass media sources 2nd and informal sources ranking 3rd. 74.40 per cent and 86.80 per cent of them had medium level of market orientation and economic motivation respectively. 87.20 per cent had medium level of scientific orientation and 99.20 per cent of the respondents had medium level of social participation.

5.4.2. Knowledge, attitude and extent of adoption of improved cultivation practices among large cardamom growers

5.4.2.1 Knowledge level of improved cultivation practices among large cardamom growers

Majority of the respondents had very high knowledge on 8 dimensions, namely climate (100 %), harvesting (100 %), varieties (96.80 %), propagation (90.40 %), roguing and gap filling (85.60 %), shade regulation (63.20 %), weed management (61.60 %) and soil (53.60 %). Further 48.00 per cent had high knowledge on mulching, followed by 82.00 per cent, 76.00 per cent, 67.20 per cent and 49.60 per cent of the respondents with medium knowledge on curing, packing, integrated disease management and integrated pest management respectively. 66.80 per cent had low knowledge on pit preparation and 100 per cent of the respondents had no knowledge on irrigation. Overall analysis revealed that majority (56.80 %) had medium level of knowledge.

5.4.2.2 Attitude of respondents towards improved cultivation practices of large cardamom

Majority of the large cardamom growers possessed favourable (65.60 %), while 18.00 per cent and 16.40 per cent possessed most favourable and least favourable attitude towards improved cultivation practices.

It was found that annual income, farming experience, information sources utilisation, scientific orientation, marketing orientation, economic motivation, productivity, profitability, knowledge and adoption had positive significant association with attitude. The variable age and family size had negative and significant association with attitude.

Based on multiple regression analysis it was found independent variables *viz*., information utilization sources, productivity and knowledge were positively significant at 1 per cent level, whereas age and family size were negatively significant at 5 per cent level. The R^2 value (0.226) indicated that the independent variables contributed to 22.60 per cent of variation in attitude of large cardamom growers towards improved cultivation practices.

With respect to direct and indirect effects of independent variables on attitude towards adoption of large cardamom growers towards improved cultivation practices, highest direct effect was recorded by productivity, information sources utilization and income from large cardamom. Further, the data showed that high total indirect effect on sustainability was recorded by profitability, economic motivation and scientific orientation. The residual effect was found to be 0.75321.

5.4.2.3 Adoption level of improved cultivation practices among large cardamom growers

It was also found out that majority (56.80 %) of the respondents had medium level of adoption index of the improved practices of large cardamom, followed by high (24.80 %) level of adoption and 18. 40 per cent under low level of adoption.

1. Adoption of varieties: Adoption of recommended varieties of large cardamom showed that 100 per cent of the respondents full adopted that variety Ramsey and 100 per cent of the growers did not adopt the varieties Sawney and Golsey as per the recommendation.

2. Adoption of pit preparation: Adoption of pit preparation of pit size (1x1x1 ft.) showed that higher number of respondents 52.00 per cent fully adopted, followed by 38.80 per cent of no adoption and 9.20 per cent partial adopted. Adoption of maintaining pit distance (1.5x1.5 m), only 11.60 per cent fully adopted the recommendation, with majority of 73.60 per cent partially adopted and 14.80 per cent of no adoption respectively.

3. Adoption of pit manuring: Adoption of pit manuring (25 kg neem cake, 2-4 kgs FYM inoculated with *Trichoderma*) showed that 100 per cent of respondents did not adopt the improved recommendation.

4. Adoption of time of planting: Adoption of proper time of planting (May to early June) showed that 100 per cent of the respondents fully adopted time of planting as per recommendation.

5. Adoption of intercultural operations (mulching, weed management and irrigation): Adoption of intercultural operation, mulching showed that higher percentage of respondents 68.40 per cent fully adopted followed by 31.60 per cent partial adopted. Weed management showed that 64.00 per cent partial adopted and 36.00 per cent full adopted weeding before harvesting. Intercultural operation, irrigation showed that 100 per cent of the respondents did not adopt the practice as per recommendation.

6. Adoption of shade regulation: Adoption of shade regulation of pruning tall growing trees regularly at the height of 4 to 5 m. showed that 57.20 per cent did not practice it followed by 42.40 per cent partial adopted and 0.40 per cent full adopted by the respondents.

7. Adoption of nutrient management: Adoption of nutrient management (NPK @20:30:40) along with 10 to 15 tonnes of FYM or compost per hectare, every once a year, showed that 100 per cent of the respondents did not adopt nutrient application on large cardamom farm.

8. Adoption of roguing and gap filling: Adoption of roguing and gap filling (May to June) showed that 87.60 per cent partial adopted and 12.40 per cent had full adoption of removing the affected plants and replacing them with healthy plants.

9. Adoption of integrated disease management:

i. Leaf spot: Adoption of management of leaf spot showed that majority of the respondent have no adoption of maintaining good drainage (79.60 %), applying *Trichoderma* (99.60 %) and spraying of Bordeaux mixture (80.40 %). Incase of partial adoption, respondent have partially adopted maintaining good drainage (20.00 %), applying *Trichoderma* (0.40 %) and spraying of Bordeaux mixture (19.60 %). With regard to full adoption, only 0.40 per cent of the respondent fully adopted maintaining good drainage.

ii. Foorkey: In adoption of management practices of foorkey, it was found that only 0.40 per cent fully adopted disease free certified rhizomes and destroying of collateral host plant. Incase of partial adoption, majority (68.00 %) of the respondent partially adopted using disease free certified rhizomes, followed by destroying collateral host plant (55.60 %), keeping infected land fallow for a year (37.20 %) and applying dimecron/ rogor (18.80 %). With regard to no adoption, majority (81.20 %) did not apply dimecron/ rogor, followed by keeping infected land fallow for a year (37.20 %), using disease free certified rhizomes (31.60 %) and destroying collateral host plant (44.00 %).

iii. Clump rot: In adoption of management practices of clump rot, it was found that majority (100 %) of the respondent have no adoption of mulching during summer, suckers dipped in *Trichoderma* or neem extract and spraying fungicide at fortnightly interval.

10. Adoption of integrated pest management:

i. Stem borer: Adoption of integrated pest management of stem borer showed that in partial adoption, 22.40 per cent of respondent followed removal of plants infested with caterpillars and majority (62.80 %) partially adopted destroying of dry shoots of large cardamom plant. With regard to no adoption, majority (77.60 %) did not adopt removal of plants infested with caterpillars and only 37.30 per cent did not adopt destroying of dry shoots.

ii. Cardamom weevil: With regard to adoption of management practices of cardamom weevil, it was found that only 19.60 per cent of the respondent partially adopted destroying of plants along with weevil. In case of no adoption, majority (80.40 %) did not adopt destroying of plants along with weevil and 100 per cent of the respondent did not adopt the practice of drenching the base of clumps in malathion.

11. Adoption of harvesting: Adoption of proper method of harvesting showed that 100 per cent of the respondents full adoption the proper time of harvest, August to September, when the seeds of topmost capsules turn brown.

12. Adoption of curing: Adoption of curing instantaneously after harvest demonstrated that 84.40 full adopted and 15.60 partial adopted this recommendation. Curing temperature of 50-55ºC showed that 61.20 partial adopted, 36.00 per cent full adopted and 2.80 per cent not adopted respectively.

13. Adoption of packing: Adoption of method of packing with coal tar coated or polythene line gunny bags, and insect proof bags and air tight containers showed that 98.80 full adopted this recommendation followed by 1.20 per cent partial adopted.

5.3. Entrepreneurial behavioural pattern of the large cardamom farmers

3.1 Attributes of entrepreneurial behaviour

The study revealed that the majority (84.00%) of respondents exhibited a considerable level of innovativeness. Additionally, 89.60%, 83.60%, and 88.00% of the respondents demonstrated a moderate level of achievement motivation, risk-taking ability, and decision-making ability, respectively. Furthermore, a majority (78.40%) displayed a moderate level of management orientation, while 79.20% showed a moderate level of leadership ability. Out of all the entrepreneurial attributes management orientation ranked 1st followed by achievement motivation, risk taking ability, decision making ability, innovativeness and leadership ability.

5.4.3. Level of entrepreneurial behaviour of large cardamom growers

It was found out that majority (58.80 %) had medium entrepreneurial behaviour, 24.40 per cent belonged to high level of entrepreneurial behaviour followed by low (16.80 %) level of entrepreneurial behaviour.

Annual income, income from large cardamom, farming experience, information source utilization, scientific orientation, marketing orientation, extension contact, economic motivation, productivity, profitability, knowledge and adoption had positive significant association with entrepreneurial behaviour of the respondents. Age was found negative and significant correlation with the entrepreneurial behaviour of the respondents.

Multiple regression analysis of independent variables with entrepreneurial behaviour indicated that variables *viz.*, income from large cardamom, farming experience, information utilization sources, marketing orientation, economic motivation and adoption were positively significant at 1 per cent level, whereas age and land holding under large cardamom was negatively significant at 1 per cent level and training exposure was negatively significant at 5 per cent level. The R^2 value (0.649) indicated that the independent variables contributed to 64.90 per cent of variation in entrepreneurial behaviour of large cardamom growers towards improved cultivation practices.

The factor analysis yielded with four factors was carried out and the first factor termed as “Innovativeness” due to high loading to factors like achievement motivation (0.742) and decision-making ability (0.702) which explain 23 percent of total variance. The second factor termed as “Achievement motivation” due to high loading to factors such as risk-taking ability (0.804) and leadership ability (0.522) which explain 19.046 percent of total variance. The third factor termed as “Decision making ability” due to high loading to the factors like innovativeness (0.567) and management orientation (0.853) which explain 17.751 percent of total variance.

Path analysis was applied to know the direct and indirect effects of independent variables on entrepreneurial behaviour of large cardamom farmers. As regards to the direct effects on entrepreneurial behaviour is concerned, marketing orientation stood first followed by economic motivation and farming experience. Further, ranking of variables based on their total indirect effect on entrepreneurial behaviour revealed that profitability, scientific orientation and information sources utilization had highest indirect effect. The residual effect was found to be 0.34139.

5.4.4. Technological gap of respondents towards adoption improved cultivation practices of large cardamom

Majority (56.80 %) had medium technological gap, nearly one fourth (24.80 %) belonged to low level technological gap followed by high (18.40 %) level of technological gap index.

Age had age had positive and significant correlation with the technological gap of the respondents at 1% level of probability. It was also revealed that independent variables information sources utilization, scientific orientation, marketing orientation, profitability and knowledge had negative and significant correlation with the technological gap of the respondents at 1% level of probability. Training exposure, extension contact and productivity had negative and significant correlation with technological gap at 5% level of probability.

It was found that annual income (0.1110), economic motivation (0.1030), land holding under agriculture (0.0540), farming experience (0.0240), age (0.0190) were the major independent variables exerting highest direct positive influence on technological gap of large cardamom growers towards improved cultivation practices, whereas remaining variables have relatively lower negative direct effects.

5.4.5. Constraints faced by the respondents in large cardamom cultivation

In the present study, constraints faced by the sample respondents in the study area were categorized under several aspects, and the overall score for each category was pooled in order to gain an overview of the constraints farmers perceive to adopting improved cultivation practices of large cardamom. The results revealed that among the selected constraints, marketing constraints were up to greatest extent by the large cardamom growers with mean score 12.65 (rank I), followed by technical constraints with mean score 11.76 (rank II), plant protection constraint with mean score 9.78 (rank III), social constraint with mean score 9.12 (rank IV), labour constraint with mean score 7.07 (rank V), extension constraint with mean score 6.96 (rank VI), climate change constraint with mean score 6.63 (rank VII), input supply constraint with mean score 4.42 (rank VIII), economic constraint with mean score 3.98 (rank IX), biophysical constraint with mean score 3.54 (rank X), irrigation constraint with mean score 3.42 (rank XI), land related constraint with mean score 3.20 (rank XII) and post-harvest constraint with mean score 1.25 (rank XIII).

5.5 Conclusion

1. Majority of the large cardamom growers were middle aged, male, medium sized family, mostly illiterate, having farming experience of 6 to 8 years, medium level of overall information utilisation sources, social participation, extension contact, economic motivation, scientific orientation and economic motivation. The training needs of the farmer were found to be medium.

2. The majority of the respondents possessed a moderate knowledge about improved cultivation practice of large cardamom. Majority of the respondents had favourable attitude towards adoption of improved cultivation practices of large cardamom, and it was found highest among farmers with land holding under 1 to 1.5 ha. It was found that annual income, annual income from large cardamom, farming experience, information sources utilisation, scientific orientation, marketing orientation, economic motivation, productivity, profitability, knowledge, adoption and entrepreneurial behaviour had positive significant association with attitude, which indicates that the higher the above mentioned variables, higher was their attitude towards adoption of improved cultivation.

3. Technological gap of large cardamom farmers was found to be medium level. Age was positively significant. Training exposure, information source utilization, scientific orientation, marketing orientation, extension orientation, productivity, profitability, knowledge, adoption, attitude and entrepreneurial behaviour showed negative significant association with technological gap.

4. Entrepreneurial behaviour was observed to be medium level and annual income, income from large cardamom, farming experience, information source

utilization, scientific orientation, marketing orientation, extension contact, economic motivation, productivity, profitability, knowledge, adoption and attitude had positive significant with entrepreneurial behaviour.

5. Constraint analysis included several aspects, namely, land related, input supply, biophysical, plant protection, technical, labour, economic, marketing, post-harvest, climate change, social, extension and irrigation constraints. It can be managed through proper identification and study on the insect pests and diseases in the field and organizing intensive trainings, demonstrations, awareness programmes on credit facilities and market strategies.

5.6 Policy implications and recommendations

1. The farmers are successful in growing large cardamom due to favourable climatic condition and suitable soil, but it was observed that vast majority had less contact with the extension agents. Therefore it is recommended that the respondents should be motivated and encouraged through intensive trainings and demonstrations with respect to the farmer's needs and problems by the extension agencies to increase their entrepreneurial behaviour.

2. It was observed that vast majority of the respondents were educated and aged between 35 to 55 years, but lacked contact with extension agents which could be a reason that most of the respondents were ignorant of recommended improved cultivation practices of large cardamom. Therefore emphasis should be given to establish good relationship between farmers and extension agents by organising awareness programmes and other extension activities.

3. It was found out that majority of the respondents had medium level of market orientation, and sell their produce through middlemen since they have difficulty selling in distant market. Therefore, it is necessary to educate the farmers on regulated market, marketing societies, government subsidies and

business management, and create marketing linkages for availing good price for the produce in the market.

4. The majority of the respondent had moderate level of attitude. To be an entrepreneur one should have positive attitude that would be able to handle any situation that rise up. Therefore, awareness and training on entrepreneurship development may be organized by the extension agencies as it will improve the farmer's knowledge on new innovations and opportunities, so that more number of farmers may be motivated to undertake agripreneurship.

5. Majority of the respondents faced problems related to incidence of diseases and pest and most of the respondents had lack of technical knowledge. Therefore, intensive trainings and demonstration programmes should be organized in concerned areas.

6. Analysis revealed that the respondents had a medium technological gap; therefore, based on the findings of this study, one of the most important avenues for closing this gap would be to improve access to improved agricultural technologies such as certified seeds, regular supply of inputs, and availability of these inputs at reasonable prices. Furthermore, measures aimed at increasing technical efficiency and production should prioritize expanding the delivery of extension services and boosting technical assistance to farmer cooperatives.

7. Majority of the respondents cultivated large cardamom without the use of chemicals, fertilizers or nutrients with immense success owing to high fertility of the land and organic produce. As such, there is great scope for organic production of large cardamom, which can have significant impact in the national market. Therefore emphasis should be given to help farmers certify their produce thereby improving their marketing opportunity.

5.7 Suggestions for future studies

1. The present study was conducted in only two selected district of Nagaland *viz*., Longleng and Mon. Similar attempts to be made in other large cardamom growing districts including more number of farmers for in depth proving and for wider application of results and the findings confirmed.

2. A study of additional variables beyond the ones already included in the present study and analysing their influence on attitude, knowledge, adoption, technological gap and entrepreneurial behaviour, in different enterprises such as commercial crop production, poultry, fisheries, floriculture, etc., may throw new light on farm entrepreneurs.

3. Impact of large cardamom cultivation on income and employment generation may be taken up concentrating on potential regions of the state.

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APPENDICES

APPENDIX-A

INTERVIEW SCHEDULE

General Information: Respondent No.

1. Name of the respondent :
2. Village :
3. RD block :
4. District :
5. Longitude & Latitude :
6. Elevation from MSL :
7. Soil type :

A. Socio -economic, personal and psychological characteristics:

i. Age : _______ (Years)
ii. Family size : Male _____ Female _____ Total _____
iii. Family type : Joint / Nuclear
iv. Education : Illiterate / Primary / Middle (5-7) / High / PU / Gr
v. Formal Education : ______ (No. of years of schooling)
vi. Size of the total land holding under agriculture
Own land: ______ acre; Land on lease: ______ acre;Total: ______ acre
vii. Size of land holding under Large Cardamom cultivation: __________ acre
viii. Annual Income:

Sl. No.	Sources of Income	Income per annum (Rs.)
1.	Agriculture	
2.	Agro based subsidiary enterprises (poultry, piggery, dairy, apiculture etc.)	
3.	Business / Service	
4.	Others (please mention)	
5.	Large cardamom cultivation	
	Total	

ix. Experience in large cardamom cultivation : ___________ (in years)
x. Training exposure:
Have you undergone trainings related to improved large cardamom cultivation during the last 5 years? : ______ (Yes/No)
If yes, please give the following details:

Sl. No.	Training imparted by	Govt / NGO / Pvt	Year of training	Area/topic of training	No. of days

xi. **Information sources utilization**:

a) Mass-media sources:

Sl. No.	Sources of information	Most often	Sometimes	Never
1.	Radio			
2.	Television			
3.	Exhibition			
4.	Extension publications (poster, folder, leaflet, etc.)			
5.	Newspaper			
6.	Mobile (Messages)			
7.	Internet			
8.	Demonstration plots			

b) Formal information sources:

Sl.No.	Sources of information	Most often	Sometimes	Never
1.	AFA / HFA			
2.	AO/ SDAO/ HO			
3.	KVK			
4.	ATMA			
5.	NGOs			
6.	Any other			

c) Informal information sources:

Sl.No.	Sources of information	Most often	Sometimes	Never
1.	Friends			
2.	Relatives			
3.	Neighbours			
4.	Progressive farmers			

xii. **Social Participation:**

Do you participate in the following activities?

Sl. No.	Organizations/Groups	Yes	No	If yes, what is status/level: Chairman /Secy/ member etc.
1.	VD Board			
2.	Village Council			
3.	Church			
4.	SHG			
5.	Farmer's Club			
6.	Others pl specify			

xiii. **Marketing Pattern**:

1.	Do you cultivate large cardamom for selling in market?	Y/N

2.	Do you sell your produce to nearby markets only?	Y/N
3.	Do you sell your produce in the nearest market whatever price is given to you.	Y/N
4.	Do you sell your products to distant markets for high profits?	Y/N

5. Total quantity of large cardamom sold in the market: …………….
6. Total quantity used for home consumption: …………………
7. Rate of product in the market: ………. (Rs/Kg)
8. Where do you sell the produce?
   a. Direct in the market
   b. Wholesale agents
   c. Cooperative societies/ SHGs
   d. Others (pl. specify)
9. Which pattern do you follow to sell your produce in the market?
   a. Producer → Consumer
   b. Producer → Wholesale agent → Consumer
   c. Producer → Commission agents → Wholesale agents → Consumer

xiv. **Extension Orientation**:

a) Extension participation:

Give your response to extent of participation for the following extension activities

Sl. No.	Extension activities	Extent of participation		
		Regular	**Occasional**	**Never**
1.	Demonstrations			
2.	Group meetings			
3.	Field trips/ Exposure visits			
4.	Agricultural exhibitions			
5.	Training programmes			
6.	Farmer field school			
7.	Seminars/ Conference/ Workshop			
8.	Krishi melas			

b) Extension Contact:

How often do you contact the extension personnel in your area?

Sl. No.	Extension worker	Frequency of contact			
		Once a month	**Once in 15 days**	**When problem arises**	**Never**
1.	Extension personnel of Agri & allied dept.				
2.	SMS of KVK				
3.	Representatives of private input agencies				
4.	Representatives of				

	cooperative societies				
5.	Representatives of banks				

xv. **Economic Motivation**:

A set of statements representing economic motivation of farmers are given below. Please state the degree of your agreement (A- Agree, UD- Undecided, DA- Disagree), about each statement.

Sl. No.	Statements	A	UD	DA
1.	A large cardamom grower should work towards more yield and economic profit			
2.	The most successful farmer is one who makes more profit			
3.	A large cardamom grower should try any new idea, which may earn more money			
4.	A large cardamom farmer should adopt improved practices of large cardamom cultivation to increase monetary profits			
5.	It is difficult for the farmer’s children to make good start unless he provides them with economic assistance			
6.	A large cardamom grower must earn his living but the most important thing in life cannot be defined in economic terms			

xvi. **Scientific Orientation**:

Sl. No.	Statements	A	UD	DA
1.	Improved cultivation practices of large cardamom give better results than the traditional methods			
2.	Traditional method of large cardamom cultivation is the best way to manage it even today			
3.	Even a large cardamom grower with lots of experience should use new improved methods of large cardamom cultivation			
4.	Though it takes time for a large cardamom grower to learn new methods in large cardamom cultivation it is worth the efforts			
5.	A good grower experiments with new ideas in large cardamom cultivation			
6.	Traditional methods of large cardamom cultivation have to be changed in order to raise the level of living of large cardamom growers			

xvii. **Cosmopoliteness:**

Sl. No.	Statements	A	UD	DA
1.	There is no need to collect additional information from outside of the village for successful large cardamom cultivation			
2.	A large cardamom cultivator should try to get information on improved cultivation practices from outside of his village by using mass media facilities			
3.	A large cardamom cultivator learns many things from the happenings and experiences of his village only			
4.	Keeping contact with progressive large cardamom grower is useful for managing the large cardamom cultivation			
5.	Visiting the subject matter specialist or extension is waste of time			
6.	Agricultural Exhibition helps to gather recent information			

xviii. **Trend of large cardamom cultivation during the last 03 years** :

Please provide following details:

Items	2016	2017	2018
Area under large cardamom cultivation in acre			
Seed Varieties used			
Source of obtaining seed / sapling			
Production (q)			
Cost of production (Rs) a. Seed / planting materials b. Labour charges c. Implements 4. Manures 5. Fertilizer 6. Plant protection 7. Storage 8. Transportation 9.Any other charges			
HH consumption (Kg)			
Total Quantity Sold (q)			
Quantity sold in nearest market (q)			
Quantity sold in other market (q)			
Rate of sale (Rs/Kg) in nearest market			
Rate of sale / bunch) in other market			

B. Entrepreneurial behaviour

i. Innovativeness

Sl. No.	Statements	A	UD	DA
1.	I am very much interested in adopting improved varieties of large cardamom			
2.	Since I am not sure of success of new varieties of large cardamom, I would like to wait till others adopt			
3.	Since new varieties of large cardamom is not profitable, I am not interested in it			
4.	I try to keep myself well informed about any new variety of large cardamom and try to adopt as soon as possible			
5.	New variety of large cardamom are not easily adoptable and hence I do not adopt			

ii. Achievement Motivation

Sl. No.	Statements	A	UD	DA
1.	Work should come first even if one cannot get proper rest in order to achieve ones goals			
2.	It is better to be content with whatever little one has, than to be always struggling for more			
3.	No matter what I have done I always want to do more			
4.	I would like to try hard at something which is really difficult even if it proves that I cannot do it			
5.	The way things are now-a-days, discourage one to work hard			
6.	One should succeed in occupation even if one has to neglect his family.			

iii. Decision making ability

Sl. No.	Statements	Not considered	Considered after consultation with others	Considered independently
1.	To try improved large cardamom cultivation			
2.	To increase or decrease crop area in large cardamom cultivation			
3.	To hire farm labour for large cardamom cultivation			

4.	To borrow loan for the inputs and farm work for large cardamom cultivation			
5.	To buy farm equipments			
6.	To try new variety of crop			

iv. Risk Orientation

Sl. No.	Statements	A	UD	DA
1.	A farmer should grow large number of crops to avoid greater risks involved in growing one or two crops			
2.	A farmer should rather take more of a change in making a big profit than to be content with a smaller but less risky profits			
3.	A farmer who is willing to take greater risks than the average farmer usually have better financial condition			
4.	It is good for a farmer to take risks when he knows his chance of success is high			
5.	It is better for a farmer not to try new farming methods, unless most other farmers have used them with success			
6.	Trying an entirely new method in farming by a farmer involves risk, but it is worth			

v. Leadership Ability

Sl. No.	Statements	Always	Sometimes	Never
1.	Did you participate in group discussions on new farm practice?			
2.	Whenever you see/hear a new farm practice did you initiate discussion about it with your colleagues?			
3.	Do people in your village regard you as good source of information on new farm practice?			
4.	Do you assign the farm work to your family members?			
5.	Do you offer new approaches to problems?			

vi. Management Orientation

Sl. No.	Statements	SA	A	DA	SDA
	a. Production orientation				
1.	Everyone should think about the income generating activity available to the local areas				
2.	The amount of inputs needed for the economic activity should be assessed well in advance				
3.	It is not necessary to make prior decisions about the steps to be followed in taking up economic activity				
4.	It is not necessary to think ahead the total cost involved in starting income generating activity				
5.	One should not consult experts and experience persons for planning the economic activities				
6.	It is possible to increase the returns through production plans				
	b. Planning orientation				
1.	Timely planning of economic activity will yield good results				
2.	For timely solving of problems, one should use appropriate problem-solving techniques				
3.	One should invest as much as he likes in taking up any economic activity				
4.	Economic activities should be adopted as recommended by specialists				
5.	With less input one can produce as much quality goods as possible				
6.	One should go for lower investment with higher returns				
	c. Marketing orientation				
1.	Marketing information is not much necessary to large cardamom growers				
2.	A farmer can get a good price by producing good quality of large cardamom				
3.	Better market facilities can help the large cardamom growers to get a better price for his produce				
4.	One should sell his large cardamom to the nearest market irrespective of prices				
5.	One should cultivate other crops instead of large cardamom which has more demand in market				
6.	A farmer should cultivate more for crops he gets subsidy rather than market demand				

C. Attitude towards adoption of improved large cardamom cultivation practices

Please indicate the choice among five alternatives (SA = Strongly agree; A = Agree; UD= Undecided; D = Disagree; SD = Strongly disagree)

Sl. No.	STATEMENTS	SA	A	UD	DA	SDA
1.	I believe that improved cultivation practice of large cardamom is worth to adopt though it is laborious and complicated. +					
2.	I believe that improved cultivation practices of large cardamom help to produce quality production. +					
3.	I think that improved cultivation practices of large cardamom is possible to adopt for all farmers. +					
4.	Recommended large cardamom production technology can't bring significant change in cultivation practices of farmers. -					
5.	The improved cultivation practices of large cardamom can improve the social status of the farmers. +					
6.	The risk of cultivation is minimized with the adoption of improved production technology. +					
7.	Large cardamom cultivation is not being properly promoted by the Government. -					
8.	Large cardamom cultivation is also possible by untrained farmers. +					
9.	Improved large cardamom cultivation is difficult to do for inexperienced farmers. -					
10.	Adoption of improved large cardamom cultivation opens the door of progressive aspiration. +					
11.	There is no surety of getting the highest price from large cardamom even if a farmer adopts improved production technology. -					
12.	Though it takes lot of time for a farmer to learn improved production technologies, it is worth the efforts. +					
13.	Land preparation, planting time and spacing as per recommendation have no effect on LC production. -					
14.	Processing and marketing of LC can be best done at local and regional level. +					

15.	It is recommended to remove the entire plant when virus diseases are noticed. +					
16.	Maintaining soil moisture and optimum temperature is not required for planting. -					
17.	For preservation of planting material, diseased and unhealthy plants can also be stored. -					

KNOWLEDGE LEVEL

Please indicate the most appropriate answer from the alternatives given under each of the following statements.

I. CLIMATE

1. Large cardamom can grow upto ………. above sea level:
   a) 600-1800 b) 500-1500 c) 500-1800 d) 800-2000

2. The optimum temperature for large cardamom cultivation is:
   a) 20-25 ºC b) 22-30 ºC c) 25-30 ºC d) 22-32 ºC

3. Large cardamom is a …………. loving plant
   a) No shade loving b) Sun c) Moderate shade loving d) High shade loving

II. SOIL

1. The soil type best suited for large cardamom cultivation is:
   a) Sandy soil b) Loamy soil c) Clay soil d) Sandy loam soil

2. Soil condition should be:
   a) Water logged b) Well drained c) Eroded soil d) None

III. VARIETIES

1. Recommended varieties of large cardamom are:
   a) Ramsey b) Sawney c) Golsey d) All of them

IV. PROPAGATION

1. Propagation is done by
   a) Suckers b) Seeds c) Suckers & seeds d) Slip

V. LAND PREPARATION

1. What field preparation operation should be followed?
   a) Pits of 1x1x1 ft , Distance of 1.5x1.5 m
   b) Pits of 2x2x2 ft, Distance of 2.5x2.5 m
   c) Pits of 0.5x0.5x0.5 ft, Distance of 1x1 m
   d) Pits of 1.5x1.5x1.5 ft, Distance of 2x2 m

2. Pit manuring is done with:
   a) FYM/Vermicompost b) Top soil c) Neem cake d) All of these

3. During pit filling, ……..gm neem cake powder, ……..kgs FYM and ……gm of compost with *Trichoderma* is applied:
   a) 30 gm neem cake, 4-5 kgs FYM, 15 gm compost

b) 25 gm neem cake, 2-4 kgs FYM, 10 gm compost
c) 20 gm neem cake, 2-3 kgs FYM, 15 gm compost
d) 15 gm neem cake, 2-4 kgs FYM, 20 gm compost

4. What is the appropriate time of planting?
   a) May-July b) June-August c) April-June d) May-August

VI. INTERCULTURAL OPERATIONS
MULCHING

1. Do you think that mulching is necessary for large cardamom?
   a) Yes b) No

2. If yes, when is the appropriate time?
   a) November-April b) December-March c) September-January d) October-May

3. Mulching in large cardamom is done to:
   a) Conserve soil moisture
   b) Check soil erosion and weed growth
   c) Conserve soil moisture and check weed growth
   d) Check weed growth

4. Please mention how it is done?
   a) Base of the plants should be mulched with dried leaves soon after planting
   b) Mulch the collar region of the clumps with fallen leaves
   c) Both a & b

IRRIGATION

1. When is irrigation done in the field?
   a) December-April b) January-April c) December-March d) November-April

2. What is the optimum interval of irrigation?
   a) 10 days b) 15 days c) 12 days d) 20 days

WEED MANAGEMENT

1. Do you think that weed management is necessary in large cardamom?
   a) Yes b) No

2. If yes, what is the appropriate time for weeding in large cardamom?
   a) May to June and before harvesting b) April-May c) June-July d) March-April

3. Weeding is practised throughout the cultivation period depending upon:
   a) The population of weeds b) No. of plants planted

4. Weeds can be controlled:
   a) Manually (Hoeing, uprooting, forks etc) b) Mechanically (Tractor drawn) c) Chemically d) All of these

VII. SHADE REGULATION

1. Is it recommended to prune tall growing trees?

a) Yes b) No

2. If yes, what is the appropriate height?
   a) <u>4-5 m</u> b) 3-5 m c) 4-6 m d) 6-8 m

3. What is the advantage of this practice?
   a) To remain erect after planting
   b) <u>New branches grow and provide shade</u>
   c) To maintain moisture and light
   d) To act as wind breaker

VIII. ROGUING AND GAP FILLING

1. What is the advantage of roguing?
   a) Remove affected plants (when virus disease are noticed)
   b) Replacing it with healthy plants
   c) Both a & b

2. When is the ideal time for gap filling?
   a) <u>May-July</u> b) June-July c) May-June d) July-August

IX. PLANT PROTECTION MEASURES

A. DISEASES:

1. LEAF SPOT

Symptoms:

1. Spots initially appear more on ………… part of the leaves.
   a) Lower b) <u>Upper</u> c) Both

2. Spots increase in size with …………. centre.
   a) Blackish b) Whitish c) <u>Greyish white</u>

Management:

1. Good ………….. should be maintained
   a) Plant distance b) <u>Drainage</u> c) Both

2. ……….. have the potential to control leaf spot
   a) Azolla b) <u>*Trichoderma*</u> c) *Bacillus gordonae*

3. Spraying of ………… before onset of monsoon or just after flowering
   a) <u>Bordeaux mixture (1.0%)</u> b) Nuvacron (0.1%) c) Thiodan (0.1%)

2. FOORKEY

Symptoms:

1. The affected plants produce ……… sterile shoots
   a) Discoloured b) <u>Stunted</u> c) Uncontrolled

2. The disease cause drying up of shoots and ……… of the entire clump
   a) Rotting b) Collapse c) <u>Die off</u>

3. The vector (*Micromyzus kalimpongensis*), which carries this virus, has its activity highest in:
   a) Winter b) <u>Spring</u> c) Summer

Management:

1. The disease can be controlled by cultivating:
   a) Diseased rhizomes b) Untreated rhizomes c) Diseased free rhizomes

2. The disease vector is controlled by regular spray of:
   a) Dimecron/Rogor (0.1%) b) Diathane M-45 c) Thiram (0.2%)

3. The collateral host plant in the vicinity should be:
   a) Destroyed b) Preserved c) Apply chemicals

4. The land infected by this virus should be kept fallow for:
   a) 6 months b) 1 year c) 2 years

3. CLUMP ROT

Symptoms:

1. The infected young foliage turns ………. and dies off:
   a) Greenish b) Yellowish c) Brownish

2. The ……….. becomes very brittle, due to rotting and can be easily pulled out.
   a) Root b) Shoots c) Stems

3. The rhizomes are often found to be:
   a) Rotten b) Healthy c) Diseased

Management:

1. The field should be maintained with…….:
   a) Well drained b) Plant density c) Both a & b

2. Mulching should be done with organic materials during:
   a) Winter b) Summer c) Spring

3. The suckers should be dipped in ………. 1 hour before transplanting
   a) Neem extract (@25% conc.) b) Trichoderma (@5gm/ L water) c) Both

4. Spraying of fungicides at fortnightly intervals:
   a) Bordeaux mixture (1%) b) Diathane M45 (0.2%) c) Thiram (0.2%)

B. PEST

1. STEM BORER

Symptoms:

1. The young larvae feeds on the central leaf core which eventually results in:
   a) Rotting of shoot b) Death of shoot c) Cease to grow

Management:

1. The dried shoots (dead heart symptoms) should be:
   a) Destroyed b) Collected c) Burnt

2. It can also be controlled by removing the:
   a) Caterpillars b) Whole plant c) Cleaning the entire field

2. CARDAMOM WEEVIL

Symptoms:

1. The grubs tunnels and feed on ………… causing death of entire clump.
   a) Stem b) Rhizomes c) Shoots

Management:

1. The infected plants should be:
   a) Destroyed b) Destroyed alone with weevil c) Collect

2. The base of the clumps should be drenched in:
   a) Malathion b) Thiram c) Thiodan

X. HARVESTING

1. What should be the appropriate time of harvesting?
   a) After 5 years (seeds), 3 years (suckers)
   b) After 3 years (seeds), 5 years (suckers)
   c) After 7 years (seeds), 5 years (suckers)
   d) After 4 years (seeds), 3 years (suckers)

2. What is the physiological stage of maturity for large cardamom harvesting?
   a) Seeds of topmost capsules turn green
   b) Seeds of topmost capsules turn brown
   c) Seeds of topmost capsules turn black
   d) Seeds of topmost capsules turn red

3. When are the fruits ready to harvest?
   a) August-September b) July-August c) September-October d) October-November

XI. CURING

1. When is the appropriate time for curing of capsules?
   a) Immediately after harvesting b) After the capsules have dried

2. Moisture content of dried capsules, on dry weight basis:
   a) 10-15% b) 5-10% c) 10-13% d) 15-20%
3. What is the optimum temperature for curing, by indirect heating?
   a) 20-25 ºC b) 40-45 ºC c) 50-55 ºC d) 45-50 ºC

XII. PACKING

1. Do you think it is necessary to pack cured capsules?
   a) Yes b) No

2. If yes, how should the packing be done?
   a) Insect proof bags
   b) Coal tar coated and polythene lined gunny bags during storage
   c) Air tight containers
   d) All of these

Note: Each correct answer carry 1 mark and wrong answer 0 mark

ADOPTION LEVEL AND TECHNOLOGICAL GAP

Adoption level and Technological gap in adoption of improved cultivation practices of Large Cardamom growers

Sl. No.	Recommended Practices	Level of Adoption			Training Need			% of Gap
		F	P	N	MN	N	NN	
1.	**Suitable varieties:**							
	a. Ramsey							
	b. Golsey							
	c. Sawney							
2.	**Pit preparation:**							
	a. Pit size of 1x1x1 ft							
	b. Pit distance of 1.5x1.5 m							
3.	**Pit manuring:** Add 25 kg neem cake, 2-4 kgs FYM or 10 gm compost inoculated with *Trichoderma*							
4.	**Time of planting:** May to early July							
5.	**Intercultural operations:**							
	MULCHING							
	a. The base of the plant or the collar region of the clumps should be mulched with dried leaves during November to April							
	b.It is done to conserve soil moisture and check the weed growth							
	WEED MANAGEMENT							
	a.It is done twice a year, during May to June and before harvesting							
	b. Weeding is practiced throughout the year depending upon the population of the weeds							
	c. Uprooted weeds can be used as organic compost and mulch							
	IRRIGATION							
	a. The optimum time of irrigation is from Dec to April							
	b. The field is irrigated at an interval							

	of 10 days during the dry period							
6.	**Shade regulation:** Tall-growing trees are pruned regularly at a height of 4-5 m							
7.	**Fertilizer application:** NPK @20:30:40 kg along with 10-15 tonnes of FYM or compost per hectare, every once a year							
8.	**Roguing and gap filling:** Removal of affected plants and replace them by healthy ones. The ideal time for gap filling is May-June							
9.	**Plant protection measure:**							
	1. Leaf spot:							
	a. Maintain good drainage							
	b. Apply *Trichoderma*							
	c. Spray Bordeaux mixture (1.0%)							
	2.Foorkey:							
	a. Diseased free certified rhizomes							
	b. Dimecron/Rogor (0.1%)							
	c. Collateral host plant isdestroyed							
	d. Infected land is kept fallow for a year							
	3. Clump rot:							
	a. Mulching during summer							
	b. Suckers dipped in *Trichoderma* or neem extract							
	c. Spray fungicide at fortnightly interval							
	4. Stem borer:							
	a. Remove the plant with caterpillars							
	b. Destroy dried shoots							
	5. Cardamom weevil:							
	a. Destroy plants along with weevil							
	b. Base of clumps drench in malathion							
10.	**Harvesting:**							
	a. Appropriate time: 5 years (seeds) 3 years (suckers)							
	b. Physiological stage of maturity:							

	When seeds of topmost capsules turn brown							
	c. Time of harvest: August to September							
11.	**Curing:**							
	a. Curing is done immediately after harvesting, to retain only about 10-13 % moisture on dry-weight basis							
	b. Heating temperature for curing should be 50-55 ºC							
12.	**Packing:**							
	a. Coal tar coated and polythene lined gunny bags are effective during storage							
	b. The cured produce needs to be packed in insect proof bags and in air tight containers							

CONSTRAINTS

Constraints faced by the farmers in adoption of improved cultivation practices of large cardamom (Garett Ranking)

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4
Land Related constraint	1.	Low land productivity				
	2.	Fragmented and undulated land				
	3.	Improper land preparation				
	4.	Unable to use farm machinery undulating land				

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
Input Supply constraint	1.	Non-availability of improved / recommended varieties of the large cardamom						
	2.	High price of planting material						
	3.	Insufficient organic manure						
	4.	High requirement of						

		manure and fertilizer for recommended varieties						
	5.	Non-availability of insecticides and pesticides						
	6.	Non-availability of fertilizers at the peak season						

Aspects of Constraints	**Sl. No**	**Constraints**	**Rank 1**	**Rank 2**	**Rank 3**	**Rank 4**
Biophysical constraint	1.	Occurrence of showers during harvest				
	2.	Epidemics of pest and diseases				
	3.	Weed infestation				
	4.	Floods/ drought during crop period				

Aspects of Constraints	**Sl. No**	**Constraints**	**Rank 1**	**Rank 2**	**Rank 3**	**Rank 4**	**Rank 5**
Plant protection constraint	1.	Damage by insects					
	2.	Damage by diseases					
	3.	Lack of knowledge on proper usage of plant protection measures					
	4.	Lack of pest and disease management training					
	5.	Problems in identification of disease and pest					

Aspects of Constraints	**Sl. No**	**Constraints**	**Rank 1**	**Rank 2**	**Rank 3**	**Rank 4**	**Rank 5**	**Rank 6**	**Rank 7**
Technical constraint	1.	Lack of knowledge about improved varieties							
	2.	Lack of knowledge about latest technology							
	3.	Insufficient availability of technical guidance							
	4.	Lack of							

		know-how about seed treatment							
	5.	Lack of technical know-how about insect-pest and disease management							
	6.	Lack of technical know- how about curing							
	7.	Inadequate training of farmers on cardamom production and management							

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Labour constraint	1.	Scarcity of labour during peak periods					
	2.	High cost of labour					
	3.	Low labour productivity					
	4.	Inadequate family labour					
	5.	Unskilled labour					

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Economic constraint	1.	Non-availability of Government subsidy					
	2.	Non availability of agricultural credit from financial institutions					
	3.	Less availability of agricultural credit from financial institutions					
	4.	Rate of interest on loan is high					
	5.	High cost of technology					

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
Marketing constraint	1.	Lack of proper marketing channel						
	2.	Lack of reliable market						
	3.	High fluctuation in market price						
	4.	Costly transportation service						
	5.	Poor access of market information						
	6.	Exploitation by middle men						

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Post-harvest constraint	1.	Lack of proper storage facility					
	2.	Lack of processing facility at local level					
	3.	Lack of knowledge about storage pests and diseases					
	4.	Increasing rate of processing costs					
	5.	High cost of technology					

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
Climate change constraint	1.	Fluctuation of temperature during growing season						
	2.	Scarcity of water for irrigation						
	3.	Increase in incidence of pest and diseases						
	4.	Soil erosion						
	5.	Adverse climatic condition at critical stages of crop						
	6.	Erratic rainfall						

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Social constraint	1.	High wages for hired labour					
	2.	Younger generation not interested in farming					
	3.	Lack of cooperation among farmers					
	4.	Scarcity of labour					
	5.	Labour intensive crop					

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
Extension constraint	1.	Lack of contact with extension agents						
	2.	Lack of effective technical supervision						
	3.	Farmers training not conducted						
	4.	Insufficient extension activities like demonstrations, farmers group discussion, kisan melas etc. by extension agencies						
	5.	Untimely visit of extension agents						
	6.	No proper supply of input materials						

Aspects of Constraints	Sl. No	Constraints	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Rank 6
Irrigation constraint	1.	Inadequate irrigation facilities						
	2.	Lack of proper water harvesting units						
	3.	High cost of irrigation on rent basis						
	4.	Insufficient water for irrigation						

APPENDIX - B

GARRETT RANKING CONVERSION TABLE

Percentage	Score	Percentage	Score	Percentage	Score
0.09	99	20.93	66	80.61	33
0.2	98	22.32	65	81.99	32
0.32	97	23.88	64	83.31	31
0.45	96	25.48	63	84.56	30
0.61	95	27.15	62	85.75	29
0.78	94	28.86	61	86.89	28
0.97	93	30.61	60	87.96	27
1.18	92	32.42	59	88.97	26
1.42	91	34.25	58	89.94	25
1.68	90	36.15	57	90.83	24
1.96	89	38.06	56	91.67	23
2.28	88	40.01	55	92.45	22
2.63	87	41.97	54	93.19	21
3.01	86	43.97	53	93.86	20
3.43	85	45.97	52	94.49	19
3.89	84	47.98	51	95.08	18
4.38	83	50	50	95.62	17
4.92	82	52.02	49	96.11	16
5.51	81	54.03	48	96.57	15
6.14	80	56.03	47	96.99	14
6.81	79	58.03	46	97.37	13
7.55	78	59.99	45	98.72	12
8.33	77	61.94	44	98.04	11
9.17	76	63.85	43	98.32	10
10.16	75	65.75	42	98.58	9
11.03	74	67.48	41	99.82	8
12.04	73	69.39	40	99.30	7
13.11	72	71.14	39	99.22	6
14.25	71	72.85	38	99.39	5
15.44	70	74.52	37	99.55	4
18.69	69	76.12	36	99.68	3
18.01	68	77.68	35	99.80	2
19.39	67	79.12	34	99.91	1
				100	0

APPENDIX - C

Abstract of Paper Publication

Scale for Measuring Attitude of Farmers towards Improved Large Cardamom Cultivation

Walling, K. and Jha, K. K. 2020. Scale for Measuring Attitude of Farmers towards Improved Large Cardamom Cultivation. Plant Archives. 20 (**2**): 4515-4520.

ABSTRACT

Attitude is considered a psychological construct. It is a mental and emotional entity that would characterize an individual. The success or failure of any agricultural activity depends on the attitude of farmers towards it to a great extent. A scale was developed to measure the attitude of the farmers towards improved large cardamom practices based on Likert's summative rating technique of scale construction. The final scale consisted of 17 statements including 10 positive and 7 negative statements, which were selected based on the 't' values. Split half technique was used to test the reliability of scale. Reliability co-efficient of the scale was found to be 0.83. Validity of scale was tested using content validity. The reliability and validity of the scale indicates the consistency and precision of the results using the developed scale. The scale was pre-tested before data collection from the large cardamom farmers.

Key words: Summated rating scale, attitude, large cardamom, validity, reliability.