ECONOMIC STUDY ON VARIOUS LEVELS OF RECOMMENDED PRACTICES IN SELECTED HORTICULTURAL CROPS OF NAGALAND AND MANIPUR

Thesis

submitted to

NAGALAND UNIVERSITY

in partial fulfilment for the Degree

of

Doctor of Philosophy

in

Agricultural Economics

by

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2020

Affectionately dedicated to my

Beloved father,

Late Shri. Thokchom Lukhoi Singh

&

To all those who meant of Indigenous Agriculture

DECLARATION

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

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

Date: 27/01/2020
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CERTIFICATE - I

This is to certify that the thesis entitled "**Economic Study on Various Levels of Recommended Practices in Selected Horticultural crops of Nagaland and Manipur**" submitted to Nagaland University in partial fulfillment of the requirements for the award of degree of Doctor of Philosophy in **Agricultural Economics** is the record of research work carried out by Mr. **Th. Motilal Singh** Adm. No. 180/15; Registration No. 822/2018 under my personal supervision and guidance.

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

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CERTIFICATE – II

VIVA VOCE ON THESIS OF DOCTOR OF PHILOSOPHY IN AGRICLTURAL ECONOMICS

This is to certify that the thesis entitled "**Economic Study on Various Levels of Recommended Practices in Selected Horticultural Crops of Nagaland and Manipur**", submitted by **Mr. Th. Motilal Singh**, Ph. 180/15, Registration No. 822/2018 to the NAGALAND UNIVERSITY in partial fulfillment of the requirements for the award of degree of Doctor of Philosophy in Agricultural Economics has been examined by the Advisory Board and External Examiner on **12th December 2020**.

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

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ACKNOWLEDGEMENTS

My foremost thanks with limitless humility to God, who blessed me with limitless internal strength and favourable circumstances to go through all odds successfully at this juncture. In this research work, there are many well-wishers to whom I am indebted to acknowledge their help, zeal, guidance, advice and leads for which I would like to express my wholehearted gratitude.

My heartfelt gratitude and respect to my major advisor Dr. Amod Sharma Professor & Head, Department of Agricultural Economics, Nagaland University, SASRD, Medziphema Campus, Nagaland for his constant encouragement, support and guidance during my study course and for taking the pain in executing this thesis in time.

My sincere gratitude to all my advisory committee members Dr. Rokoneituo Nakhro, Professor, Department of Agricultural Economics, Dr. K. K. Jha, Professor & Head, Department of Agricultural Extension , Dr. Manoj Dutta, Professor, Department of Soil and Water Conservation and Dr. Y. Chakrabarty, Professor & Head, Department of Agricultural Economics, College of Agriculture, Central Agriculture University, Imphal, for all their substantial help and encouragement during my course of research work.

I emphatically express my thanks to the Dr. M. Aleminla Ao, Pro Vice Chancellor and Dr. Akali Sema, Dean, SASRD, Nagaland University, Dr. Sanjoy Das, Associate Professor, Dr. Naveen Kuma, Guest Faculty, Department of Agricultural Economics and all other non-teaching staff and faculty members for providing me unconditional helping hand whenever needed at various stages of my research work and Specially thankful to Mr. Mhonbemo Ngullie, Deputy Librarian; Sagolsem Satyajit Singh, Computer Assistant and staff for the use of library facilities whenever required.

I would be thankful to God if my beloved Father, Late Shri. Thokchom Lukhoi Singh, who had departed before my final declaration as a Doctorate of Philosophy in Agricultural Economics that he always

wish to live in this world by looking into my world of management. I reckon the moral and physical support of My Mother, Smt. Thokchom Leirikmacha Devi, My Sister, Smt. Thokchom Prabhasini Devi, My Wife, Dr. Anju Yumnam, My Brothers & Sisters, daughter & son and all my well wishers & Mentors who have been contributing me to become a better Academician.

I will not cherish without acknowledging My Fellow Research Scholar, Shri. Chongtham Roben Singh who has been always My Partner during the entire course of the study and research work. I reckon the contributions of Dr. Kolom Rabi, Scientist, KVK, Dimapur and Mr. L. Somorendro Singh, Research Scholar, SASRD during my village survey period.

I am extending my sincere thanks to Dr. N. Jyotsana Devi, Senior Scientist & Head, Krishi Vigyan Kendra, Sylvan who had extended her co-operation during the field investigation juncture of Senapati district, Manipur. It will not be completed if I excluded the village Secretary, committee members and also the respondents of Molvom, Khuzama, Viswema, Kalinamei, Phikomai and Waithou-Chiru villages who spared their valuable time in furnishing the required information for this thesis work, without whom this research work could not have been completed.

Finally, I am extending my sincere thanks and gratitude to Dr. S.V. Ngachan, former Director, ICAR-Research Complex for NEH Region, Umiam, Meghalaya , Dr. I. M. Singh , Joint Director, ICAR, Manipur Centre and Dr. R. K. Nimai, Retd. IAS, Govt. Of Manipur for their Physical and moral support towards me in pursuing my Doctor of Philosophy for which I am still cherishing in my heart.

Date : 27/01/2020
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(TH. MOTILAL SINGH)

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LIST OF ABBREVIATIONS

ACZ	: Agro Climatic Zone
ADC	: Additional Deputy Commissioner
AI	: Artificial Insemination
AIBP	: Accelerated Irrigation Benefit Programme
APEDA	: Agricultural and Processed Food Products Export Development Authority
APMC	: Agricultural Produce Marketing Committee
APMSC	: Agricultural Produce Marketing Sub Committee
ATM	: Automated Teller Machine
ATMA	: Agricultural Technology Management Agency
Avg.	: Average
BCR	: Benefit Cost Ratio
CA	: Conservation Agriculture
CACP	: Commission for Agricultural Costs and Prices
CC	: Cost of Cultivation
CEO	: Chief Executive Officer
CR	: Cost and Return
DAO	: District Agriculture Officer
DAP	: Di-ammonium Phosphate
DC	: Deputy Commissioner

EAC : Extra Assistant Commissioner

ET : Economic Times

FAO : Food and Agriculture Organization

FCS : Food and Civil Supply

FPOs : Farmer Producer Organizations

FYM : Farm Yard Manure

GAP : Good Agricultural Practices

GCA : Gross Cropped Area

GOI : Government of India

HDFC : Housing Development Financial Corporation

HDP : High Density Planting

HTM : Horticulture Technology Mission

ICICI : Industrial Credit and Investment corporation of India

IGP : Indo-Gangetic Plain

IPNS : Integrated Plant Nutrient System

ITC : International Trade Centre

MIDH : Mission for Integrated Development of Horticulture

MOFA : Ministry of Food and Agriculture

MPP : Marginal Physical Product

MT : Matric Tonne

MTE : Mean Level of Technical Efficiency

MVP : Marginal Value of Product

NABARD : National Bank for Agriculture and Rural Development

NEFA : North East Frontier Agency

NGO : Non Government Organization

NHTA : Naga Hills Tuensang Area

NMOOP : National Mission on Oilseeds and Oil Palm

NMSA : National Mission for Sustainable Agriculture

NPOP : National Programme for Organic Production

NPOP : National Programme for Organic Production

NPV : Net Present value

NRC-M : National Research Centre-Mithun

OGADEP : Ogun State Agricultural Development Programme

PKVY : Paramapragat Krishui Vikas Yojana

RKVY : Rashtriya Krishi Vikas Yojana

SDO : Sub-Divisional Officer

SHGs : Self Help Groups

SRSWOR : Simple Random Sampling without Replacement

SSA : Sub-Saharan Africa

TRC : Terrace Rice Cultivation

UAE : United Arab Emirates

UK : United Kingdom

UPA : Urban and Peri-Urban Agriculture

US : United States

USA : United states of America

USD : United States Dollar

ABSTRACT

In India, agriculture not only occupies the primary sector and is also an important occupation of which 52.40 per cent of the people depend for their livelihood. However it has not reached its potential level, since most of the farmers use the traditional technology, slow adoption of modern and proven technologies, which impaired productivity and results in lower standard living of the framers in the north east region of India. In flip side the intensification of agriculture in recent decades made the agricultural sector unsustainable due to over exploitation of groundwater and land degradation due to the judicious use of chemical fertilizers. North-eastern region of India not only having technology gap, it also facing severe ecological challenges mainly because of large extent of shifting cultivation, increased levels of soil erosion, land degradations, encroachment of forest lands etc; which was caused impairment in yield of the important crops, insecurity of food and nutrition among the people of the region.

Therefore, in order to tackle these issues the present research work was under taken and initiated in the year 2017 to study the economic aspects and socio-economic status of the rural households so that the policy implications with suitable and viable technologies can be work-out. By considering the significance and relevance aforementioned facts, the present study entitled **"***Economic study on various levels of recommended practices in selected*

*horticultural crops of Nagaland and Manipur***.**" For this purpose, a multistage stratified random sampling technique was employed and totally 300 farmers i.e. 150 farmers from Nagaland and 150 farmers from Manipur that are growing horticultural crops viz. Pineapple, Potato and Cabbage crops on sustainable way to earn their livelihood were selected in the study area.

The results of the study revealed that the return earned from Pineapple crop of Nagaland at Medziphema is highest as compare to Manipur state across the farm levels, which were significantly higher among all the selected crops. The Regression analysis results also show that the farmer's enrollment increases about two-three fold against their investment, which were statistically proven and found significant.

Key words: *Nagaland, Manipur, socio-economic, impact, economics, management, production function.*

CHAPTER I

INTRODUCTION

INTRODUCTION

Struggle for food has been the basis for survival ever since mankind had evolved. From the nomadic people to the settled or permanent groups or communities, agriculture or farming has becomes the only primary means or of way of existence. Indigenous peoples have different ways of life in their specific boundaries. Of these, farming in their own way for socio-economic development is considered to be an unavoidable aspect of the indigenous people living in different parts of the world. So, indigenous farming is associated with indigenous people and its various forms of indigenous cultures and agricultural practices that have been developed and practised by the Indigenous peoples. In fact, Indigenous farming is a way of life and it encompasses the social, economic, cultural and political purview too.

On the other hand, population explosion coupled with human being consistent pressurization on the natural resources for their existence or livelihood has been the concerned for the planners and policy makers for an effective solution to the above problems. Also, the decadal population growth rate and modernization of agriculture has led to the rise of Green Revolution in many underdeveloped and III- World countries. This Revolution of the modern agriculture is by and large depended on heavy use of chemical inorganic inputs for improving the production and productivities of the major's crops. However, the success of this agricultural system is largely depended on the efficient of water, use of quality seeds, and heavy use of weedicides, insecticides or fungicides and better management practices through agricultural farm mechanization. Again, the current burgeoning issue of climate change and its impact have a fuller capacity or tendency of altering the crops-livestock's production and productivity level too. Further, climate change has also resulted

in altering or changing the crop-livestock's habitation of the present certain ecosystem.

The world's population is projected to reach 8.5 billion by 2030, 9.7 billion by 2050 and exceed 11 billion in 2100, with India expected to surpass China as the most populous around seven years from now and Nigeria overtaking the United States to become the world's third largest country around 35 years from now, according to a new United Nations report released today (United Nation Sustainable Goal, 2015). According to the report of "Future of Food and Agriculture, Trends and Challenges; 2017-FAO-United nation" major transformation in agricultural systems, rural economics and natural resource management will be needed if we are to meet the multiple challenges before us and realize the full potential of food and agriculture to ensure a secure and healthy future for all people and the entire planet. High-input, resource-intensive farming system, which has caused massive deforestation, water scarcities, soil depletion and high levels of green-house emission cannot deliver sustainable food and agricultural production, adds the report.

Village-Community System of farming exists in different parts of the world becomes an indispensable part if the concept of sustainability arises. Different Taboos or culture and practices have been maintain in certain agricultural heritage site of the world and this heritage becomes the basis for their social, economic life since time immemorial *(Small Holders farming Mechanism).*

Back to our nation, India's agricultural scenario was also facing the problems of population growth, post Independence political dilemma across the union of India and the great Famine during the two decades had led to the rise of Green Revolution in the 60s. With these, agricultural modernization emerged and the India's food grains production figure became almost the

doubled. Agriculture infrastructural development had given priorities during the India's Five Years Plan and resulted in a positive impact on the production scenario of the nation till she witnessed an irregular and sharp declined in the production and productivity level of some major food crops. Eminent Scientists, Experts, Policy makers & Planners and different Stakeholders reveals that the country un-sustainability like scenario in the entire agricultural system may be attributed by many factors such as injudicious use of synthetic inorganic inputs in the production processes, deterioration of natural resources and society-triggered climate change phenomena.

It is also estimated that the India's population will reach 1.51 billion by 2030. Again with the advancement of Health Sciences, Indian consumers are realizing on the healthy food for the future perspectives. The present Government of India also emphasises on the Doubling of Farm Income through various technologies intervention on sustainable approach by 2022. Bringing or balancing the entire scenario on the sustainable basis requires integrated and cumulative efforts of different Stakeholders from Top to Bottom or Bottom to Top approach through indebt study and understanding of the present existing systems and their nature of resource management patterns.

Again focussing on the North Eastern India, the total agricultural scenario is quite peculiar and can be differentiated from the agricultural system of Northern, Central and Southern India's agricultural practices or patterns. The entire region comprises of seven hilly states *viz*. Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura.

The North- Eastern states of India are inhibited by several Indigenous people having various cultural, political, social and economic values. The region has a rich flora and fauna and is considered as biodiversity Hotspot of many crops. North- Eastern region has a huge potential for growth and

development in agriculture and allied sectors as the region is endowed with various Indigenous socio-economic aspect of farming. The *Apatani*; *Bun; Zabo; Zero Tillage* and *Fruit-Based system* of farming can be mentioned. The region is considered or assumes as low uses of synthetic inputs and even some states are declared as Organic states and many more are on the pipeline of organic states. In fact, majority of the agricultural land areas are declared as "Organic by Default" and even some states are also considered as less or minimum inorganic user states.

Manipur and Nagaland are the two adjoining states out of the seven states of North- Eastern States of India. These states are inhabitated by many Indigenous people having special or peculiar system of social and economic life. *Zhuming; Zabo; Zero- Tillage and Fruit - Based Farming system* are some of the exemplified ones and many system are still left untouched in many pockets or areas from extensive study.

Bringing the agricultural scenario of these two states on the sustainability forum; assessing the various form and system of existing agricultural practices and their recommended practices that have been existing and adopted/ adopting is the need of the hour so as to come up with the concrete findings and recommendations for future course of action and a handy manual for the Planners and Policy makers is the real core of the study. Thus, a thorough study and understanding of various Indigenous Agricultural Practices of these two agriculturally important states has been taken up for the fulfilment of my Doctoral Degree of Philosophy on the theme **"***Economic study on various levels of recommended practices in selected horticultural crops of Nagaland and Manipur* "so that a policy recommendation can be tabled with the following objectives:

- To estimate the costs and returns of the various level of farm's for selected horticultural crops,
- To analyze the resource-use-efficiency for the selected horticultural crops,
- To study the income and employment patterns for the selected horticultural crops,
- To study the farmers' perception for the selected horticultural crops, and
- To analyze the problems and constraints faced by the various level of farm's for the selected horticultural crops.

1.1 Limitation of the study:

- The present study has limitation of the time and other resources commonly faced by researcher.
- The study pertained to field survey. Though all attempts were made to extract correct information, the peculiar behaviour of respondents might have caused limitations to some extent in extracting the true information.
- The study and analysis of pineapple crop is limited to the first cropping only.
- Sources for the Secondary data collection from the reputed Organization are also limited.

CHAPTER II

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Reviewing of literature is of utmost important in the context of the present study. This chapter is all about collection and depicting the various results, finding and outcomes of the earlier work-done which is relevant to the objectives of the research work. It summarizes correlates and gives direction of the theme to follow. Reviewing of the work done by the various researchers, scholars and eminent workers in the similar field of the present study are highlighted as follows:

I. Socio-Economic characteristics

Kasirye (2013) studied the determinants of improved agricultural technologies adoption in Uganda, using a nationally representative panel data set of 1,600 farming households, collected by the Ugandan Bureau of Statistics in 2005-06 and 2009-10. Estimates from the probit regression model show that farmers with low education and land holdings are less likely to adopt improved seeds and fertilizer, while peer effects play a big role in influencing farmers to either use improved seeds or fertilizer. Furthermore, cattle keeping farmers in Western Uganda are more likely to abandon fertilizers and possibly resort to organic manure from livestock excreta. Policy, therefore, should be directed at addressing the supply side constraints of agricultural technologies.

Nyaruwata (2019) in an attempt to analyze the "Contribution of Selected Indigenous Vegetables to Household Income and Food Availability in Wedza District of Zimbabwe" revealed that gender and income had a significant ($p < 0.05$) influence on intensity of consumption during the growing season only. Age, education level and market options had a significant ($p < 0.05$) influence during and after growing seasons. Hence, socio- economic factors influence intensity consumption of indigenous vegetables during and after the growing

season. Results further show that 3% of the total household income was accounted for by the selected indigenous vegetables. The study cautiously concludes that indigenous vegetables can be a possible source of reliable income. It is recommended that farmers integrate modern technologies and indigenous knowledge to improve production and consumption of indigenous vegetables. Farmer and private sector driven awareness campaigns on the benefits and business potential of indigenous vegetables is essential. The government through the extension officers should spread their services along indigenous vegetables value chain to improve production, processing, post-harvest handling and marketing. There is hope that these efforts should facilitate commercialization of indigenous vegetables for increasing household income and food availability.

I. Costs and Returns structures

Ishaq *et al.* (2003) revealed that the cost for producing cucumber on per acre basis was Rs. 55,906/- of this, 60.00 per cent was accounted for production cost, 28.00 per cent for marketing cost and 12.00 per cent rent of land. The per acre gross income from growing of cucumber was Rs. 1, 28210/- with the production of 14,822 kgs and net revenue were Rs.79, 102/- and Rs. 72, 302/- excluding and including rent of land, respectively. The benefit cost ratio shows that investing one rupee in off-season cucumber production would generate Rs. 1.29. The study found that purchase of seed, labour charges, fertilizers cost, and land rent and marketing charges were the major component of total cost of cucumber production.

Chase *et al*. (2008) concluded that a 4-crop organic rotation increased returns to management substantially from $158 per acre for the conventional corn-soybean rotation to $332 per acre for the organic rotation. The dramatic increase in returns per acre would allow a farmer to reach an overall economic

goal with half the acres. The current commodity prices would lower economic returns approximately $150 per acre, resulting in a $10 per acre return. At $10 per acre, the conventional corn-soybean producer would need to farm 4,500 acres to attain the income goal of $45,000. Although conventional corn prices for new crop 2009 are higher, significantly higher production costs could keep returns to management at approximately $20 per acre.

Ibanez and Allen (2010) study on the environmental and economic impacts of growing certified organic coffee in Colombia suggest that organic certification decreases the input costs and yields but does not have a significant effect on labor costs, total costs, income, or net return. For input costs, ATT is both negative and significant for four of the five matching estimators. The magnitude is substantial, ranging from 154 to 170 thousand pesos per hectare. For yield, ATT is both negative and significant for one of five estimators. The insignificance of ATT for total costs, income, and net return probably reflects the fact that lower yields associated with certification are offset by lower input costs and potentially by higher price premiums.

Kijima *et al*. (2011) propounded that some study find reasons beyond the constraints as forestalling agricultural technology adoption as well as the study publication to approximately $10.50 per bushel for corn and mid-$20s for soybean, as organic oat prices have increased to $4.50 per bushel and conventional hay prices, which were used for the study, are up to $130 - $150 per ton for good alfalfa. If these prices were received, returns to management would increase approximately $189 per acre, resulting in a $521 per acre return for the organic producer. Given these assumptions, a $45,000 economic goal could be achieved with less than 100 acres of organic production.

Anon. (2013)the gross income from raising one acre of cucumber was estimated at Rs. 1, 28210/- with the production of 14, 822 kg. After deducting

total cost incurred 0n various inputs, the net revenues came out to be Rs. 79, 102/- and Rs. 72, 302/- excluding and including rent of land, respectively. The benefit cost ratio shows that investing one rupee in off-season cucumber production would generate Rs. 1.29; this would provide a clue to those who want to initiate cucumber production in the off-season. Also the share of the various cost components of producing cucumber in off-season showed that marketing cost was the major component 29.00 per cent, followed by labour cost 15.00 per cent, fertility inputs 13.00 per cent (chemical fertilizers + FYM) and saling preparation cost 11.00 per cent.

Sain *et al.* (2013) concluded that the overall average operational cost of guava orchard increased from first year to seventh year. The overall average operational cost per hectare per annum from first to seventh years were found to be on plant protection, manures and fertilizers. The overall average net returns from the intercropping range from Rs. 39371 in the first year to Rs. 25438 per hectare during the fifth year of the orchard I.

Sudheer (2013) found that organic farming is more profitable for farmers in terms of costs and returns than chemical farming. The estimation of revenue function revealed that revenue is significantly affected by the respective prices, production with the exception of per unit cost. The exploitation of farmers at the hands of commission agents was the major complaint reported. The estimated major cost components on per acre basis for producing cucumber in the off-season showed that Rs. 33,554/- (60.00 per cent) accounted for production cost Rs. 15,564/- (27.84 per cent) for marketing of the produce and Rs. 6,800/- (12.16 per cent) rent of land . The production cost of off-season cucumber comprises of seed cost Rs.6, 284/-followed by picking cost Rs. 4, 340/-, irrigation charges Rs. 3, 900/-, FYM cost Rs. 3,346/- and weeding cost Rs. 2,520/-. The commission charges Rs. 8, 864/- accounted for the major share of the total and marketing costs.

A comparative analysis of the profitability of pineapple-mango blend and pineapple fruit juice processing in Ghana by Michael and John, 2014 revealed that pineapple juice processing had a BCR of 1.03 which implies that pineapple juice processing is profitable. The results also reveal that it is more profitable to invest in processing pineapple and mango blend than the pineapple juice as this yields a BCR of 1.36 which was greater than the BCR of 1.03 for processing pineapple juice only.

Bidari (2014) studied on the economic analysis of horticulture based farming systems in Dharwad district of Karnataka observed the costs and returns of various horticulture based farming systems. The results show that under Farming System-II, total cost per farm was Rs. 1, 93,976 and the net return was Rs. 1, 48,611. In Farming System-II the major share in total cost was occupied by Sapota (50.59 per cent). Under the system, in the total net returns the share of Sapota was 46.11 per cent. The dairy maintenance cost and net returns were 22.22 per cent and 20.46 per cent respectively. In the total cost, maize cultivation cost was observed to be 9.55 per cent and 13.55 per cent of net return was contributed to the total net returns. The share of soybean and summer maize in the total costs were found to be 6.20 per cent and 11.44 per cent respectively and the respective net returns was 3.67 per cent and 16.22 per cent. The returns per rupee expenditure were found to be highest in the case of *kharif* maize and *summer* maize with 2.09 followed by dairy (1.71), Sapota (1.70) and soybean (1.45) respectively.

Kumar *et al.* (2017) compared the overall costs and returns across vegetables in district Nainital and found that the input-output ratio over cost C is Rs. 2.07 for tomato, Rs. 2.42 for peas, Rs. 2.15 for cabbage, Rs. 2.77 for cauliflower, Rs. 2.68 for capsicum and Rs. 2.52 for beans. The highest returns per rupee invested in cauliflower indicate that cauliflower cultivation was most profitable among all six off-season vegetables crops under study. The highest

returns per rupee invested in capsicum cultivation indicate that capsicum cultivation was most profitable among all the offseason vegetable crops. When the overall situation is examined capsicum cultivation is found to be more profitable than cauliflower, beans, tomato, peas and cabbage.

In overall situation the per hectare cost A_1 was Rs. 50180, cost A_2 was Rs. 52762 cost B was Rs. 88444 and cost C was Rs. 146288. Cost C was more in case of marginal than that of small and medium size of farms. The gross return per hectare were estimated Rs. 441438, Rs. 388423, Rs. 359738 and Rs. 423074 on marginal, small, medium and overall size of farm respectively. The net returns per hectare were found Rs. 372895, Rs. 370312, Rs. 334630 and Rs. 276786 at cost A_1, A_2, B and C respectively.

Kumar *et al.* (2013) carried out an investigation on the estimation of cost of cultivation of commercial crops in Himachal Pradhesh .The empirical findings of the study shows that the cost of cultivation (based on cost D) of potato amounted to Rs. 1, 78, 739 per hectare in Kangra whereas, in Lahaul & Spiti it was Rs. 2, 75, 643 per hectare. The net returns per hectare over Cost D were Rs. 48,261 in Kangra district and Rs. 18, 945 in Lahaul & Spiti. The cost of production per kg of potato based on cost A1 (without family labour) amounted to Rs. 4.39 and Rs. 4.62, respectively in these two districts. Based on total cost, the cost of production per kg in Kangra and Lahaul & Spiti was found to be Rs. 7.16 and Rs. 7.80 respectively.

Sudheer (2013) found that organic farming is more profitable for farmers, in terms of costs and returns, than chemical farming. However, the variation in profits is smaller for small farmers of *red-gram* and large farmers of groundnut. This improved profitability of organic farmers in the present study is despite the fact that these farmers (N=350) are not reaping a premium price for their produce since they are not certified organic and their produce is

sold undifferentiated in the market, that is, it is sold without labelling and at 'normal' prices.

Kerutagi and Deshetti (2018) studied the "Comparative Economics of Traditional *viz*. High Density Mango Cultivation in Karnataka" from the sixty sample farmers from Dharwad district at the rate of 30 each from traditional and high-density orchard of Dharwad taluk and revealed that the area and production of mango in Dharwad district showed positive growth. Total annual maintenance cost of traditional mango (Rs. 21, 783/ ha) was lower compared to HDP (Rs. 48,132/ha). In high-density orchard, the average yield obtained was more (7.86t/Ac) than in traditional orchard (3.50/t/Ac). However, the sale price was Rs. 90, 950, Rs.2, 04,320 in both traditional and high-density orchard respectively. Pay Back Period was found to be higher in traditional *i.e*. 5.90 years whereas in high-density orchard it was 5.54 years. The Benefit cost ratio was 1.49 and 2.00 in traditional and HDP respectively.

II. Resource-use Efficiency

Boerngen and Bullock (2004) propounded that although some practices or systems for improving sustainability require more time than conventional agriculture, it is not clear that the time investment in increasing labor and management decreases quality of life for farm households, conventional farmers reported spending just over 3 hours / week "keeping up" with information about their production practices, while reduced-chemical and organic farmers reported a time investment of nearly 4 hours/week. The difference was found to be statistically significant, suggesting that chemical inputs and human capital might be economic substitutes. Farmers who adopted reduced-chemical practices reported a transition period of 1±2 years; during the transition period, they spent around 3 hours / week learning about reduced-chemical technology. Adopters of organic practices also reported a transition

period of 1 to 2 years; during that period, they invested 5 hours / week learning about organic technology.

Kshirsagar (2008) from his study on "Organic Sugarcane Farming for Enhancing Farmers' Income and Reducing the Degradation of Land and Water Resources in Maharashtra found that the organic sugarcane cultivation, needs large number of human labour days. On an average, the per ha human labour use was found to be 251.08 days on organic sugarcane farms and 214.79 days on inorganic sugarcane farms, showing 16.90 per cent higher use on organic sugarcane farms. This is mainly attributed to increased labour use for operations such as preparatory tillage, manuring, green manuring and managing the weeds, pests and diseases on organic sugarcane farms. Furthermore, the intercropping typically found on organic sugarcane farms, with crops having various planting and harvesting schedules, may distribute the labour demand more evenly which could help stabilize the employment. This implies that organic sugarcane farming provides an opportunity to rural masses of sustained farm employment throughout the year.

Jat *et al*. (2011) study on "Layering Precision Land Leveling and Furrow Irrigated Raised Bed Planting: Productivity and Input Use Efficiency of Irrigated Bread Wheat in Indo-Gangetic Plains" revealed that over the past decade, researchers in association with farmers and entrepreneurs have been trying to overcome the problems of depleting water resources, diminishing input use efficiency, declining farm profitability, and deteriorating soil health by developing, evaluating and refining conservation and precision agriculture-based resource-conserving technologies for the wheat system in the IGP of South Asia. This study on the integrated effect of raised bed planting of irrigated wheat on laser leveled fields increased wheat yields (average of 2 yrs) by 16.63 per cent over flat planting on traditionally levelled fields. Whereas, the yield enhancing effects of precision land leveling alone under raised beds and

flat beds were 9.49% and 8.14%, respectively. The saving in irrigation water with layering of precision-conservation was 49.83 per cent compared to traditional practices (traditional leveling, flat planting), whereas precision leveling could save 31.26 per cent water in flat planting and 22.56 per cent in raised beds. The improvement in nutrient use efficiency was also significant with layering of precision-conservation management compared to individual effects. Therefore, this study confirms that Precision Conservation Agriculture (PCA) based crop management solutions seem to be promising options to sustain the system of agriculture.

Rahman (2011) evaluates the determinants of switching to modern rice and its productivity while allowing for production inefficiency at the level of individual producers. Model diagnostics reveal that serious selection bias exists, justifying the use of a sample selection framework in stochastic frontier models. Results revealed that modern variety selection decisions are influenced positively by the availability of irrigation and gross return from rice and negatively by a rise in the relative wage of labour. Adoption of modern rice is higher in underdeveloped regions. Seasonality and geography/location does matter in adoption decisions. Stochastic production frontier results reveal that land, labour and irrigation are the significant determinants of modern rice productivity. Decreasing returns to scale prevail in modern rice production. The mean level of technical efficiency (MTE) is estimated at 0.82. Results also demonstrate that the conventional stochastic frontier model significantly overestimates inefficiency by three points.

Murugasamy and Veerachamy (2012) analyzed the resource use efficiency, total economic efficiency and technical efficiency in various crops of agricultural regions. The studies cover major farm inputs such as human labour, bullock labour, fixed capital, land, seeds, fertilizers and manure and irrigation. The studies fail to incorporate the ideologies of resource use

efficiency in the context of head, mid and tail reaches of the channel irrigation.This research gap opens the new avenue of research for the study on economics of resource use efficiency in head, mid and tail reaches in cannel irrigation based agriculture.

Rola et al. (2013) Estimated maximum livelihood of stochastic frontier production function revealed that farm size (6.410), fertilizer (3.913), stem cutting (3.812), capital (2.589) and labour (2.017) were found to be the production factors influencing cassava output and the relationships were statistically significant at 1.00 per cent levels of probability respectively. The inefficiency model, education (4.511), farming experience (5.578), farm income (3.837), household size (-5.511) and extension contact (2.456) and membership of co-operative (2.011) were found to be statistically significant at 1.00 per cent level of production as regards the use of farm size, stem cutting and labour, thus, implying decreasing returns to scale, whereas for fertilizer use, they operated within the third stage of the production process as marginal physical product (MPP) was below zero. However, farmers complained of inadequate production capital and limited availability of land.

Bhan and Behera (2014) conservation agriculture technologies involve minimum soil disturbance, permanent soil cover through crop residues or cover crops, and crop rotations for achieving higher productivity. In India, efforts to develop, refine and disseminate conservation-based agricultural technologies have been underway for nearly two decades and made significant progress since then even though there are several constraints that affect adoption of CA. Particularly, tremendous efforts have been made on no-till in wheat under a rice-wheat rotation in the Indo-Gangetic plains. There are more payoffs than tradeoffs for adoption of CA but the equilibrium among the two was understood by both adopters and promoters. The technologies of conservation

agriculture provide opportunities to reduce the cost of production, save water and nutrients, increase yields, increase crop diversification, improve efficient use of resources, and benefit the environment.

Mugabo *et al.* (2014) studied on-farm data from Kamonyi district collected during two agricultural seasons from September 2007 to July 2008 and identified key factors determining soybean production and resource use efficiency in soybean production. Cobb-Douglas production function was fitted. Results indicate that, with an elasticity of 0.46, plot size was the most important factor of soybean production. It was closely followed by intermediate inputs (fertilizers, pesticides and seeds), with a coefficient of 0.44. When intermediate inputs were decomposed, fertilizers with an elasticity of 0.062 appears to contribute more to soybean production than pesticides (0.057) and seeds (0.034). Technical inefficiency was responsible for at least 93.00 per cent of total variation in soybean output among the survey farmers. The relative efficiency (allocative efficiency) of resource use, expressed as the ratio of marginal value product (MVP) to marginal factor cost (MFC), were 1.73 for soybean plot size, 1.36 for fertilizers and 1.92 for pesticides. These indicate that too little of these inputs are being used in relation to the prevailing market conditions.

Okoruwa *et al.* (2014) assessed the resource-use efficiency of plantain farmers in Ogun state, Nigeria using the stochastic frontier production function analysis. Primary data were collected from 160 plantain farmers in Abeokuta zone of Ogun State Agricultural Development Programme (OGADEP). The mean efficiencies values for plantain production were 0.835, 0.675 and 0.721 for technical, allocative and economic efficiencies respectively. The return to scale value showed that plantain production was at stage of decreasing positive return to scale. The study also revealed the presence of inefficiency in the resource-use among plantain farmers in the study area ($p < 0.05$). The

distribution of results also showed that the plantain farmers were more efficient in the use of some inputs. Changing the input combinations was observed to increase farm level efficiency. The farmers in the study area therefore need to use available input intensively so as to reduce current inefficiencies significantly.

Onubuogu *et al.* (2014) carried out a study on *"*Resource use efficiency of smallholder cassava farmers in Owerri Agricultural Zone, Imo State, Nigeria" and revealed that cassava production in the area is dominated by females (63.33%). Majority (71.67%) of the farmers were married with an average household size of seven persons. Average annual farm income was N59, 843.00. The average farm size was 0.97 ha while the farmers produced an average output of 1,394.70 kg ha-1 in the 2013 cropping season. Mixed cropping system (73.33%) was dominant in the area.

Tirlapur *et al.* (2015) revealed that the resource use efficiency analysis for the major crops of Dharwad district seed, fertilizers, PPC and machine labour were over utilized and human labour and bullock labour were underutilized by the chickpea farmers. Cobb-Douglas production function for cotton under rainfed condition revealed that seed, PPC, human labour and bullock labour were over utilized and FYM, fertilizer and machine labour were underutilized. During production of paddy seed, fertilizers, FYM, bullock labour and machine labour were over utilized and human labour and PPC were underutilized by the farmers. FYM and PPC were underutilized and seed, fertilizers, human labour, bullock labour and machine labour were underutilized by farmers in cultivation of soybean. Resource use efficiency under rainfed chilli production revealed that seed, PPC, bullock labour and machine labour were over utilized and FYM, fertilizer and human labour were under utilized by the farmers.

Dahal and Dhakal (2016) found that organic farmers generally have a larger number of cattle and land holdings, but are not very different from conventional farmers in terms of education and household size. In terms of crop productivity, conventional yields are statistically higher than organic yields for two crops, tea and rice, and conventional profits in rice are also higher. However, net revenues are higher in organic maize and coffee relative to their conventional counterparts because of lower costs. In general, conventional crops are more costly to produce than organics. Organic farms face many more policy barriers than conventionally cropped farms. In this context, technological options such as suitable seed varieties, bio-fertilizers, vermi-compost, and improved farm yard manure would improve organic crop productivity. A shortage of organic manure could be overcome by promoting farm livestock enterprises.

Sachitanand (2016), horticulture has a number of advantages compared with agriculture crops. For one, it's more remunerative. Horticulture can be done on dry and hilly land. Water utilization is lower and so is consequent risk of crop failure. Unlike large-scale cereal crops, horticulture farms can be much smaller, allowing marginal farmers to boost their earnings from their small landholdings. While horticulture crops require more inputs in the form of fertilisers and so on, farmers often plant two or three crops simultaneously to maximise yield from each acre. Farmers ET Magazine spoke to say their incomes have at least doubled since making the transition to horticulture.

Interview of smallholder farmers during the field mission indicated that they needed a total of 400 man days of labour or equivalent of five fulltime family or hired labour for one hectare land of onion continuously working for three months. The labour requirement for tomato is 300 man days, slightly less because of the less labour intensive weeding and planting processes. The major

fruit grown by smallholder in the study area is papaya, requiring about 120 man days per year. Most of the smallholder farmers use family or neighbour labour.

Akter *et al*. (2018) revealed that the economic efficiencies range from 0.21 to 1.00 with an average economic efficiency of 0.8261. This means that if a farmer were to reach at the economic efficiency level of its most efficient farmer, then on an average the farmer could experience a cost saving of 17.23 per cent while the most inefficient farmer suggests a gain of 78.80 per cent in economic efficiency. The percentage distribution implies that about 21.00 per cent of the farmers in the study area had economic efficiencies between 0.21 and 0.70, while 79.00 per cent of the farmers had economic efficiency of 0.71 and above. That is, most of the farmers were economically efficient in pineapple production. These results coincide with the findings of [20] for pineapple in Nigeria. They reported more or less similar finding where 79.44 per cent of farmers had economic efficiency between 0.51 and 0.90.

III. Income and Employment patterns

Christins and Luker (2007) as horticultural crop production create jobs it provides twice the amount of employment per hectare of production compared to cereal crop production. The move from cereal production towards high-value horticulture crops is an important contributor to employment opportunities in developing countries.

Nichols and Hilmi (2009) highlighted the contribution of vegetable production to sustainable livelihoods. Usually smallholders intensively cultivate vegetables in gardens, and promoting vegetables in gardens can help smallholders in a number of ways:

1. It can teach smallholders how to grow vegetables;

2. It allows for testing out vegetables that were never planted before;

3. It can provide income from the sale of vegetables;

4. It can provide gender employment and gender participation in economic activities and

5. It can provide employment for the disabled and the elderly.

Anon (2010) the urban and peri-urban agriculture (UPA) expands the economic base of the city through production, processing, packaging, and marketing of consumable products. This results in an increase in entrepreneurial activities and the creation of jobs, as well as reducing food costs and improving quality. UPA provides employment, income, and access to food for urban populations, which helps to relieve chronic and emergency food insecurity.

Kleemann (2011) highlighted that as consumer demand for organic food grows, organic certification is increasingly promoted in many developing countries. Organic products earn a premium price on the market compared to conventional varieties. Hence, organic production is often seen as a valuable alternative for developing countries with many smallholders. The results indicate that organic production is more profitable for smallholders than conventional production and farmers collect a fair share of the price premium on the retail level. Even more, from a theoretical perspective, organic farmers should also be more likely to get into contractual relations with exporters. The results are set into perspective with relation to the debates on small versus large farms, environmental impact, and the selection effect of standards.

Michael and John (2014) women have the most to benefit from the increasing importance of horticulture in rural economies. Women, in general, play a much more significant role in journal of Biology, Agriculture and horticultural crop production compared to starchy staple crops. Throughout the

developing countries of Africa, women plays a dominant role in the production of horticultural crops and cultivate more than half of the total smallholdings. Besides creating jobs on the farm, the horticultural sector also generates off-farm employment, especially for women.

Anon. (2015) the employment composition at the horticultural farms varies on the type of crop and nature of work. Over 80% of the labour force for onion production is women while the reverse is true for tomato. This difference in distribution of labour by gender is related to the fact that plant population per square area for onion is large and hence demands a more precision during planting, weeding and cultivating. Women are active in activities that demand precision and attention to details and less physical strength. The male workforce is mostly youth between 15 to 30 years of age. This group is responsible for activities that demand physical strength such as land preparation, spraying agro-chemicals, cultivating and loading harvest. The table below represents the data of 10 smallholder farmers, 5 medium commercial farms and 4 large scale farms.

Joosten *et al.* (2015) opined that fruits and vegetables are strategic export commodities for Ethiopia. Over the last five years export has shown steady growth of nearly 80.00 per cent per year. Important export markets for fruits and vegetables are the surrounding countries (Djibouti, Somalia, and Sudan). The main products to these countries were non-graded fresh fruit and vegetables such onion, tomato, potato, banana, mango and avocado. High-value graded pre-packed vegetables and fresh herbs account for only 11.00 per cent of the total export. Most of these products are exported to the United Kingdom (UK), United Arab Emirates (UAE) and The Netherlands. There are three categories of people engaged in production of horticulture: self-employed, permanent employees and daily labourers. The self-employed are mostly smallholder farmers growing vegetables and fruits on their own land; they

account for not more than 10.00 per cent of the community. These are households who have land closer to the lakeside whereby pumping water is not costly. Farmers cultivating vegetables on their own land can get a net annual income of up to USD 4,000 per year in two production cycle at the time of good harvesting and market season.

Mundinaman (2015) according to data from the Agriculture Ministry, horticulture crops first outpaced food variants six years ago. Since then, horticulture output has been mostly widening its margin with food production, with profound impact on farm incomes, water utilization, land-usage and employment patterns. Farm-related policies also need to keep up with the shift. Horticulture gives farmers a higher income, but there is little protection against a glut. While food grain enjoys a minimum support price mechanism, there is little by way of a safety net in horticulture. To extend the life of the perishable produce, India also needs better cold chain storage and transport networks. Horticulture also lends itself to greater mechanization, and with its spread, might have an impact on farm employment. Horticulture accounts for around 15.00 per cent of the cultivated land in Karnataka and 40.00 per cent of the income from agriculture. In Bagepalli, for example, the annual turnover from the two FPOs was 6 lakhs in 2016. But it has been Rs. 10 lakhs a month in 2018, as farmers swiftly shifted to horticulture crops, says Narasimha Murthy, the Chikkaballapur hub manager for Vrutti Livelihood Centre.

Pinthukar (2015) the fruit and vegetable sector created partial employment opportunity for over 9m smallholder farmers. Apart from contributing to the overall economic development of the country, the horticultural export industry has created job opportunities for about 133,000 people (excluding the flower farms), of whom the 70.00 per cent are women. In addition, the number of people engaged in trading, transporting and processing

could be over 100,000. Fresh juice and fruit and vegetable business is common in major cities and highly preferred by consumers.

Mintesnot (2016) reviewed that horticulture comprises diverse cropping systems in all agro-climatic zones, provides healthy and nutritious food, and generates employment and income for smallholder farmers, including women who are often the main primary producers. Benefits from horticultural development include improved nutrition for children and families, increased income from sale of horticulture products, and improved status and confidence of women farmers. In many cases, horticulture can generate substantial income from smallholdings that would not be profitable if planted only to cereal crop staples. In addition, women typically use the income generated from horticulture to invest in family health and education, which multiplies the benefits by increasing social capital.'

Gathaara *et al.* (2017) concluded that Farmers ranked banana first in terms of food security and income generation. In all the agro-ecological zones, the crop was allocated the largest (1.1 ha) portion of household land compared to other crops. Lack of adequate information on banana production and management practices (34.50 per cent), high cost of clean planting materials (25.50 per cent), organic fertilizers (17.50 per cent), inaccessibility of manure (18.30 per cent), inadequate quantities of manure (9.10 per cent), high labour in terms of watering and manure application (4.00 per cent) and lack of capital (3.00 per cent) were identified as major reasons for non-adoption of recommended crop production technologies with 7.30 per cent having no tangible results while 1.00 per cent did not believe in using inorganic fertilizers on their farms. Capacity building addressing all segments of the banana crop value chain including marketing and market linkages is recommended together with government intervention of fertilizer prices for improved crop productivity and crops' benefits to the farmers and the country.

Schreinemachers *et al.* (2018) stated that vegetables are increasing and recognized as essential for food and nutrition security. Vegetable production provides a promising economic opportunity for reducing rural poverty and unemployment in developing countries and is a key component of farm diversification strategies. Vegetables are mankind's most affordable source of vitamins and minerals needed for good health. Today, neither the economic nor nutritional power of vegetables is sufficiently realized. To fully tap the economic and nutritional power of vegetables, governments and donors will need to give vegetables much greater priority than they currently receive. Now is the time to prioritize investments in vegetables, providing increased economic opportunities for smallholder farmers and providing healthy diets for all.

IV. Farmers' perception for the selected horticultural crops

Lahmar (2012) the study examined the perception of smallholder pineapple farmers on Global GAP standard compliance, assessed compliant farmers' rate of adherence to Global GAP requirements, and compared the average farm profit between Global GAP compliant and non-compliant farmers. Findings of the study revealed that majority of farmers (81%) were aware of Global GAP standard. About one-third (32%) of respondent farmers perceived Global GAP to be a market standard that guarantees market premium to certified farmers.

Meena and Punjabi (2012) indicated that majority of farmers perceived knowledge regarding use of FYM, urea & DAP, line sowing and seed replacement technologies, while minority of farmers possessed knowledge regarding use of green manure & micro elements, broadcasting, cultivation of fruits and vegetable crops and making compost/vermi-compost. Further, it was also observed that the majority of farmers perceived climatic changes, uneven

distribution and uncertain behaviour of the rainfalls, declining level of ground water on their farms and non-remunerative price of crops during last ten years.

Panneerselvam *et al.* (2012) on their research on the Indian farmers' experience with and perceptions of organic farming to investigate the perceived relevance, benefits and barriers to a conversion to organic agriculture in three different Indian contexts-in Tamil Nadu, Madhya Pradesh and Uttarakhand states revealed that conventional producers identified production and marketing barriers as the main constraints to adopting organic farming, while the age and education of the farmer were not deemed a problem. Lack of knowledge and lack of institutional support were other barriers to conversion.

Singh and Maharjan (2013) analyzed the farmer's perception on yield and income from organic vegetable farming in Kathmandu valley and Chitwan district of Nepal. The study has shown that less than half of respondent perceived increased yield in organic vegetables. It also indicates their perception is positively related to experience of practicing organic farming and negatively to having large-sized farms. Thus, support should be provided during initial years as yield improves only in later years. Access to premium market assures increased income and compensates for decreased yield of organic vegetables. In this regard, consumer awareness on appearance of organic vegetables should be emphasized which could help establish and boost local organic vegetable market.

Sudheer (2013) found that organic farming is more profitable for farmers in terms of costs and returns, than chemical farming. This improved profitability of organic farmers in the present study is despite the fact that these farmers (N=350) are not reaping a premium price for their produce since they are not certified organic and their produce is sold undifferentiated in the market, that is, it is sold without labelling and at 'normal' prices. An analysis

of the farmers' perception of organic farming reveals that electronic media (mostly television agricultural programmes presented in the local language) is the prime motivator for them to adopt this method and all the organic farmers in the sample have been practicing this method for over six years. Organic farmers believed that organic farming improves soil fertility and their profits in the long run. They expressed the view that the certification process is very difficult and expensive. Certification would allow them to potentially sell their produce at a premium price. Organic farmers indicated that government support services are needed for marketing their produce through special markets and that targeted support services and awareness programmes would be welcomed.

Darko (2014) concluded that adoption of farming technologies is very crucial to agricultural development. In Ghana, a greater percentage (70.00 per cent) of the people is in the agricultural sector. Improvement in agriculture will have direct positive impact on the livelihood of the people. Farmer perception on agricultural technology influences their decision to adopt the technology or not. The study revealed that farmers perceived the improved crop varieties with particular reference to Maize (*Zea maize*), Cassava (Manihot esculentus) and Oil Palm (Elaies guineensis) as lacking some good characteristics of the landraces and also expensive to adopt. The need for farmers to be actively involved in the development of improved crop varieties was also highlighted. The study recommends that all stakeholders (Plant Breeders, Agronomists, Post Harvest Technologists, Ministry of Food and Agriculture (MOFA) and Farmers) should be actively involved in the development of farming technologies.

Uddin *et al*. (2014) concluded that overall perception by the potato growers in the study area will not be improved unless intensive and effective steps are taken to increase their access to various information sources of

agriculture. Growers' perception was comparatively lower as rated by them in case of plant spacing, seed size and well land preparation; but their perception is higher in case of use of quality seeds, optimum irrigation and modern variety cultivation. Hence, it may be concluded that without improving knowledge by adequate training facilities and ensuring availability of those required inputs in time at farm level growers will not get ready to perceive those innovations.

Patidar and Patidar (2015) conducted a study on "A Study of Perception of Farmers towards Organic Farming" of 39 districts in the state of Madhya Pradesh. 100 respondents from 50 villages of Khargone district of Nimar region revealed that 67% of respondents have positive perception towards organic farming. Also, 5 out of 9 variables selected, affects respondents perception towards organic farming. There were significant relationships ($p \leq 0.05$) between respondents' age, educational background, farm size, benefits, social aspects and perception of organic farming and social factors. This indicates that the communities will have high adoption rate of innovations related to organic farming and other agricultural policies. This gap between knowledge or perception and practice can be bridged by better understanding of the system and government provision of enabling environments (*e.g.* provision of credit facilities, training on technicalities) to farmers. This study also revealed some unexpected outcomes such as cost associated with organic farming does not affect farmer's attitude. May be farmers focus is on yield and profit (benefit aspect) but not cost of inputs in the agriculture. Other factors like knowledge, environment and gender have no explanatory significance towards attitude of the farmers.

Pinthukas (2015) from his investigation on "Farmers' Perception and Adaptation in Organic Vegetable Production for Sustainable Livelihood in Chiang Mai Province" revealed that a number of farmers in three study areas had previous experience in organic vegetable production, organic vegetable

farming practice, *i.e*. land preparation, vegetable seed, types of crop, planting method, soil nutrient management, pest management, weed management and harvesting. The disadvantages or constraints in small-farmer adoption of organic agriculture include: debt and income, bio-physical and knowledge constraints. The multiple regression analysis results indicated that age, education level, household labour, farm income and extension visit significantly contributed to farmers' perception on organic vegetable production. Moreover, education level, experience, natural water and farmers' networks or membership significantly contributed to farmers' adaptation on organic vegetable production**.**

Marsh *et al.* (2016) analyzed Organic farming: knowledge, practices, and views of limited resource farmers and non-farmers on the Delmarva Peninsula of USA and revealed that most of the respondents were farmers; fewer than 30.00 per cent grew both organic and inorganic crops, and less than 10.00 per cent grew only organic crops. Organic commodities produced were fruits, vegetables, herbs, and animals. At least 60.00 per cent of the farmers had some knowledge about production costs, marketing, and farming practices for organic crops, while nearly 50.00 per cent did not know about the practices for growing certified organic. Lack of time and the length of time to certify for organic farming were the two most cited reasons for farmers not growing organic. Both the farmers and non-farmers believed that organic crops are safe, high quality, and high cost. Some non-organic farmers and non-farmers desired to do organic farming, but needed information such as production techniques and costs.

Annor (2017) examined the perception of smallholder pineapple farmers on Global GAP standard compliance, assessed compliant farmers 'rate of adherence to standard requirements, and compared the average farm profit of Global GAP compliant and non-compliant pineapple farmers in Akuapem

South Municipal Area of Ghana in "Global GAP Standard Compliance and Profitability: A Case Study of Smallholder Pineapple Farmers in Akuapem South of Ghana". The study found that compliant farmers perceived Global GAP to offer market premium on certified products as it is the case for organic certification. Factors that accounted for farmer non-compliance with Global GAP included: high cost of standard compliance, uncompetitive farm gate price and low farm yield. Although average farm profit of Global GAP compliant farmer (GH¢9,083.64) was higher than that of non-compliant farmer (GH¢8,893.62), the difference was insignificant. The study recommended, among others, that a concerted attempt should be made by the Government of Ghana and the private sector to create a national commodity exchange institution that will seek to provide a transparent and efficient marketing system for Ghana's key agricultural commodities.

Hayran *et al*. (2018) carried out a study on "Farmers' sustainable agriculture perception in Turkey: the case of Mersin province" for 239 farmers and revealed that majority (94.14%; n = 225) of the farmers had favourable perception towards sustainable agriculture in Mersin. In addition, the study showed that farmers were highly interested in protecting natural resources for future generations. They had concerned about negative effects of agrochemicals on human and animal health. Besides, they had positive perceptions about sustainable agricultural practices such as application of organic fertilizers, application of cover crops, crop rotation and diversification, application of soil tests before applying fertilizers, not burning of plant residues after harvest etc. They were also aware the roles of sustainable agriculture in solving problems of environmental pollution and natural resources degradation, increasing profits and reducing production risks in the long-term; as well as they were aware the importance of selling products by contracts farming. The result of the regression analysis indicated that 4 variables that affecting

farmers' sustainable agriculture perception. These variables were agricultural program on TV, agricultural program on radio, credit use and cooperative partnership. These variables explained 10.6% the variation of farmers' sustainable agriculture perception. The Agricultural program on TV was a most significant and positively influence variable on farmers' perception towards sustainable agriculture.

Timsina and Shivakoti (2018) highlighted Perception of vegetable growers on selection of seed type and their willingness to pay from his study on "Vegetables production and marketing: practice and perception of vegetable seed producers and fresh growers in Nepal". The significant findings of the study indicated that farmers were choosing hybrids mainly due to their higher production, attractive fruits and more profit, whereas the main reasons for choosing OPs were easy availability and preference given by the consumers.

V. Problems and Constraints faced by the farm households

Narayanan (2005) propounded that the most important constraint felt in the progress of organic farming is the inability of the government policy making level to take a firm decision to promote organic agriculture. Unless such a clear and unambiguous direction is available in terms of both financial and technical supports, from the Centre to the Panchayat levels, mere regulation making will amount to nothing. The following are found to be the major problem areas for the growth of organic farming in the country.

Emana and Gebremedhin (2007) propounded that the eastern part of the country is based on tradition, which is poorly supported by scientific recommendations. Although one can associate this constraint to institutional factors, it is apparent that inadequate farmer skills and knowledge of production and product management affects the supply. Farmers attempt to select varieties and practice traditional crop management practices. Farmers'

know-how of product sorting, grading, packing and transporting is traditional, which severely affects the quality of horticultural products supplied to the market. This skill gap should be addressed to improve the quality of marketable horticultural products.

Christine and Luker (2007) based on this evidence, various experts have suggested that rescuing traditional management systems combined with the use of agro ecologically based management strategies may represent the only viable and robust path to increase the productivity, sustainability and resilience of peasant-based agricultural production under predicted climate scenarios. In this paper we explore a number of ways in which three key traditional agro ecological strategies (bio diversification, soil management and water harvesting) can be implemented in the design and management of agro ecosystems allowing farmers to adopt a strategy that both increases resilience and provides economic benefits, including mitigation of global warming.

Natural factors such as rainfall, water supply, flood and pests are often beyond the control of farmers and institutions. There is a shortage of irrigation water mainly in the lowland areas. Yet, contingency planning and forecasting of the events which may help to minimize the effect is not available perhaps due to traditional ways of production. Moreover, an appropriate management system including variety selection and diversification would reduce the effect of natural factors. Improving the institutional constraints discussed above will be instrumental for improving the management system. Infrastructure such as rural roads and means of communication for efficient flow of goods and market information is a limiting factor. Most of the rural area is not accessible by vehicle. The products are transported to the road side by donkeys or by people. This requires longer time to reach the market and affects the quality of the

products. Moreover, there is no telephone or other fast communication systems to access market information that would assist decision making.

Bezu and Holden (2008) highlighted the evidence from the empirical studies on Africa and confirmed that farmers in Sub-Saharan Africa (SSA) face a lot of constraints, ranging from infrastructure, incentives, and liquidity, which impedes adoption and retention of agricultural technology. Nonetheless, some studies find reasons beyond the above mentioned constraints as forestalling agricultural technology adoption as well.

Marenya and Barret (2009) based on a study in Kenya shows that without addressing complementary factors such as soil quality, merely availing infrastructure alone cannot ensure sustained adoption of agricultural technologies.

Foster and Rosenzweig (2010) revealed that the two major drivers of successful agricultural technology adoption in developing countries are: (i) the availability and affordability of technologies; and (ii) farmer expectations that adoption will remain.

Rola *et al*. (2011) propounded that the farming systems in two horticulture growing regions in Timor Leste and outlines the challenges and constraints faced by farmers in the production and marketing of horticultural products. One of the main challenges faced by farmers is the low productivity and quality of the produce. Product quality is a problem due to poor product handling. Marketing is hampered by the poor transport and road network system, inadequate communication, the lack of storage facilities, and the lack of a grading and standardization system in the industry.

Darko (2011) argued that availability of land helps reduce the liquidity constraints faced by households and also reduces risk aversion. On the other

hand, ownership of large tracts of land can facilitate experimentation with new agricultural technologies, and also determine the pace of adoption as large land owners are more likely to be the early adopters.

Onubuogu *et al.* (2014) found that the Constraints encountered by Smallholder Cassava farmers in effective resource allocation of farm resources reveals that majority (98.33 per cent) of the smallholder cassava farmers in the study area complained of inadequate production capital as a constraint to cassava production, 95.00 per cent of the farmers complained of limited availability of land, 90.00 per cent of the farmers identified of poor feeder roads, 83.33 per cent of the farmers complained of high cost of labour, 75.00 per cent of the farmers complained of pests and diseases infestation, 71.67 per cent complained of poor extension contact, while 68.33% identified long distance between farm and market. Other 65.00 per cent and 51.67 per cent of the farmers in the study area complained of inadequate production inputs and inadequate storage facilities respectively. Ultimately, there is no doubt that these constraints are responsible for the poor resource use efficiency and poor cassava production recorded in the area. Fighting these problems will be vital in promoting not just subsistence cassava production but commercial cassava production in the area and beyond.

Mack *et al.* (2015) put their effort to identify production barriers to vegetable and fruit producers adopting organic methods of production and determine which of these barriers to organic production influence adoption most. Further, it was found that a large number of factors including producers' evaluation of production barriers are shown to influence adoption of organic production methods. Among perception factors and characteristics influencing adoption are organic certification costs, reluctance to adopt new production methods lower organic yields, liability of organic producers is higher, labor

costs, producer age, educational attainment, years of organic farming experience and farm size (measured as gross annual farm sales).

Negi and Anand (2015) study on "issues and challenges in the supply chain of fruits & vegetables sector in India: a review" concluded that the entire supply chain of Fruits and Vegetables in India is laden with various issues and challenges. The study found that cold chain facilities; fragmented supply chain; linkages and integration between the partners; taxation issue; infrastructure facilities; cost of packaging material; technology and techniques; farmer's knowledge and awareness; quality and safety standards; processing and value addition; supply chain inefficiency; farmers income; supply chain losses and wastage of fresh produce; transportation facilities; demand and market information etc. are the factors which constitutes serious challenges for fruits and vegetables sector and are affecting the overall growth of the agricultural development of India.

Constraints of Organic Farming in India are: Marketing of organic farming produce is the main problem for organic growers; the lack of awareness among people (customers/buyers) is the main hurdle in selling organic products; Further the cost of the organic products is high which only the elite and foreigners can afford. Moreover peoples should verify the organically certified produces before buying; Organic growers are not in a position to spend money towards the organic certification; The organic marketing in most of the countries is still relatively small and on an average it is less than half a percent of the total agricultural sector except in Germany and Austria, where 2.00 to 3.00 per cent of their agriculture area is under organic production.

Shankar and Singh (2016) stated that the green revolution is one of the greatest successes that the country has observed and resultantly achieved self-

sufficiency and a good degree of stability in food grain production. However, the country still faces the challenges of comprehensive food security and malnutrition. Analysis shows, there is an inverse relation between the farm size of the respondents and their overall problems of marketing vegetables in farmers' market. It could be noted that higher their farm size, lower their overall problems of marketing vegetables in farmers' market and the vice versa. It is noted that there is an inverse relation between the caste status of the respondents and their overall problems of marketing vegetables in farmers' market.

Altieri and Nicholls (2017) studied "the adaptation and mitigation potential of traditional agriculture in a changing climate" and propounded that the threat of global climate change has caused concern among scientists because crop production could be severely affected by changes in key climatic variables that could compromise food security both globally and locally. Although it is true that extreme climatic events can severely impact small farmers, available data is just a gross approximation at understanding the heterogeneity of small scale agriculture ignoring the myriad of strategies that thousands of traditional farmers have used and still use to deal with climatic variability. Scientists have now realized that many small farmers cope with and even prepare for climate change, minimizing crop failure through a series of agro ecological practices. Observations of agricultural performance after extreme climatic events in the last two decades have revealed that resiliency to climate disasters is closely linked to the high level of on-farm biodiversity, a typical feature of traditional farming systems

Anon. (2017) institutional factors are related to the provision of improved horticultural production technologies including supply of relevant varieties, agronomic practices and improved product management techniques. The study reveals that the farmers are not receiving the varieties they wish to

cultivate. The capacity to distinguish between varieties is also low in the area. Institutions failed to bring up farmers' capacity to the expected level. Research based practical recommendations on agronomic practices and pre- and post harvest management are lacking at farmers level. Moreover, inputs such as fertilizer, seed and pesticides should be available through known and accountable sources. Conducive policies and enforcement mechanisms should be put in place.

Institutions like the marketing agency should also make available the market information needed for production planning. The data available should enable to forecast demand to adjust production planning. The extension system lacks highly qualified staff at *woreda* and field level. The observation in the field depicts that some of the development agents have little knowledge compared to the farmers.

Carletto *et a*l. (2017) found that maize-legume intercropping is a fundamental component of mixed farming systems in the mid-hills of Nepal. However, its productivity is constrained by several biophysical and social factors, and limited adoption of proven agricultural innovations. The active involvement of farmers enlarged our understanding of underlying decision-making factors to adopt or non-adopt agricultural innovations. Additionally, the in-depth farmer engagement in our on-farm trials positively influenced farmer perceptions of the innovations and their interest to adopt the agricultural innovations. Yet, the farmer final decisions to adopt some of the evaluated innovations were limited by a lot of factors including labour scarcity, the availability of inputs, and by cultural preferences despite the increased yields. This was particularly true for low and medium resource-endowed farmers.

Hunde (2017) study on "Opportunity, Problems and Production Status of Vegetables in Ethiopia" revealed that vegetable crops are produced in

different agroecological zones. Vegetables are produced in commercial as well as smallholder farmers both as a source of income and food. However, due to perishable nature and biological nature of production process, vegetables process, vegetables productions are risky investment activities. In this context, risk perceptions play a key role in the production and investment behaviour of farmers in vegetable production decisions. Vegetables are highly perishable; they start to lose their quality right after harvest and continued throughout the process until it is consumed.

In general, the drawback to this sector include social and cultural habits of the population like dietary preferences for meat and other animal products and distaste for vegetable crops, lack of consumer awareness, economic reasons of the local consumers, absence of nutrition intervention programme using vegetables and their processed products and certain environmental limitations. Heavy losses that are caused mainly due to price fluctuations, lack of guaranteed prices and unplanned planting patterns. This causes heavy post-harvest losses most vegetables are sold in unprocessed form. Lack of storage facilities, poor traditional storage system, which are prone to storage pests and diseases, lack of on-farm storage system and absence of cool storage facilities are among the important limitation to the vegetable production sector of the country.

Hinojosa *et al.* (2015) study on the constraints of small farmers for their agricultural development in four selected districts of Karnataka state namely Bangalore rural, Bangalore urban, Kolar and Tumkur found that the constraints faced by small farmers in adoption of improved production practices were like non-availability of inputs (62.00 per cent), lack of credit (61.00 per cent), lack of assured irrigation (58.00 per cent), untimely availability of inputs (58.00 per cent), high cost of inputs (57.00 per cent). Insufficient funds (47.00 per cent), lack of knowledge (43.00 per cent), poor quality seed (41.00 per cent), lack of

technical guidance (40.00 per cent), non-availability of plant protection equipment (28.00 per cent), poor marketing facility (26.00 per cent), poor quality of lands (23.00 per cent).

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CHAPTER III

RESEARCH METHODOLOGY

RESEARCH METHODOLOGY

Research methodology adopted to meet the objectives of the research problem and the various tools employed to obtain and interpret the results of study are described under the following sections.

1. Sampling procedure
2. Sampling plan
3. Data collection
4. Analytical framework

1. Sampling Procedure

The present study has been carried out in the state of Manipur and Nagaland in consultation with the organizations and the line-departments working in the field of Organic farming at the first and secondly the feasibility of the researcher. A multi-stage- random sampling technique have been used for the selection of sample units. Both purposive and cluster sampling method have been used for the selection districts, blocks and surveyed of the sample sizes.

2. Sampling plan

After selection of district, three stage sampling technique have been followed for constructing sampling plan of the study. The first stage of sampling was the selection of block followed by selection of villages (2^{nd} stage) and ultimately selection of the respondent farmers (3^{rd} stage) from the selected villages

2.1 Selection of district

In the first stage of sampling, selection of district has been carried out. Dimapur and Kohima districts from Nagaland and Senapati and Thoubal districts from Manipur were selected purposively for the study because of its popularity and production of major horticultural crops in the District.

2.2 Selection of block

In the second stage of sampling, block having highest acreage and production of major horticultural crops under the selected district have been selected with the help of District Agriculture Department and other reputed institutes. Kohima and Medziphema from Nagaland and Thoubal & Mao-Maram blocks from Manipur were purposively selected to get the desire information on the above objectives.

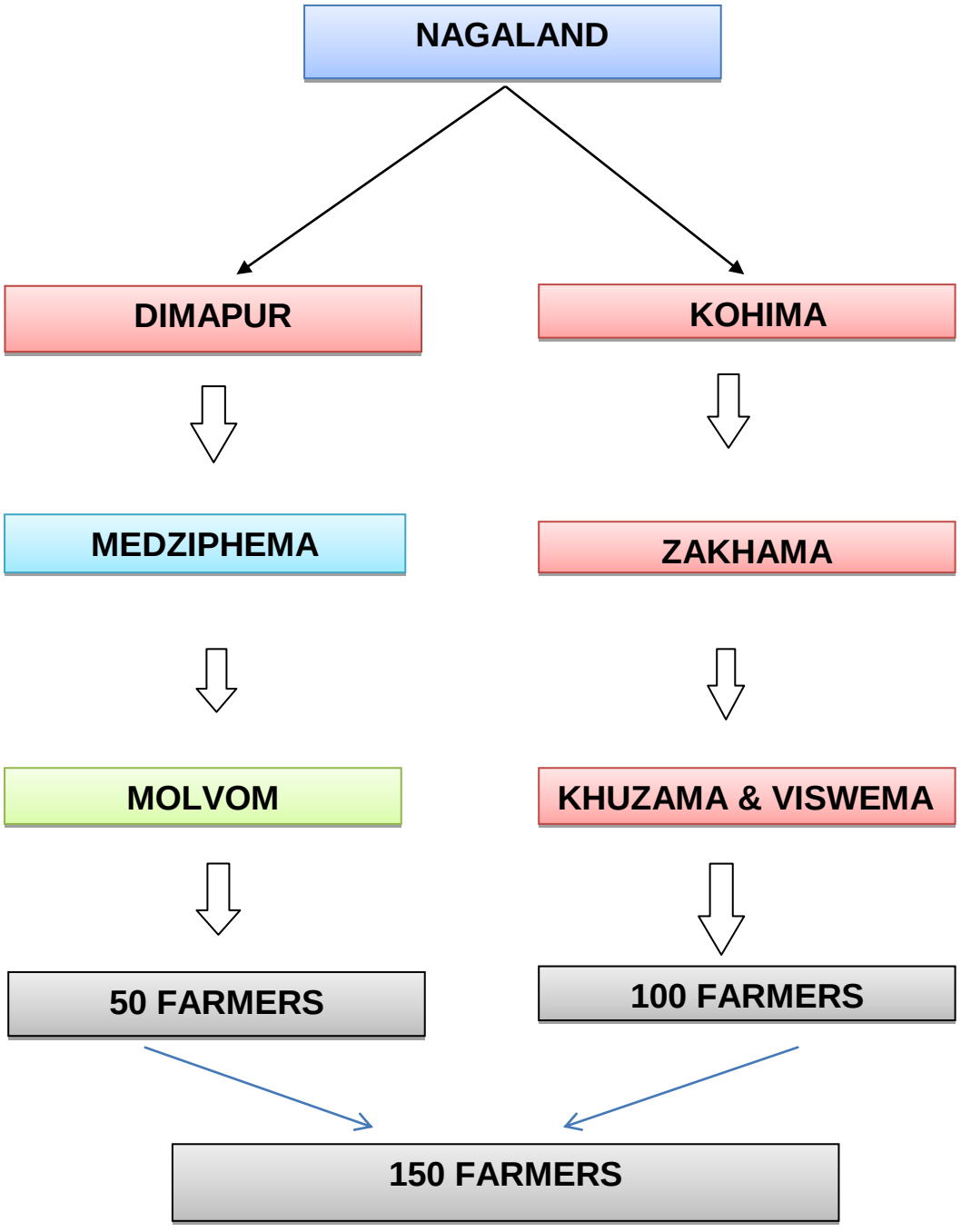
2.3 Selection of villages

In the third stage of sampling plan, a list of villages under the selected blocks were prepared with the help of Block Development Officer/District Agriculture Department and ICAR institutes. From the villages available in this concerned district, villages which have popularity and production of major horticultural crops were randomly selected for further selection of respondent farmers by using simple random sampling without replacement. Accordingly, Khuzama and Viswema from Nagaland and Phikomai; Kalinamei and Waithou Chiru from Manipur were selected for the study.

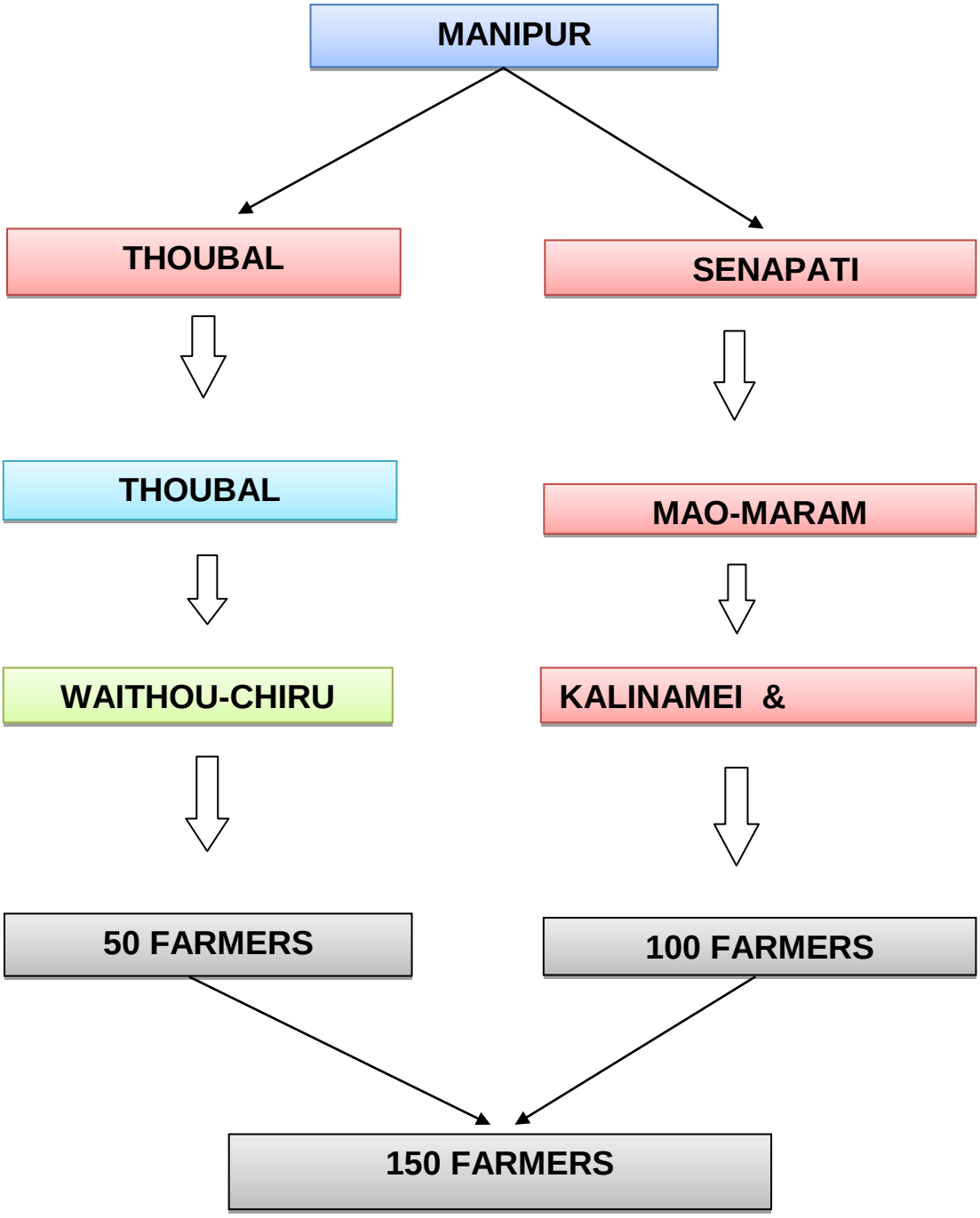
2.4 Selection of sample respondent farmers

In the fourth stage of sampling plan, with the help of the selected villages, authority (Headman) and KVKs institutes, the farmers who cultivate pineapple and potato& cabbage were analysed and from these villages, 300 farmers (150 respondent farmers from Manipur and 150 respondent farmers from Nagaland) were selected for each crop (*i.e*. 50 farmers/ crop) for the data collection of the above crops. From the prepared farmers list, by adopting stratified random sampling, proportional allocation and cluster sampling techniques, the respondent farmers were drawn for collection of information using pre-tested schedule.

SCHEMATIC REPRESENTATION OF SAMPLING PLAN- I



SCHEMATIC REPRESENTATION OF SAMPLING PLAN- II



The categorizations of household farmers into marginal, small and medium group were done on the basis of their operational land holdings as follows:

Table 2.4.1 Classification/categorization of Farmers

Sl. No.	Category of farms	Land Holding Size (in ha)
1.	Marginal	0.01 to 0.31
2.	Small	0.32 to 0.71
3.	Medium	0.72 and Above

2.5 Selection of sample farm household

A complete list of farmers along with their holding size was prepared from each of the selected villages with the help of village headman / Chairman / Pradhan of the respective villages. While preparing the list due consideration was given to those farmers who have devoted at least twenty percent of their net sown area to the particular selected vegetables for inclusion in the final list of the selected household. In the third stage farmers was selected randomly each from a selected village to get optimum sample size. Finally, the farmer respondents were classified into different categories or marginal, small and medium size groups. To determine the optimum sample size two step approaches was be used, first a preliminary sample size was selected using simple random sampling without replacement (SRSWOR) to estimate the population parameter values, which in turn was used to determine the final sample size. Secondly, the preliminary sample was augmented by drawing additional units from the population so that the size of the augmented sample is same as the required sample size (Ravindra and Nauran, 1975).

Let n1 be the size of preliminary sample selected using simple random sampling without replacement (SRSWOR) then sample mean square

$$S_1^2 = \frac{1}{n_1 - 1} \sum_{i=1}^{n_1} (y_i - y_1)^2$$

Where, $y = \frac{1}{n_1} - \sum_{i=1}$ is the preliminary sample mean.

Sample size required for estimating population mean with permissible error B is given by;

$$n = \frac{N S_1^2}{ND + S_1^2}$$

Where, $D = \frac{B^2}{}$ and N= size of the population *i.e*. total number of vegetable Growing farmers

3. Data collection

To meet the objectives of the proposed study, both primary as well as secondary have been collected.

3.1. Primary data

The primary data and other relevant information of the proposed study have been collected by adopting personal interview method from the selected farm households in the study area for agricultural year 2016 to 2018. Data on demographic features (family size, age, education, occupation etc.) and economic parameters (land inventory, farm building,livestock, income, value

of planting material, manures and fertilizer, insecticide and pesticide, human labour, etc;) and problems faced by the sample growers in the production of rice were collected for the study.

3.2. Secondary data

Pertaining to the locale of the study area, secondary data were collected from the published and / or unpublished records and journals of the Department of Agriculture, Horticulture, KVKs, Directorate of Economics and Statistics of the concerned state.

4. Analytical Framework

Various analytical tools that has been employed for the collection of primary and secondary data analysis and interpretation to meet the objectives of the study is being analysed as below.

Evaluation of inputs and output

Inputs and output are quantified and valuated as:

1. Human labour:

Human labour both family and hired have been measured in terms of man-days of eight hours. The differences in the efficiency of labour will be accounted by converting female and child labour-days into man-days by using the following criterion.

Man equivalent: Male = 1, Female = 0.75, Children = 0.5

a) Hired labour: The wage for hired labour will be evaluated as the actual amount paid in cash and kind.

b) Family labour: The imputed value of family labour have been work out on the basis of hired labour charge.

2. Bullock labour:

The work done by a bullock team (a pair of bullock and a ploughman) have been calculated at the actual amount paid in cash and kind.

a) Hired bullock labour: The wage for bullock have been estimated at the actual amount paid for hiring the bullock team for different operation.

b) Owned bullock labour: The wages for owned bullock labour have been accounted for as per the rates of hired bullock team prevailing in the locality.

3. Hired machines charges:

Machines charges have been accounted on the basis of actual amount paid.

4. Seed:

The purchased seed have been value at the actual amount paid plus transportation charges. Home produced seeds are valued at the prevailing price in the locality plus transportation charges.

5. Manures and Fertilizer:

Farm produced manure have been value at the prevailing locality price. Purchased manures and fertilizer will be value at the actual amount paid plus transportation charges.

6. Plant protection chemicals:

These will be value at the actual amount paid plus transportation charges.

7. Interest on working capital:

Calculated at the commercial bank's rate for half the duration of the crop on the sum total of paid out cost.

8. Land revenue:

The land revenue paid by the sample farmers have been apportioned for the crops using the relationship:

$$\text{Land revenue} = \frac{\text{total land revenue paid per annum}}{\text{total crop area}} \text{ x area under the crop}$$

9. Depreciation:

The cost associated for using farm tools and implements production have been calculated using straight line method. The annual rate of depreciation will be converted to the duration of production period.

$$\text{Annual rate of depreciation} = \frac{\text{purchased price} - \text{junk value}}{\text{life span of the asset}}$$

10. Interest on fixed capital:

Rate of interest for fixed capital have been work out at per interest rate paid by the commercial bank in short term deposits. Using the rate of interest, the interest on fixed capital have been calculated for the total fixed cost.

4.1 Cost and Returns Analysis:

Analysis of cost and returns of major horticultural crops grown under organic and conventional farming practices have been done using simple mathematical and average calculation.

4.1.1 Cost of production

The expenses incurred in the production have been categorized into two groups.

a) Total fixed cost (non recurring cost): It will include the expenses (value) incurred in the following items:

1. Family labor
2. Depreciation

3. Land revenue

4. Interest on fixed capital

5. Imputed rental value of owned land

b) Total variable cost (recurring cost): It will include the expenses of the value incurred in the following items;

1. Seed

2. Fertilizer

3. Manure

4. Hired Human labour

5. Hired machine/ bullock

6. Interest on working capital

7 .Rental value for lease-in land

c) Total cost (Gross Cost) = Fixed cost + Variable cost

4.2 Cost Concepts

The cost concept has been used in working out the cost and returns structures of production are as follows:

Cost A_1 includes

1. Value of hired human labour (permanent and casual).
2. Value of manure and fertilizer.
3. Value of hired and owned machinery.
4. Value of seed (both farm produced and purchased).
5. Depreciation on farm implements used
6. Land revenue and other taxes
7. Interest on working capital
8. Miscellaneous expenses

Cost A_2 = Cost A_1 + Rent paid for leased-in land.

Cost B = Cost A_2 + Imputed rental value of owned land (less land revenue paid there upon) + imputed interest on fixed capital (excluding land).

Cost C = Cost B + Imputed value of family labor.

Cost D = Cost C + Managerial cost (10% of Cost A_1+ Risk Margin (10 per cent of Cost A_1).

4.3 Returns analysis

1. Gross farm income (GFI) (gross returns) = Gross value of output (qt) × price (Rs)/qt
2. Net farm income (NFI) = GFI – Cost D.
3. Farm business income= GFI – Cost A_1
4. Owned farm business income = GFI – Cost A_2
5. Family labor income = GFI – Cost B
6. Benefit cost ratio based on the total cost=GFI / Cost D
7. Benefit cost ratio based on the variable cost =GFI / CostA_1

4.4 Production function

1. The functional relationship between inputs use and output produced has been fitted using Cobb-Douglas type of production function. The parameters of the function have been estimated using ordinary least square method. The production function is as follows:

$$Y= aX_i^{b_i}$$

By taking natural logarithm of both side the functional relationship will be transformed into log-linear form as;

$$\log Y = \text{Log } a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + b_7 \log x_7 + u \log e \quad .....(2)$$

Where,

Y = Gross returns (Rs.)

X_1 = Value of seed (Rs.)

X_2 = Value of manures and fertilizers (Rs.)

X_3 = Value of plant protection chemicals (Rs.)

X_4 = Human labour charge (Rs.)

X_5 = Bullock labour charge (Rs.)

X_6 = Machine labour (Rs.)

a = Constant/intercept term

b_i = Production elasticities (i = 1, 2, …..6)

4.5 Multicollinearity

The independent variables have been tested for the existence of multi-collinearity using correlation analysis. If multi-collinearity exists between two independent variables, one of the variables has been removed from the analysis to mitigate the multicollinearity**.**

4.5.1 Test of Significance

a) t-test: Student's t- test have been used for testing significance of the parameter estimates at a chosen level of probability by comparing the estimated value and table value using the following formula:

$$t = \frac{b_i}{SE(b_i)}$$

Where,

b_i= regression co-efficient of ani^{th} input

S.E (b_i) =standard error of ani^{th} input, i = (1, 2…n)

b) F-test: Overall significance of regression coefficients have been tested using F-test. This test aims at finding out whether the explanatory variables

do actually have any significance influence on the dependent variable. The calculated value of 'F' have been compared with the table value to examine the significance. The value 'F' have been calculated using the following formula (Koutsoyiannis 2001).

$$F = \frac{R^2(n-k)}{(1-R^2)(k-1)}$$

Where,

n = no. of sample/respondent farmers

K = no. of parameters in the model

R^2 = coefficient of multiple determination

4.5.2 Coefficient of unadjusted multiple determination

In order to ascertain the goodness of fit, co-efficient of multiple determination (R^2) will be calculated by using the formula;

$$R^2 = \frac{RSS}{TSS}$$

Where,

RSS = regression sum of squares

TSS = total sum of squares

4.5.3 Coefficient of adjusted multiple determination

The adjusted value of R^2 is denoted as $\bar{R}^2$ will also be calculated by using the formula,

$$\bar{R}^2 = \frac{(n-1)R^2}{n-k}$$

Where,

n = number of respondent farmers

k = number of parameters estimated

4.6 Resource use efficiency

Economic rationale of resource use have been examined by comparing marginal value product of a given resource with the marginal factor cost (Allocative efficiency).

$$\mathbf{AE_{xi} = \frac{MVP_{xi}}{MFC_{xi}}}$$

Where,

AE_{xi} = *Allocative efficiency of an* i^{th} *input*

MVP_{xi} = *Marginal value product of an* i^{th} *input*

MFC_{xi} = *Marginal factor cost of an* i^{th} *input*

If the marginal value product of an i^{th} input is greater or less than the marginal factor cost of an i^{th} input, then the resource is not use optimally. For optimal use of an i^{th} input the marginal value product of the i^{th} input should be equal to marginal factor cost of the i^{th} input.

4.6.1 Estimation of marginal value productivity

The marginal value product of a particular resource represents the expected addition to the gross returns caused by an addition of one unit of that resource, while other inputs are held constant. The marginal value productivities (MVP_s) of different resource were calculated by multiplying the marginal physical product of the i^{th} input by the unit price of the output.

$$MPP_{Xi} = \frac{d_y}{d_X} = bi\frac{\bar{y}}{\bar{x}}$$

$$MVP_{xi} = MPP_{xi}(Py)$$

$$MVP_{xi} = bi\frac{\bar{y}}{\bar{x}}(Py)$$

Where,

MPP_{xi}= *Marginal physical product of an* i^{th} *input*

$\bar{y}$ = *Geometric mean of output*

$\bar{x_i}$= *Geometric mean of* i^{th} *input*

b_i = *Regression* coefficients (i = 1, 2… 5)

P_y= Unit price of output (Rs.)

4.6.2 Estimation of marginal factor cost

The marginal factor cost indicates the cost of an additional factor use in the production of an output. The factor cost of different resources was worked out by taking per unit charges of the respective resource.

$$MFC_{xi} = P_{xi}$$

Where,

MFC_{xi}= Marginal Factor Cost of i^{th} input

P_{xi}= Unit price of i^{th} input

4.6.3 Marginal value product and factor cost ratio

To evaluate the economic rationale of resources use on the farms, the marginal value productivities of an i^{th} input (MVP_{xi}) will be equated with its marginal factor cost (MFC_{xi}).

$$\frac{MVP_{xi}}{MFC_{xi}} = 1$$

To examine the significance difference between the marginal value productivity of inputs to the marginal factor cost will be tested by using the following formula:

$$T_{cal} = \frac{MVP_{xi} - P_{xi}}{SE(MVP_{xi})}$$

Where,

P_{xi} = Price per unit of anith input

S.E (MVPxi) $= \sqrt{AVP_{xi}(bi)}$

AVPxi = Average value product of anith input

V (b_i) = S.E (b_i) ^{2} = Variance of an i^{th} elasticity co-efficient

The Cobb-Douglas production function allows greater degree of freedom and has the advantage over other types of function as the estimated

can be computed conveniently. The regression co-efficient (b_1) in Cobb-Douglas production function directly indicate the elasticity of production which measures the percentage change in out for unit percentage change in the input (Bhowmick, 1975).

The Cobb-Douglas production function facilitates to examine the resource use efficiency by comparing marginal value product (MVP) to its factor cost. The marginal value product of an input is computed as follows:

MVP $x_1 = d_y / d_x = b_1 . y / x_1$, where b_1 is the elasticity co-efficient of x_1, x_1 and y are the geometric means of input and output respectively.

4.7 Measure for Increasing Farm Income and Employment

The response of the farmers to various problems faced by the sample farmers in production and marketing of vegetables were estimated through frequency simple percentage and ranking were estimated to examine the problems and measure for increasing farm income and employment were included.

4. 8 Farmer's Perception

Farmer's perception of the technology has been worked out by using the following equation. The parameters will be estimated using regression analysis.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ...\beta_n X_n + e$$

Where;

Y = farmers' adaptation and perception on organic vegetable farming

β_0 = constant / intercept

β_1, β_2, β_n = coefficients / parameters

e = random error term

X_1 = Age of farmer

X_2 = Gender

X_3 = Household head educational level

X_4 = Number of labor

X_5 = Experience

X_6 = Farm income

X_7 = Farmer debt

X_8 = Land size

X_9 = Frequency of extension visit

X_{10} = Farmers' networks or membership in organic farming

X_{11} = Farmers training in organic activities

X_{12} = Sources of knowledge

4.9 Problems and constraints faced by the respondent farmers

The problems and constraints faced by the respondent farmers in the production of the selected crops have been calculated and ranked using Garette ranking technique. Possible solutions of the problems will be identified to enhance productivity of the crops by the respondent farmers. Policy implications have been drawn as suggestion for the policy planners from the outcome of the research.

4.10 PROFILE OF THE STUDY AREAS

The North East part of India has seven states comprising an area of 255,083 km^2 with hills, valley and plateau. This region is inhabited by 100 major tribes and immigrant communities. Due to topographical and environmental conditions this region is rich in biodiversity and is one of the hot spots of the world. The utilization of bio-resources by tribes and other communities is based on indigenous and traditional knowledge that help in sustainable use and conservation of natural resources.

Manipur and Nagaland are the two adjoining states from the seven (7) North-Eastern states of India. The states share various international boundaries with Myanmar. The two states are inhabitated by various communities. Nagas in Nagaland and Kukis, Nagas and Meiteis in Manipur form the majority of populations in the two states. The states have a rich heritage sites. The region has a pleasant agro-climate for the cultivation of various crop plants. Both the states have tropical to sub-temperate climate and for which various tropical and sub-temperate crops are grown in various pockets of the states. 60-70 percent of the populations in the two states are actively engaged in the farming activities. Farming in their indigenous approach for livelihood is the very essence of these two states. Pineapple and potato are the two major crops grown in these states. The present study is an investigation into the indigenous way of cultivating crops and its economic implications to the farm households of the two states.

Agriculture being the main occupation of the people of Manipur, it has an important place in the economy of the state. Agriculture sector contributes a major share to the total state domestic product and provides employment to about 52.19 per cent of the total workers in Manipur (Anon. 2017).

4.10.1 ABOUT THOUBAL DISTRICT

Thoubal district is one of the sixteen districts of Manipur state in Northeastern India. This district is bounded by Senapati district on the north, Ukhrul and Chandel districts on the east, Churchandpur and Bishnupur districts on the south and Imphal West and Imphal East districts on the west. The district occupies an area of 519 km^2. The population as of 2011 is 422,168. Thoubal town is the district headquarters. This district is known for Khongjom, where the last battle of the independence of Manipur was fought in April 1891 against the British army.

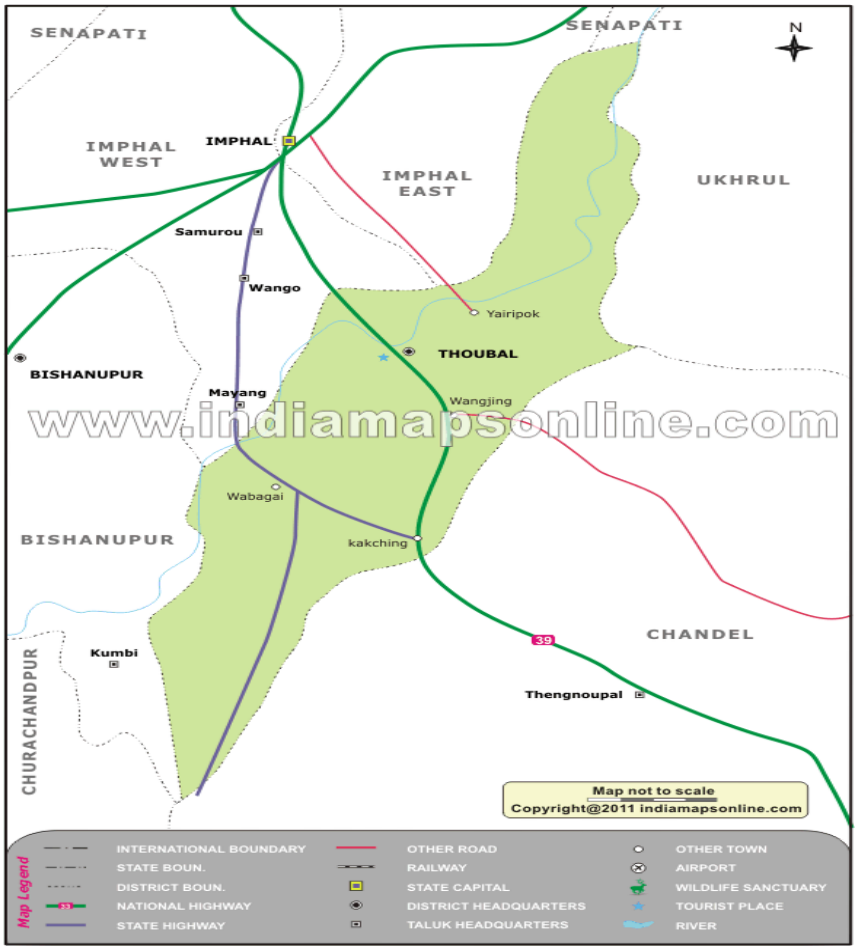
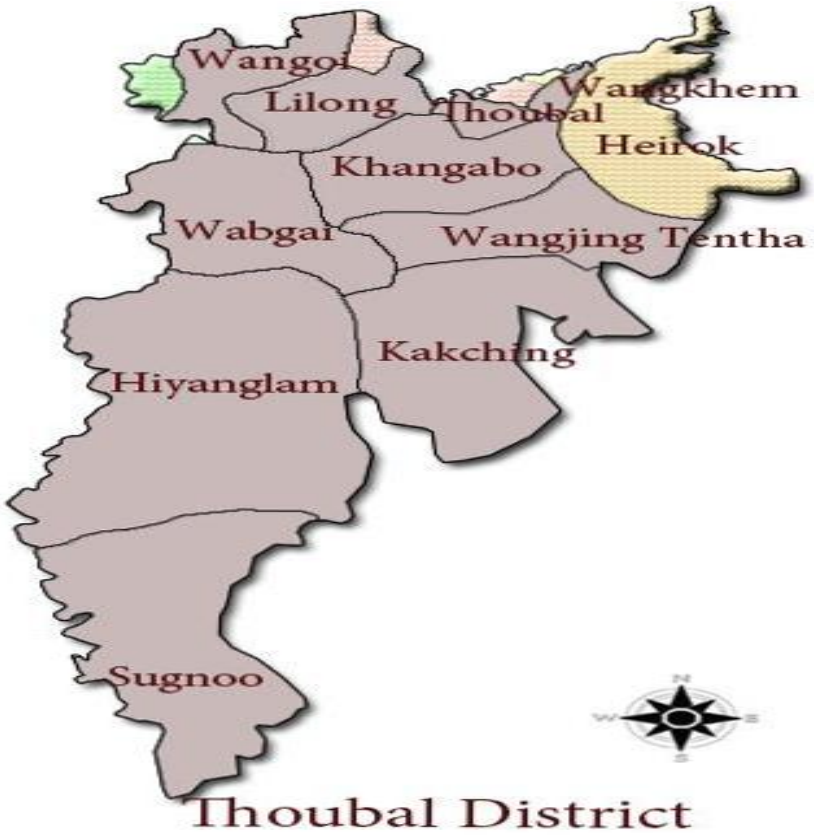


Figure 4.1. District Map of Thoubal



4.10.2 DEMOGRAPHY

According to the 2011 census, Thoubal district has a population of 422,168 roughly equal to the nation of Malta. This gives it a ranking of 555th in India (out of a total of 640). The district has a population density of 818 inhabitants per square kilometre (2,120/sq.m). Its population growth rate over the decade 2001–2011 was 15.48 per cent. Thoubal has a sex ratio of 1006 females for every 1000 males, and a literacy rate of 76.66 per cent.

Table 4.2 Demographic classification of Thoubal

Sl. No.	Religion	Percent
1.	Hindus	63.28
2.	Muslims	25.42
3.	Others	10.03
4.	Christian	1.02
5.	Not Stated	0.19
6.	Sikh	0.03
7.	Buddhist	0.03
8.	Jain	0.01

(Source: District Census, 2011)

4.10.3 GEOGRAPHY

Thoubal district lies between 23° 45' to 24° 45' North latitudes and 93° 45' to 94° 15' East longitudes. It occupies the larger part of the eastern half of the Manipur Valley. The shape of the district is an irregular triangle with its base facing north with an elevation of about 790 m above the sea level. Few hillocks with low heights are scattering in the middle of the district. Of these, Punam hill has an elevation of 1009 m above the sea level.

4.10.4 RIVERS AND LAKES

The Imphal and the Thoubal are the most significant rivers that flow through the district. The Thoubal River originates in the hill ranges of Ukhrul

and is an important tributary of the Imphal River. It passes through Yairipok and Thoubal before joining the Imphal at Irong near Mayang Imphal. The Imphal River rises in the hills of Senapati district and flows south. It forms the northern and western boundaries of Thoubal district. Other rivers in the district are the Wangjing, the Arong and the Sekmai. These rivers originate in the hills of Ukhrul district. The Arong River flows through Khangabok and falls into Kharung Pat. The Wangjing River flows west via Heirok and Wangjing before joining the Loushi Pat.

4.10.5 CLIMATE

The district has a moderate climate with relatively abundant and widespread rainfall. The rainy season starts in June and continues till September. Intermittent rains continue till October. The winter season lasts from December to February. During the winter months light rainfall occurs under the influence of the northeast monsoon. The average minimum temperature during winter is 4 to 6 °C; sometimes the minimum temperature goes below 0 °C. April and May are the summer season. The average maximum temperature is 32 to 35 °C during these months; seldom has the maximum temperature gone beyond 37 °C. Occasional thunderstorms occur during these months. The average annual rainfall was 1318.39 mm during the period 1983–89.

4.10.6 AGRICULTURAL SCENARIO OF THE DISTRICT

Agriculture is the most important source of livelihood for the people of this district of Manipur. More than 70.00 per cent of the total population of the district is directly or indirectly engaged in agricultural activities. The valley is fertile and the topography of Thoubal district provides good opportunity for irrigation, natural as well as artificial. Rice accounts for above 90.00 per cent of the total land area under cultivation. The soil of the district is fertile and with the help of irrigation facilities from the Imphal barrage double cropping is

widely practiced in the district. In some areas, even triple cropping is practiced - first paddy crop starting late February or early March, second paddy crop in July and early August and the third crop of mustard seeds, pulses, etc. in November. Other crops grown in Thoubal district are sugarcane, oilseeds, maize, potatoes, pulses, chilies, etc. The district is the largest producer of sugarcane in Manipur. Its cultivation is mainly confined to Thoubal, Wangjing, Kakching, Kakching Khunou and Wabagai. Although maize is grown throughout the district, it is cultivated as major cash crop around Serou, Pallel and Kakching belt. Oilseeds, mainly mustard seeds, are found all over the district. Recently cultivation of sunflower has also started. Vegetables such as cabbages, cauliflower, different kinds of peas, gourds, pumpkins, etc. are cultivated here. Among the plantation crops, pineapples are the most important and are cultivated in the slopes of low hills and hillocks it is mainly cultivated in Waithou hill range and Sharam hill. Another important sector of economy of Thoubal District is Animal Husbandry. Important livestock found in Thoubal District are cattle, buffaloes, goats, horses and ponies, pigs, dogs etc. Significant progress have been made in the district in the direction of milk production, breeding of better varieties of cattle and poultry, and generation of employment through piggery and poultry development. Recently a dairy production firm is planning to open in Khangabok. Khangabok is famed throughout Manipur for Tule, (Schoenoplectus acutus) known locally as Kouna, based handicrafts too. Kouna is used for making seating mat (phak), stool (mora), chair, mattress and various other crafts.

Fishing also contributes to the economy of Thoubal District. Fishing provides an important occupation for a large number of people in the district. Fishing is commonly practiced in villages such as Tentha, Leishangthem, Wabgai, Khangabok, Kakching-khunou and Wangoo.

4.10.7 ABOUT WAITHOU CHIRU VILLAGE

The place is important for its scenic beauty. Paddy, Pineapple and Bean are the major agricultural commodities grow in this village. The place is noted for its tasty pineapples. Pineapple is a major fruits crop abundantly available in the village for almost 8 months a year. The present pineapple cultivated area is about 10,000 hectares with an annual yield of 70,000 MT. It is said and believed that the cultivation of Kew variety of Pineapple in Manipur had started from their village. Pineapple fruits are cultivated and harvested for at least 7 to 8 months in a year. The cultivation of pineapple in the village is based on the traditional approach and the production systems of the fruits are still sustained in the village.

4.10.8 DEMOGRAPHY

Waithou Chiru is a small having a population size of 671 with 138 households. The village is still considered as a heritage village. The percentage of female population is 55.00 per cent. The total literacy rate of the village is 55.70 per cent. Most of the females in the village are still illiterate with a percentage of only 26.80 per cent. The village has a Scheduled tribe population of 95.70 per cent.

Table 4.3. Demographic Feature of Waithou Chiru village

Sl. No.	Census Parameter	Census Data
1.	Total Population	671
2.	Total No of Houses	138
3.	Female Population %	55.00 (369)
4.	Total Literacy rate %	55.70 (374)
5.	Female Literacy rate	26.80 (180)
6.	Scheduled Tribes Population %	95.70 (642)
7.	Scheduled Caste Population %	0.00 (0)
8.	Working Population %	46.20
9.	Child(0 -6) Population by 2011	75
10.	Girl Child(0 -6) Population % by 2011	50.70 (38)

4.10.9 MARKETING

Though the village is located not far from the capital Imphal, the village is still isolated from the rest of the village. There are no organized Government offices, Institutions, Hospitals, ATM, Commercial Bank in less than 10 km 10 km. No Mandis /Regular Market and Weekly Haats / santha are available in this village.

The fruit crops are marketed from the farms, local village market, directly sold to the nearby local market and the capital by the farmers themselves. There is no Public Bus service in less than 10 km. Private Bus service available in this village. There is no Railway Station in less than 10 km. Nearest National Highway is in 5 to 10 km. Nearest State Highway is in 5 - 10 km. Nearest District Road is in 5 to 10 km. Kuccha road and foot Path are other roads for transportation of the farm products within the village.

4.10.10 SENAPATI DISTRICT

The *Senapati District* was earlier known as Manipur North *District* which came into existence w. e. f. 14 November 1969 with its headquarters at Karong. Later the *district* headquarter was shifted to *Senapati* on 13 December 1976. The *District* came to be known as *Senapati District* wef 15 July 1983.

4.10.11 GEOGRAPHY

Senapati District is located between 93.29° and 94.15° East Longitude and 24.37° and 25.37° North Latitude and is in the northern part of Manipur state. The District is bounded on the south by Kangpokpi District, on the east by Ukhrul District, on the west by Tamenglong District and on the north by Kohima District and Phek district of Nagaland state. The district lies at an altitude between 1061 meter to 1788 meters above sea level.

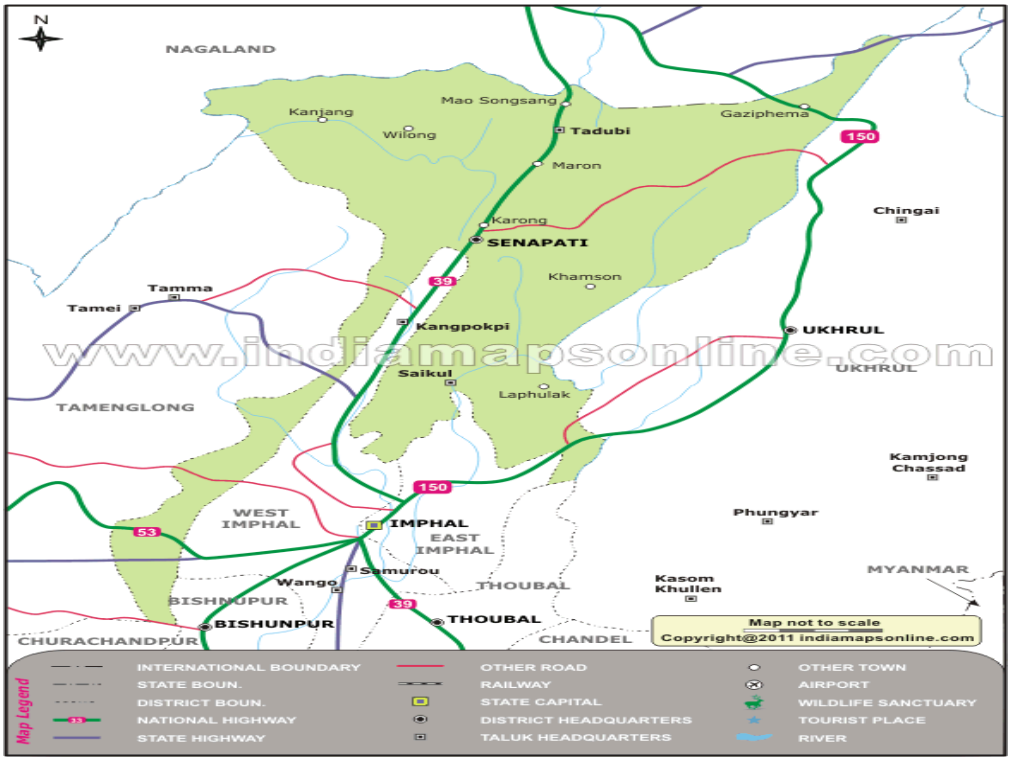


Fig 4.4 Distric map Senapati

4.10.12 CLIMATE

The district is under humid subtropical climate. The soil is moderately fertile with clay loam soil with little patches of clay and loam. The temperature ranges from a minimum of 3.40 °C (38.10 °F) to a maximum of 34.10 °C (93.40 °F). The annual rainfall ranges from 670 to 1,450 mm (26.40 to 57.10 in). There are about 110 watersheds each of geographical size ranging from 2,000 to 3,000 hectares (4,900 to 7,400 acres), which are drained finally at about 5 major rivers/streams of different aspects and sources as indicated below.

4.10.13 ADMINISTRATION

Senapati is the fourth largest district of Manipur within the union of India. Senapati district is under the charge of a Deputy Commissioner cum

District Magistrate assisted by a number of other officials including District Supply Officer (FCS), one Assistant Engineer (Dev), one Assistant Election Officer, one Assistant Project Officer and one office Superintendent. The Deputy Commissioner functions as the Additional Development Commissioner, and he is also the *ex officio* Chairman of the District Rural Development Agency, Senapati.

Table 4.5 Senapati district subdivisions:

Sl. No.	Subdivision	Headquarters
1.	Mao-Maram	Tadubi
2.	Paomata	Paomata
3.	Purul	Purul
4.	Willong	Willong
5.	Chilivai-Phaibung	Phaibung
6.	Song Song	Song Song
7.	Lairouching	Lairouching

4.10.14 AGRICULTURE

66.43 per cent of the land area is covered by forest while the rest 20.00 per cent are utilized for cultivation. Rice, Maize, Potato, Cabbage and cereals are the major farm produce of the district. Agriculture is the main occupation of the people and terrace cultivation is generally practice by the people.

4.10.15 DEMOGRAPHY

According to the 2011 census, Senapati district has a population of 479,148, roughly equal to the nation of Belize. This gives it a ranking of 565th in India (out of a total of 640). The district has a population density of 109 inhabitants per square kilometre (280/sq.m). Its population growth rate over the decade 2001-2011 was 25.16 per cent. Senapati has a sex ratio of 939 females for every 1000 males, and a literacy rate of 75.00 per cent.

Mao Naga, Maram, Thangal, Poumai, Thangal, Zemai, Liangmai, Rongmei(Kabui), Tangkhul, Meetei, Thadou, Nepalese, Vaiphei, Chothe, Chiru, Maring are the major inhabitants of this district.

Table 4.6 Senapati district religion classification

Sl. No.	Religion	Per cent
1.	Christians	89.08
2.	Hindus	9.15
3.	Not Stated	0.63
4.	Buddhist	0.50
5.	Muslims	0.34
6.	Others	0.26
7.	Sikh	0.03
8.	Jain	0.01

(Source: District Census, 2011)

4.10.16 MAO-MARAM

Mao-Maram is a sub-division of Senapati district of Manipur. It is the last sub-division of Manipur bordering the state of Nagaland state. Every family of the Mao community has their own terrace fields and cultivate for their sustenance and sustainability (Heshu, 2008).The Maos also practice shifting/jhum cultivation and permanent garden cultivation. They grow various kinds of crops. Rice, maize, potatoes, cabbages, chillies, tomatoes, tree tomatoes, cho-cho (squash), beans, pumpkins, cucumbers, brinjals, oriental onions, spring onions, onions, yam, etc are the main crop that have been cultivating since their forefathers.

Mao area is traditionally known for the best varieties of potato grown in the lower reaches of the western hills above Mao Gate with its cool climate and black soils.The famous Regional Potato Farm, first sponsored scheme of North Eastern Council which are producing both the Tubers and kitchen purposes

Potato is in Mao area, located at *Pfukhro*. The farm is totally owned by the state government and supply potato for the whole north east regions. The farmers of the Maos are the only community producing potato for commercial aspects in the state. Even, the supply of potato to the neighbouring state is also from these particular villages. The farmers are also cultivating fruits like plum, peach, pear, guava, banana, passion-fruit, kiwi, grapes, etc for their livelihood. Floriculture is also an another potential area for the farm womens of the village. Farm-womens; youths and students cultivate flowers for both home beautification and for commercial purposes. Being situated on the National 39, the farm products are easily marketed and also transported to state capital, Imphal, Kohima and other local markets such as Senapati or Dimapur and sold out at lucrative price.

4.10.17 ABOUT THE VILLAGES

Kalinamei and Phikomai are the villages located in the Mao-Maram Sub-division of Senapati district of Manipur. These villages are also famous for the cultivation of Potato. Majorities of the farmers living in these villages are very hard-working and they cultivate Rice and potato in both the terraced and undulated farm lands. Vegetables like Cabbages and Squash are the main crops besides the production of Potato.

Kalinaei has a total population of 7053 and Phikomai has a total population of 1467. It is learnt that only 5.00 per cent and 2.00 per cent of the populations of Kalinamei and Phikomai respectively are in the government service. The average family size of the farm households is 7 to 8 in numbers and the average farm holding size of the these villages ranges from 0.25 ha to 0.50 ha. The literacy rate of the kalinamei villages is 82.00 per cent, whereas the Phikomai has 79.00 per cent.

4.10.18 ABOUT THE NAGALAND STUDY AREA:

Nagaland, with a total land area of 16,579 sq km is one of the hill states located in the extreme North-Eastern part of India. It is bounded by Myanmar on the East, Arunachal Pradesh on the North, Assam on the West, and Manipur on the South. It is situated between the 26.60º to 27.40º North Latitude and 98.00º to 96.00º East longitude. The state is mostly mountainous, except those areas bordering Assam valley. Nagaland's economy is mainly based on agriculture as more than 60.00 per cent of the population is engaged in this sector. The economy of Nagaland is also dependent on forestry, cottage industry, and tourism. The gross domestic product of the state Nagaland amounted to 7,252 crores in 2006 to 2007, while in 2007 to 2008 this figure amounted to be 8,075 crores and in 2008-09 this figure stood at 9,288 crores. Agriculture contribution to the state GDP is 1,676.95 crores in 2006 to 2007, in 2007 to 2008 the figure amounted to 1,680.60 crores and in 2008 to 2009 it is 1,929.34 crores (Anon. 2014). Rice is the staple food. It occupies about 70.00 per cent of the total area under cultivation and constitutes about 75.00 per cent of the total food production in the state. The major land use pattern is slash and burn cultivation locally known as *Jhum*. Area under *Jhum* cultivation is about 1, 01,400 hectare and under terraced cultivation.

Again, cultivated area under certified organic farming all over the country has grown almost 17 fold in last one decade (42,000 ha in 2003 to 2004 to 7.23 lakh ha in 2013-14) Anon. (2014). Government of India has implemented the National Programme for Organic Production (NPOP) in the year 2001. The national programme involves the accreditation programme for certification agencies, norms for organic production, promotion of organic farming etc; States like; Uttarkhand, Karnataka, Madhya Pradesh, Maharashtra, Gujarat, Rajasthan, Tamil Nadu, Kerala,

Nagaland, Mizoram, Sikkim has been promoting organic farming. Government is promoting organic farming through various schemes and programmes under National Mission for Sustainable Agriculture (NMSA); Paramapragat Krishi Vikas Yojana (PKVY); Rashtriya Krishi Vikas Yojana (RKVY); Mission for Integrated Development of Horticulture (MIDH); National Mission on Oilseeds & Oil Palm (NMOOP) and Network Project on Organic Farming of ICAR.

The farming system in the State is largely 'Organic by default' which means that the farmers do not use fertilizers or other soil amendments and therefore, with time the soil loses its fertility leading to low productivity.

Interestingly, the state of Nagaland has been conferred Krishi-Gramin Award for the years 2011, 2012, 2013 and 2014, consecutively by the Government of India for achieving its self-sufficiency in food grains. Thus, to attain drastic changes in the global food system in order to achieve a more sustainable agriculture that feeds people adequately, contributes to rural development and provides livelihoods to farmers without destroying the natural resource basis. Organic agriculture has been proposed and also practices as Organic by Default for achieving these goals. Organic agriculture currently covers large areas of the state of Nagaland and its extent is continuously growing as demand for organic product is increasing. At present, the area under organic certification in Nagaland is estimated to be 5,168.16 ha (Anon. 2016).

The size of the cultivated area is about 7.41 per cent only of the total geographical area of the State. Of this total cultivated area, 52.00 per cent is confined to the valley. Therefore, half of the total valley area which accommodates 67.00 per cent of the total population is occupied for agriculture purposes. The pressure on land in the valley is thus quite conspicuous. The farmers of the state have been practised organic farming as "organic by

default" and also taken up organic farming under the guidance of NGOs; state agriculture and horticulture department and other ICAR institutes (Ao, 2015)

4.10.19 ABOUT THE DIMAPUR DISTRICT

Dimapur is the 8th district of Nagaland established on December 1997 and lies between $25^0$48' and $26^0$00'North latitude and $93^0$30' and $93^0$54' East longitude. The district is bounded by Assam on its North and West, Kohima on the East and Peren District in the South. The district comprises of four blocks, 2 sadars and two circles with an area of 927 Square kilometres. Medziphema block has a total area of 345 sq. km with 67 revenue villages. Likewise, Dhansiripar block is spread over 130 sq. km area with 28 revenue villages; Niuland block has a total area 305 sq. km approximately with 59 revenue villages whereas Kuhuboto block has a total area of 147 sq. km with a total of 38 revenue villages.

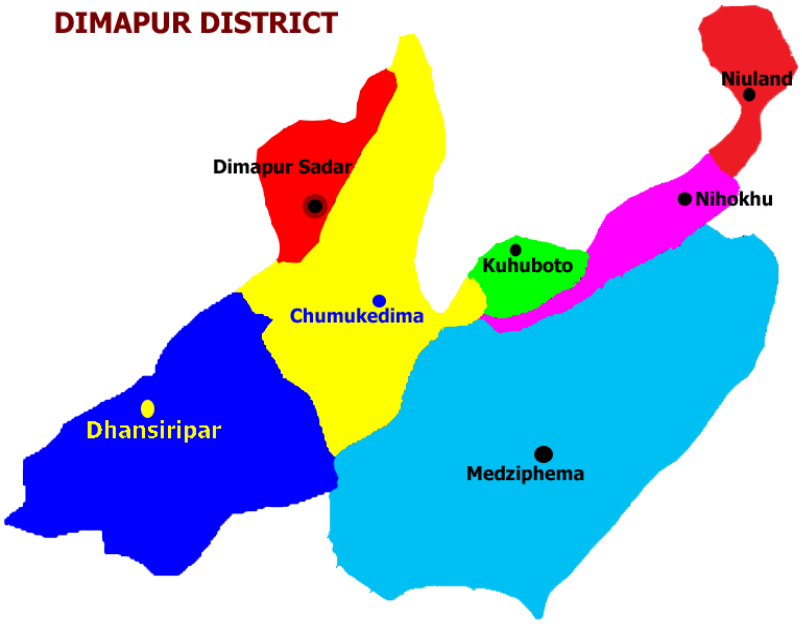


Fig 4.7 District map of Dimapur

Dimapur District is the most populous District in Nagaland, with a total population of 3, 79,769. The proportion of its population to the State population was 19.17 per cent. Dimapur district has shown a decline in rural male residents by 9.00 per cent and increase by 27.96 per cent in female population during the last decade.

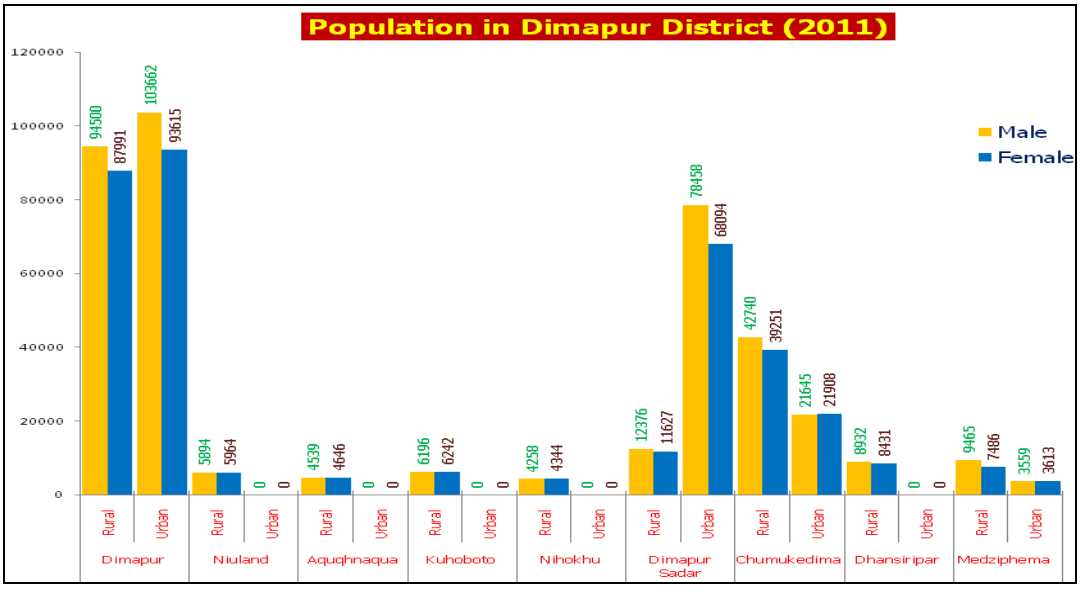


Figure 4.8 Dimapur district population during 2011

There is sizable population of non-tribal living in the town areas. Although notified town of Dimapur district has remained the same, the neighbouring villages /settlement have expanded considerably over the years merging with town boundary to form a length of more than 13 km. In addition, there is sizeable rural population in the Sub-division of Niuland, Kuhuboto, Dhansiripar and Medziphema blocks. The Niuland, Kuhuboto blocks are dominated by Sumi tribe, and Dhansiripar by different group of people like Chakesang, Sumi, Angami, Nepalese, Amalumba, Ao etc. Medziphema sub division is dominated by Angamis. The main factor contributing to large increase in population of the district is migration from other parts of state. There is also considerable migration from Assam.

Dimapur town is the commercial hub of the state and is the magnet around which the economic and developmental activities of the district are centred; it is one of the fastest developing townships of the North East. The business of the town can trace their history to British times. The town is also a gateway to Nagaland and Manipur state. It is important rail head and also has airport. The National Highway 39 that connects Kohima, Imphal and Myanmar border of Moreh runs through Dimapur District.

Farming population in Dimapur is nearly 46.00 per cent. Agriculture in the district is rainfed. Total cultivable area is 61, 197 ha, cultivated area is 53,710 ha out of which irrigated and rainfed area is 32,800 ha and 20,910 ha, respectively. By and large mono-cropping is practiced in the district. Under agricultural crops cereals (Paddy, Maize, Millets), pulses (Arhar, Pea, Lentil, Gram, Naga Dal, Beans, Rajmas), oilseeds (Mustard, Soybean, Sesame, Sunflower, Groundnut) are major one. Under commercial crops sugarcane, jute, potato, ginger, tea, cardamom are common whereas leafy vegetables, Colocasia, Tomato, Chilly, Cauliflower, Turmeric, Black pepper, Okra etc. and fruits like Lemon, Pineapple,Orange, Litchi, Banana, Papaya, Pomelo etc. are

the common horticultural crops. Besides these cattle, buffalo, pig, backyard poultry, duck, goat and rabbit are important livestock of the district. Apart from that Dimapur district has potential in fishery development in dams, rivers, ponds and small lakes, which is under progress in different areas.

4.10.20 CLIMATE

Dimapur district falls under humid Subtropical Agro climate Zone (ACZ) in summer it is hot and humid and moderately cold in winter. The district receives rains in two spells- South-West monsoon in summer and Northeast monsoon in winter. The South-West monsoon sets normally in the first week of May and extent up to October and the North-East monsoon normally sets in the month of November and extent till December. The major shares of the rains were received during June to August. The average rainfall is about 1000 mm to 1500 mm and annual maximum temperature is 26^0C and minimum temperature is 21^0C. The details of climate are given in Table.

Table 4.9 Temperature, RH and Rain fall recorded at ICAR Research Complex for NEH Region, Jharnapani

Month	Temp (^{o}C)		RH (%)		Rainfall (mm)	Rainy days
	Max	Min	Max	Min		
January	23.9	9.2	73	22	0	0
February	25.3	10.1	74	23	26	3
March	29.4	14	77	17	33.9	4
April	32.5	18.2	72	23	41.2	5
May	32.4	22	76	41	137.6	8
June	33	24.8	81	55	114.5	9
July	32	25.4	83	62	311.5	18
August	31.1	25.2	83	63	269.9	18
September	30.8	24.1	85	60	149.5	12

October	30.2	21	83	47	89.4	3
November	27.6	15.6	80	27	0	0
December	24.7	10.8	76	14	4.8	1
Total	**352.9**	**220.4**	**943**	**454**	**1178.3**	**81**
Average	**29.4**	**18.4**	**78.6**	**37.8**	**98.2**	**6.8**

Mean Temperature (^{0}CMaximum and Minimum) and Relative humidity (% Maximum and Minimum for the last five years (2010-15)

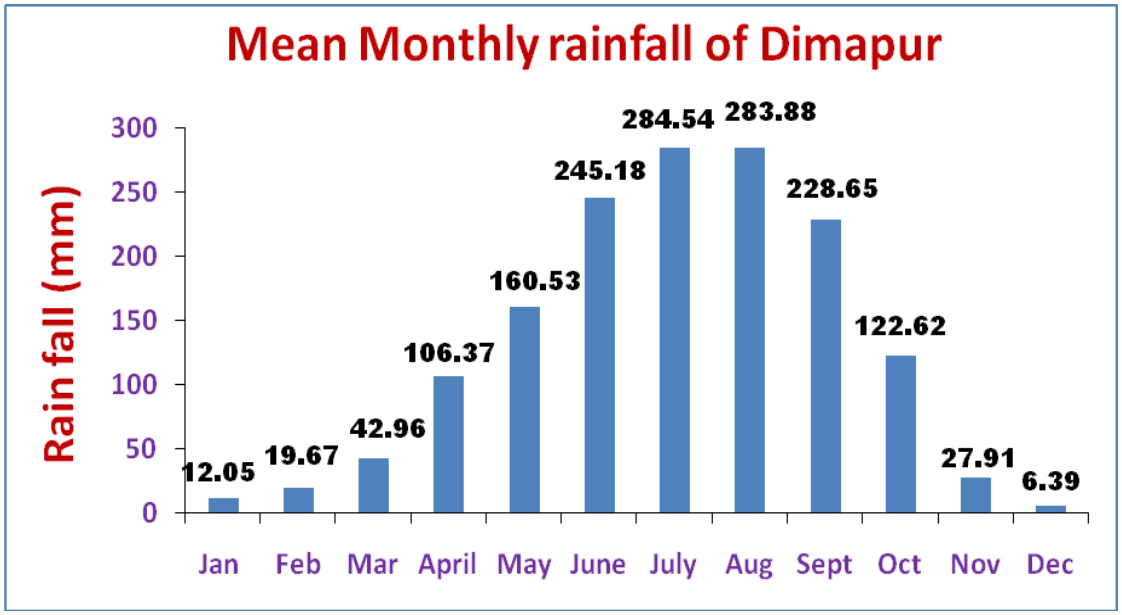


Fig 4.10 Mean monthly rainfall for the last five years (2010 to 2015)

4.10.21 TOPOGRAPHY

Dimapur district lies between 25^{0}48´ and 26^{0}00´ North latitude and 93^{0}30´ and 93^{0}54´ East longitude. The altitude of district ranges from 160 - 350 meters above the mean sea level. The district is bounded by Assam on its North and West, Kohima on the East and Peren District in the South.

The district comprises of four blocks, 2 sadars and two circles with an area of 927 Square kilometres. Medziphema block has a total area of 345 sq. km with 67 revenue villages. Likewise, Dhansiripar block is spread over 130

sq. km area with 28 revenue villages; Niuland block has a total area 305 sq. km approximately with 59 revenue villages whereas Kuhuboto block has a total area of 147 sq. km with a total of 38 revenue villages. Major portions of Dimapur district lies in plain sector except Medziphema block. The plain sector consist of 3 blocks namely Dhansiripar, Niuland, and Kuhuboto having identical topography whereas Medziphema blocks lies at higher altitude.

4.10.22 FOREST

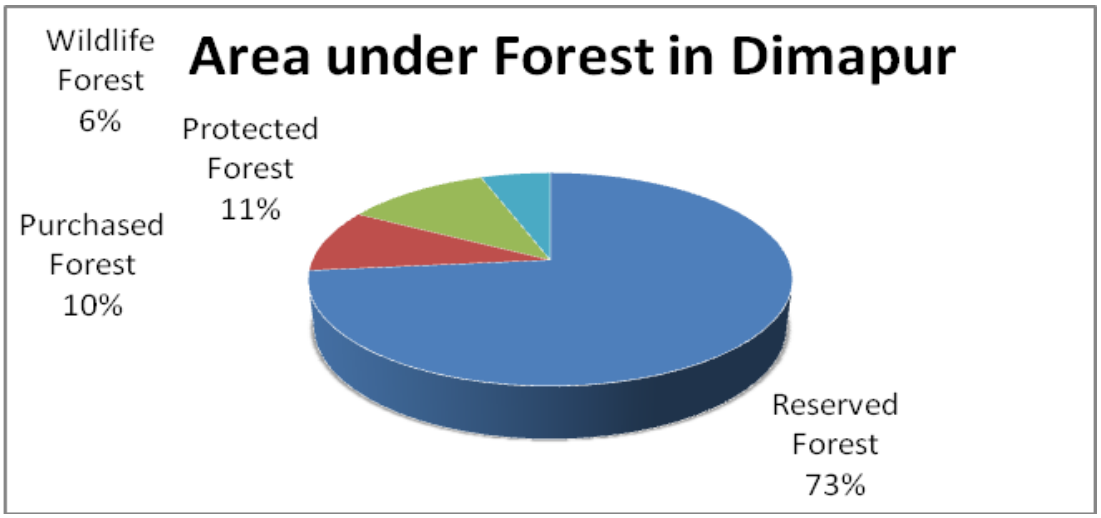
Before the state of Nagaland was separated from Assam, Dimapur Forest division was under Dhansiri valley forest division of Assam till the constitution of Naga Hills, separated from Assam in the year 1958 along with Tuensang and Mon area (NEFA). There is no Forest division worth name in Naga Hills except few Forest Offices viz. Rangapahar Range with Beat Offices under range at Dimapur and Nichugard (Chumukedima). Dimapur forest division as Kohima forest division came into being headed by a Deputy conservator of Forest with headquarter at Dimapur along with the creation of a new unit called Naga Hills Tuensang Area (NHTA) in the year 1961.

The then Kohima forest division covers the present district of Kohima, Peren, Mokokchung, Zunheboto, Wokha, and part of Tuensang, Mon, Longleng and Kiphire with its range and Beat Offices at Rangapahar , Kohima, Nichgard (Chumukedima), Mokokchung and Naganimora for managing the reserved forests viz. Rangapahar R.F. Singphan R.F. and Intangki R.F.

Table 4.11 Area under Forest (Area in Hectares) 2015-16

Sl. No.	District	Reserved Forest	Purchased Forest	Protected Forest	Degraded Forest	Wildlife Forest	National Park	Total Forest
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1	Dimapur	6226.00	812.38	973.18	-	470.00	-	**7508.38**
Total		**6226.00**	812.38	973.18	-	470.00	-	**7508.38**

(Source: Statistical hand book of Nagaland 2015)



(Source: Statistical hand book of Nagaland 2015)

4.10.23 WATER RESOURCES

The district being in the assured high rainfall zone, the lands are sufficiently irrigated through natural precipitation and perennial streams.

Dhansiri and Diphu are two major rivers flowing through district. A number of other rivers like Langlong, Amaluma flow down from Jalukie hills in the Dhansiripar / Chumukedima plains. However, none of them are navigable.The district is blessed with numerous perennial sources consist of

the tributary network of Chathe River, Zubza River, Diphu and Dhansiri River. These sources could also be harnessed for irrigation purpose

4.10.24 DEMOGRAPHY

Dimapur District is the most populous District in Nagaland, with a total population of 3, 79,769. The proportion of its population to the State population was 19.17%. Dimapur district has shown a decline in rural male residents by 9% and increase by 27.96% in female population during the last decade.

Table 4.12 Dimapur district at a glance

S. N.	DIMAPUR DISTRICT	
1.	Total geographic area	927 sq. km (92700 ha)
2.	Location	$25^0$48' & $26^0$00'North latitude and $93^0$30' & $93^0$54' east longitude
3.	Number of villages	204
4.	Number of households	28762
5.	Population a) Male b) Female c) Male/female ratio	308382 166335 142047 1.5:1
6.	Density of population	332 per sq km
7.	Literacy % a) Male b) Female	78.15% 82.16% 73.34
8.	Climate	Subtropical
9.	Temperature	10^0-40^0C
10.	Soil pH	4.5-6.0
11.	Rainfall	1500-2000 mm
12.	Altitude	140-600 m(ASL)
13.	Major rivers	Dhansiri, Diphu, Chathe, Zubza

(Source: Statistical hand book of Nagaland 2015)

Table 4.13 Block wise Demographic data (4 rural blocks)

S no.	Particulars		Dhansiripar Block	Kuhuboto Block	Niuland Block	Medziphema Block	Total
1.	Geographical area (Sq. Km.)		130 (14.02%)	147 (15.85%)	305 (32.90%)	345 (37.21%)	927 (100%)
2.	Population as per 2001 (C)		20322	20746	34086	105014	180168
3.	Total house hold		4142	3182	7164	14274	28762
4.	Land holding (ha)	Large*	663	255	2363	Nil	3281
		Medium**	1490	1050	1146	5281	8967
		Small***	1036	891	1863	4996	8786
		Marginal ****	953	986	1791	3997	7727
5.	Literacy (%)		77.60	78.00	77.00	80.00	78.15%
6.	Irrigated area (ha)		3274	4342	9746	15438	32800
7.	Rainfed area (ha)		2858	3137	7230	7685	20910
8.	Cultivated area(ha)		6132	7479	16976	23123	53710
9.	Cultivable area(ha)		7632	8987	18938	25640	61197
10.	Forest area (ha)		4653	4934	10182	8031	27800

10ha and above – Large, ** 5ha to 10ha – Medium, * 2ha to 5ha – Small*

***** Below 2ha – Marginal*

4.10.25 TRADITIONAL, CULTURAL AND SOCIAL IDENTITY OF DISTRICT

The name Dimapur comes from the Kachari dialect. Etymologically **di** means "river", **ma** means "big" and **pur** means "city"; in effect, the name means "the city near the great river." The Kachari tribe did not have a name for this city, though the Ahoms called it Che-din-chi-pen, or "the brick city". It was

also called Che-dima, meaning "city on the Dima River" and it was once the ancient capital of 13th century Kachari rulers. "Dimapur" is a later appellation.

The ancient Kachari capital Dimapur is one of the important sites of the megalithic culture. Most of the ruins appear to be contemporise with the Kachari civilization, established before the Ahom invasion in the 13th centuary A.D. There is evidence of a touch of Hindu influence on most of them, though these are predominantly Non-Aryan, with elaborate rituals and the cult of fertility. Besides the monoliths the ancient Kachari capital Dimapur contains other ruins of temples, embankments and tanks.

Dimapur city is the major commercial hub in Nagaland and it has a heterogeneous mix of people from all over India, and for which it is also known as "mini India." Besides the dominant Naga tribe who comprises about 50% of the city's population, other prominent groups include Bengalis, Assamese, Nepalese, Biharis, Marwaris, Punjabis and also Tamils and Keralites. In the last two decades, Tibetan traders have also settled in the city.

In Dhansiripar sub division, the tribes inhabiting the area is predominantly Angami, Sumi, Kachari and Chakhesang while in Medziphema sub division, the Angami tribe is predominant although a few Kuki and Sumi villages are also found. In Kuhuboto and Niuland sub divisions, the Sumis are the predominant tribe inhabiting the areas. All these tribes have their own customary laws which dominate their social life. The Village Councils are the local bodies through which such customary laws are enacted. The norms and traditions regarding marriage, divorce, inheritance, death etc are governed by such customary laws. Disputes regarding land, water and such resources and even personal disputes are very often resolved based on these customary laws.

In Dimapur district, all these tribes also celebrate their own indigenous cultural festivals. The following is a brief write up on the festivals of the major tribes that inhabit the district: The **Angami** tribe celebrates **Sekrenyi** in the

month of February. It normally falls on the 25th day of the Angami month of Kezei. The ten-day festival is also called Phousanyi by the Angami's. The festivals follows a circle of ritual and ceremony, the first being “Kizie” followed by “Dsuseva” (touching the sleeping water) sacrifices are also made during this time. **Ahuna** is a traditional post harvest festival of the **Sumi** tribe. Ahuna signifies the celebration of the seasons harvest's in thanks giving, while evoking the spirits for good fortune in the New Year **Tuluni** is a festival of great significance. The festival is marked with feast as the occasion occurs in the bountiful season of the year.

It may be mentioned that other tribes who have settled in Dimapur also celebrate their festivals with as much pomp and gaiety. The **Ao** tribe observes **Moatsü Mong** after the sowing is done. It provides the Aos a period of recreation after the strenuous job. The festival marked by vigorous songs and dances merry making and fun is now observed only for three days from 1-3 May. The Aos have another festival called **Tsungrem Mong** celebrated on the eve of harvest from 1 to 3 August. These festivals provide opportunities to the building generation and village stalwart to demonstrate their intellectual skill and physical powers.

The **Tokhu Emong** is the harvest festival of the **Lothas**. Tokhu Emong is celebrated on November 7, every year. The main features of the feast are community songs, dances, feast fun and frolic. Tokhu Emong is also a festival of thanksgiving, sharing and reconciliation but the most beautiful aspect of this festival is that past rancor's are forgiven, new ties are formed and bonds of closer intimacy are formed.

The **Chakhesang** community celebrate the **Suhkruhnye** festival on15th January which is their most important festival.

All the tribes celebrate their distinct seasonal festivals with much gaiety and community feasting. Most of these festivals revolve round agriculture,

since it is the main-stay of Naga society. Over 85% population of Nagaland is directly dependent on agriculture and lives in a thousand and odd villages situated on high hill tops or slopes overlooking verdant valleys humming with murmuring streams.

4.10.26 ADMINISTRATIVE SETUP

The first Deputy Commissioner of the district took over charge formerly on 2nd January 1998. The proposed head quarter for the district is Chumukedima but presently DC office is located in Dimapur town. The administrative setup is as follows:

4.10.27 FINANCIAL INSTITUTIONS:

Different financial institutions like banks and Insurance companies are working in the district dealing with money transactions, promoting the agriculture in the districts by financing the loans to marginal and small farmers. The list is given below (in table).

Table 4.14 List of banks and no of branches in Dimapur

Sl. No.	Name of Bank	No. of Branches in Dimapur
1.	Allahabad Bank	2
2.	Axis Bank	3
3.	Bank of Baroda	1
4.	Bank of India	1
5.	Bank of Maharasthra	1
6.	Canara Bank	1
7.	Central Bank of India	1
8.	Federal Bank	1
9.	HDFC Bank	1
10.	ICICI Bank	2

11.	IDBI Bank	1
12.	Indian Bank	1
13.	Indusind Bank	1
14.	Punjab National Bank	1
15.	Punjab & Sind Bank	1
16.	State Bank of India	13
17.	South Indian Bank	1
18.	Syndicate Bank	1
19.	United Bank of India	2
20.	United Commercial Bank	4
21.	Union Bank of India	1
22.	Vijay Bank	2
23.	Yes Bank	1
24.	Nagaland Rural Bank	4
25.	Nagaland State Co-operative Bank	5
	Total	**56**

(Source: Statistical hand book of Nagaland 2015)

4.10.28 AGRICULTURAL MARKETING SYSTEM:

Marketing of Agricultural produce is mainly done by weekly market, held at different places on different days in a week, i.e., local weekly markets. The farmers are selling their produce at lower prices prevailing in market. To promote the marketing of agricultural produce, Agricultural Produce Marketing Committee (APMC) has been proposed in the district. Under the supervision of APMC, Agricultural Produce Marketing Sub-committee and Village Market committee has been constituted. In Village market committee -one member of each farming household is member and one lady member of farming community is must. The office bearer will consist of Chairman, Secretary,

Treasurer and Executive members. 10 APMSC has been proposed and 10 Sub Market Yards are also proposed. Two APMC is proposed one in Dimapur and other in Niuland. APMC will be affiliated with Nagaland Agricultural Marketing Board.

Table 4.15 Local Markets of Dimapur

Sl. No.	Name of the block	Name of the Market	Periodicity (Weekly/ Daily)	Important commodities handled	Commodity wise Quantity handled (Annual)	Area Covered	No. of farm families covered
1.	Medziphema	Medziphema	Weekly	Cereals, Pulses, Oilseeds, Fruits & vegetables	All commodities	30 Villages	6,000
2.	Dhansiripar	Doyapur	Weekly	-do-	-do-	20 villages	4,000
3.	Niuland	Niuland	Weekly	-do-	-do	35 Villages	7,000
4.	Kuhuboto	Kuhuboto	Weekly	-do-	-do-	15 Villages	3,000

(Source: SREP ATMA, Dimapur)

Figure 4.16 Friday local market at Medziphema

4.10.29 Farmer's organization:

There are about 250 different Farmers Interest Group and about 700 different self help groups. Medziphema block alone is having around 204

SHGs. Agriculture Technology Management Agency (ATMA) for Dimapur district was started in the year 2005 to 2006. The Strategic research and Extension Plan for Dimapur district has been prepared and action on it has been initiated. There are 6 no of farmer's club formed with the help of NABARD functioning for welfare of the farmers.

4.10.30 ECONOMIC SCENARIO OF THE DISTRICT

The agriculture in the district is TRC, rainfed and traditional. By and large mono cropping of paddy is practiced in the district. The TRC paddy alone covers an area of 32,900 ha where as Jhum covers about 7,800 ha. Besides the second important crop in the district is Kharif, Maize covers about 2500 ha. Maize is generally grown as an inter-crop with jhum paddy. Winter maize is also grown in certain blocks of the district which covers about 460 ha.

Important Pulses are also grown in the district include pea, lentil, black gram, beans, green gram, arhar; these are grown over an area of 1360 ha, in both Kharif and Rabi season.

With the favourable agro climatic condition, oilseeds such as groundnut, soybean, sesame, sunflower, mustard, linseed, etc; are grown in an area of 5800 ha. Commercially viable crops such as sugarcane, ginger, jute, turmeric, tea, potato etc are also grown in the district covering an area of 1,580 ha. Mechanized farming is encouraged, by providing 50.00 per cent subsidy on power-tillers.

4.10.31 CROPS

a. **Existing Agricultural farming systems:** The farming in the district is a mixture of Jhum and TRC paddy followed by oilseed and cash crops. TRC paddy being main crop of the district is sown in May and harvested in last week of Nov. or first week of Dec followed by maize.

b. **Cereals production system:** The major cereal crops are grown in district is Paddy, maize, Bajra, Ragi, Wheat, Barley and Oat. With an annual production of 131040 MT with an area of 54490 hectares, this accounts about 19.17 per cent of total state production. Dimapur district is called as "Rice bowl" of the state. The area under rice cultivation in the district is 24.87 per cent against the total rice area (35520 hectares, *source: Directorate of Agriculture, Govt. of Nagaland*) of the state, with an annual productivity of 1.9t/ha (Jhum paddy) and 2.62t/ha (TRC). While maize occupies 6730hectares, with the average productivity of 1.97 t/ha grown in Kharif as well as in Rabi. Wheat is also grown in some pockets of district covering 390 hectares area with the productivity of 1.85t /ha.

c. **Wet Rice Cultivation:** Wet rice cultivation is generally followed in valley or low land areas of the district. The land for wet rice cultivation is prepared by ploughing with bullocks and power tillers (only in medium and large land holdings). Irrigation is provided by construction of channels in some areas; through rainfall is the major source of irrigation. 25 to 30 days old seedlings of paddy are transplanted in June / July. Application of fertilizers and pesticides is found to be negligible. However, use of fertilizers and pesticides are reported from the areas neighbouring Dimapur town.

d. **Jhum Paddy:** Jhum field, after cutting and burning the jungles, are ploughed manually with spade and seeds are broadcasted in the month of April- May after the onset of monsoon. Jhum paddy is harvested in the month of October.

e. **Pulses production system:** During 2013 to 2014, the district had total pulse production of 2490 MT from an area of 2480 hectares. Among the Pulses, the major are Pigeon pea, Green gram and Black gram. Beans are cultivated during Kharif whereas pea, Lentil and Horse Gram are grown in Rabi season. Some of local Bean (Rice Bean) varieties are also cultivated in the district.

f. **Oilseed production system:** Soyabean, sesamum, and rapeseed/mustard are the predominant oilseed crops, widely cultivated by the farmers. The improved varieties of oilseeds are being cultivated by the farmers are: Soybean variety JS-335, groundnut var. ICGS-76, sesamum var. Till-1, sunflower var. Modern and Hybrid-21, mustard var. TS-38, M-27 and B-9, linseed J-23 and JLS-9. Sesamum is grown in Kharif in Jhum fields along with maize and in plain area (630ha) of districts. Soybean covering an area of 2040 ha is the major oilseed crop of district in kharif season.

Mustard and rapeseeds are generally cultivated as Rabi crop covering the maximum (4180 ha) area. Mustard is grown in Jhum fields as well as in TRC plots after harvest of paddy. Few farmers cultivate this crop at commercial scale and sell it in weekly markets. Linseed covers an area of 1100 ha after mustard in Rabi season. Linseed is grown in late harvested paddy plots generally in December first week to third week. The oilseed production in the district is recorded to be 8710 MT during 2013-14.

g. **Cash crop production systems:** Major cash crops of the district are sugarcane, potato, ginger and vegetables. Sugarcane is sown in April in valley or plain areas of district after onset of monsoon and harvested in February. As Sugar Mill of the district is closed down, farmers are selling their produce in local markets and some of them are engaged in jaggery preparation. Ginger is the mostly grown in Jhum fields of Medziphema block. During 2013-14 the area under ginger was reported to be 169 ha; however 2006 to 2007 the area under ginger cultivation were 970 ha only. The farmers of the district are discouraged for ginger cultivation due to soft-rot and bacterial wilt diseases.

Potato is cultivated in an area of 680 hectares with the average productivity of 10.044 t/ha due to lack of irrigation. The potato is attacked by red ants and market quality is reduced and farmers are not willing to apply chemicals to control the ants. These problems discourage the farmers for area expansion under potato.

Table 4.17 Farming systems in the district

Farming system	**Soils**	**Rainfall**	**Altitude**	**Principal crops /breeds**	**Important features**	**Location (area) extent of area in ha**
Multi-cropping in Jhum fields	Loamy sand	1200 mm	250-350m MSL	Paddy, maize, Soybean, Ginger, pineapple.	A part of block is hilly terrain	Medziphema block; Area - 34,500 ha.
Mono-cropping as well as double cropping	Sandy clay loam	1000 mm	250 m MSL	Paddy, maize, Soybean, mustard, linseed, cabbage, cucurbits, black gram, Arhar.	Valley or plain land	Dhansiripar block; Area - 13,000 ha
Mono-cropping as well as double cropping	Sandy clay loam	1000 mm	250 m MSL	Paddy, maize, Soybean, mustard, linseed, cabbage, tomato, cucurbits, black gram.	Valley or plain land	Niuland block Area - 30,500 ha
Mono-cropping as well as double cropping	Sandy clay loam	1000 mm	250 m MSL	Paddy , maize, Soybean, mustard, linseed, cabbage, cucurbits, black gram	Valley or plain land	Kuhuboto block; Area - 14,700 ha

(Source: Anon. 2019)

4.10.32 LAND USE PATTERN UNDER THE FARMING SYSTEM

a. Mono cropping: This system of farming is generally followed in case of Wet Rice cultivation. Here paddy is the major crop, is cultivated in low land area of district almost in all the blocks. Some of farmers cultivate maize and ginger as mono-crops in their fields.

b. Mixed cropping: vegetables like beans and leafy vegetables along with soybean and Naga dal are cultivated in plain areas of districts. The summer vegetables like Okra and cucurbits are very common. Other vegetables for e.g. brinjal, chilli and tomato are grown in winter season. This farming system is followed in Niuland, Kuhuboto and Dhansiripar blocks of district.

c. Double cropping: here paddy is the main crop followed by mustard or linseed as secondary crop. Sometimes winter maize is taken as second crop.

d. Multi-cropping farming system: This farming system is generally followed where Jhum paddy is cultivated on gentle slope of hills/ plains along with maize and colocasia, beans, brinjal, tomato, chilli, cucumber etc. TRC paddy is also grown followed by mustard /linseed or maize in December or January. This system is followed in whole district (4 blocks). Vegetables are also cultivated in the district in Jhum fields, on an area of 1049 hectares only.

e. Horticulture based farming system: Pineapple is grown on the slope of hills with colocasia and cucurbits as inter crop. King chilli is also grown in Jhum fields as inter crop. This system is followed in Medziphema block of district.

f. Soils under the farming system: The soils of district are dominantly of loamy sand and clay loam soil with pH ranging from 4.50 to 6.00. The total soluble salt is within normal limit. The organic carbon content is low to medium; available phosphorus is low to medium, available potassium is low to

medium, magnesium is high, calcium is low, nitrate nitrogen is medium to high, sulphur is low to medium and ammonical nitrogen is low.

4.10.33 CLIMATES UNDER FARMING SYSTEM:

The district of Dimapur falls under humid-Sub-Tropical Agro-climatic Zone (ACZ) and receives southwest monsoon rain during summer and north east monsoon during winter. The annual average rainfall is about 1000mm and annual average maximum temperature is 26^{o}C and minimum temperature is 21^{o}C. The highest one day temperature is 40^{o}C and lowest one day temperature recorded is 10^{o}C

Table 4.18 Area & Production of principal crops for the year 2015-16

S. N.	**Crops**	**Area (Ha)**	**Production (MT)**	**Productivity (t/ha)**
	A. CEREALS			
1.	Jhum Paddy	9450.00	17990.00	1.90
2.	TRC/WRC Paddy	37670.00	98810.00	2.62
3.	Maize	6730.00	13250.00	1.97
4.	Bajra	60.00	60.00	1.00
5.	Ragi	30.00	30.00	1.00
6.	Wheat	390.00	720.00	1.85
7.	Barley	90.00	100.00	1.11
8.	Oats	70.00	80.00	1.14
Total		**54490**	**131040**	**2.40**
	B. Pulses			
1.	Tur/ Arhar	480.00	440.00	0.91
2.	Urd/ Mong	130.00	130.00	1.00
3.	Cow pea	200.00	290.00	1.45

4.	Horse gram	60.00	60.00	1.00
5.	Pea	890.00	970.00	1.08
6.	Lentil	470.00	380.00	0.80
7.	Gram	100.00	100.00	1.00
8.	Black Gram	150.00	120	0.80
Total		**2480.00**	**2490**	**1.00**
	C. Oil Seeds			
1.	Ground nut	160	170	1.06
2.	Soybean	2040	2520	1.23
3.	Castor	60	40	0.66
4.	Sesamun	630	400	0.63
5.	Sunflower	670	410	0.61
6.	Rape Seed/Mustard	4180	4260	1.02
7.	Linseed	1100	910	0.82
Total		**8850**	**8710**	**0.98**
	D. Commercial Crop & Others			
1.	Sugar Cane	1140	49630	43.53
2.	Cotton	70	-	-
3.	Tea (Green)	2890	12960	4.48
4.	Ramie	40	30	0.75
5.	Mesta	270	300	1.11
6.	Tapioca	120	2430	20.25
7.	Colocossia	240	2280	9.50
8.	Yam	100	720	7.20
Total		**6450**	**77270**	**11.97**

(Source: Krishi Vigyan Kendra, Dimapur)

4.10.34 HORTICULTURE IN DIMAPUR DISTRICT

In Nagaland, fruits and vegetables are produced in 37479 and 51343 ha with the total production of 286920 MT and 605984 MT respectively of which Dimapur district contributes major portion of production as 13.08% of fruits (37,541 MT) and 8.56 per cent of vegetables (51899MT). Commercial cultivation of pineapple, banana, cashew nut and lemon is also followed in the district. The Horticulture Technology Mission (HTM) has helped to a great extent in popularizing the cultivation of horticultural crops including floriculture.

Table 4.19 Major fruits during 2015-16

S. N.	Crops	Area (ha)	Production (MT)	Productivity (t/ha)
1.	Orange	100	1300	13.00
2.	Lemon	450	2984	6.63
3.	Pomelo	120	500	4.17
4.	Pomegranate	15	60	4.00
5.	Papaya	60	347	5.78
6.	Banana	360	4580	12.72
7.	Guava	30	150	5.00
8.	Mango	70	490	7.00
9.	Litchi	100	1000	10.00
10.	Jackfruit	35	100	2.86
11.	Pineapple	2550	25000	9.80
12.	Mosambi	20	160	8.00
13.	Ber	5	30	6.00
14.	Others	140	840	6.00

(Source: Krishi Vigyan Kendra, Dimapur)

Table 4.20 Major vegetables during 2015-16

Sl. No.	Crops	Area (Ha)	Production (MT)	Productivity (t/ha)
1.	Sweet Potato	126	1957	15.53
2.	Cabbage	723	14595	20.19
3.	Cauliflower	108	710	6.57
4.	Brinjal	48	429	8.94
5.	Chilly	472	3313	7.02
6.	Peas	316	2227	7.04
7.	Bean	203	1280	6.30
8.	Bhindi / Okara	23	211	9.17
9.	Tomato	290	1754	6.05
10.	Ginger	169	3197	18.91
11.	Garlic	20	215	10.75
12.	Radish	52	664	12.77
13.	Colocassia	260	2080	8.00
14.	Tapioca	468	8500	18.16
15.	Xanthophylum	11	62	5.64
16.	Onion	208	2176	10.46
17.	Naga Cucumber	42	332	7.90
18.	Mushroom	533	3213	6.03
19.	Pumpkin	14	118	8.43
20.	Leafy vegetable	416	3328	8.00
21.	Water Melon	17	175	10.29
22.	Carrot	54	618	11.44
23.	Coriander	12	20	1.67
24.	Potato	680	6830	10.04
25.	Others	105	725	6.90

*(Source**:** Krishi Vigyan Kendra, Dimapur)*

Table 4.21 Major plantation crops during 2015-16

Sl. No.	Crops	Area (Ha)	Production (MT)	Productivity (t/ha)
1.	Cashew nut	486	395	0.81
2.	Areca nut	144	789	5.48
3.	Coconut	675	5450	8.07

*Source***:** Krishi Vigyan Kendra, Dimapur

Table 4.22 Major spices during 2015-16

Sl. No.	Crops	Area (Ha)	Production (MT)	Productivity (t/ha)
1.	Black pepper	40	5	0.13
2.	Turmeric	217	2865	13.20
3.	Naga Chilly	132	686	5.19
4.	Betel vine	34	60	1.76
5.	Aromatic & Medicinal	16	94	5.87

*Source***:** Krishi Vigyan Kendra, Dimapur

4.10.35 HORTICULTURE POTENTIAL:

The state of Nagaland in general and Dimapur in particular has been gifted with a unique topography and varied agro-climatic and soil conditions, which offers opportunities to cultivate a variety of horticultural crops like vegetables and fruits. Among vegetables spring summer (cucurbits, bhindi beans), summer (cucurbits, bhindi, beans) as well as winter vegetables (cabbage, cauliflowers, carrot, radish, palak, pea, etc;) are being cultivated in the district. Fruits like pineapple, guava, lemon, litchi and mango are the major ones covering the area in the district. Among floriculture, the commercial crop is Anthurium, which is being

exported through Zopar Exports under poly house conditions in Sovima village of the district.

4.10.36 SCENARIO OF IRRIGATION IN THE DISTRICT:

The Total geographical area of Dimapur district is 927000 ha. The Total Irrigation potential of the District is around 67000.00 ha. The Department of Irrigation & Flood Control, Government of Nagaland, Dimapur has so far had created an irrigation potential of about 12947.50 ha (under AIBP Scheme implemented by the Department).

Table 4.23 Irrigation scenario of Dimapur district

Sl. No	Districts	Gross cultivated area	Net cultivated area	Gross irrigated area	Net irrigated area	Net irrigated %	Rainfed	
							Area	% of net cultivated area
1.	Dimapur	20704.00	18470.00	15400.00	14635.23	95.03	32380.00	57.04
2.	Nagaland	179236.62	176948.62	74880.00	61152.39	81.67	378821.31	-

(Source: Nagaland Basic Facts-2014, Directorate of Agriculture Department, Nagaland & NASTEC)

4.10.37 BIO-FERTILIZER LABORATORY

Bio-fertilizer Laboratory at Medziphema was initiated during the year 1999-2000. Construction of the Lab building was completed in December 2001. Biofertilizer Laboratory was commissioned on the month of January 2002. Nagaland was brought under Biofertilizer Production Map in India in 2002.It has the capacity to produce 20 to 25 MT in a year.

i. Aims and Objective

1. To promote Integrated Plant Nutrient System (IPNS) for sustainable agriculture.
2. To minimize the use of chemical fertilizers by 25.00 per cent.
3. To increase crop production level by 25.00 per cent to 30.00 per cent.
4. To maintain soil fertility system.
5. To protect destruction of natural eco-system in eco-friendly manner.
6. To promote and substantiate organic farming/organic agriculture.
7. To produce healthy crops and healthy food.

ii. List of Bio-fertilizers:

1. The term "Biofertilizer" is made up of two words; 'Bio' means living 'fertilizer' means a product which provides nutrients in useable form.
2. Bio fertilizers are carrier based preparations containing live or latent cells of effective strains of bacteria or fungi or algae.
3. When it is applied to seeds, seedlings and in soils, they helps in fixing nitrogen, solubilising, Phosphorus and Potash through their microbial activity and nutrients are made available to the plants.

iii. Production Status

1. Production of Bio-fertilizer is a continuous process in the laboratory for meeting departmental requirement research & demonstrations.
2. Since its inception in January 2002, 157.60 metric tons of different types of bio fertilizers have been producing till 2014 February.
3. The Laboratory is producing 13(thirteen) MT every year on an average.
4. During 2000 to 2014 laboratory has produced 157.6202 Metric tonnes of bio fertilizers.

iv. Types of Bio-fertilizer produced in the Laboratory

1. **RHIZOBIUM:** It is nitrogen fixer. It is use for legume crops like pulses, oilseeds crops like soyabean and groundnut. Rhizobium is crop specific. The production of Rhizobium is approx. 2.50 metric tonnes / year.
2. **AZOTOBACTER:** It is use for cereal crops, vegetable crops, fruit crops, plantation crops and flowers. The production of Azotobacter is approx. 2.00 metric tonnes/year.
3. **AZOSPIRILLUM:** It is use for cereal crops, vegetable crops, fruit crops, plantation crops and flowers. The production of Azospirillum is approx. 2.00 metric tonnes/ year.
4. **PHOSPHOTIKA:** It is Phosphate solubilising micro-organisms, use in all the crops with Rhizobium, Azotobacter, Azospirillum, in the same ratio. The production of Phosphotika is approx. 6.50 metric tonnes / year.

v. Distribution System of Bio-Fertilizer

1. Bio fertilizers were distributed to different districts and Sub-divisions along with seeds during Kharif season and Rabi season respectively through SDO and DAO Dimapur.
2. Bio-fertilizers are distributed to the farmers at free of cost for proper implementation of departmental schemes, for demonstrations, Researches and training Programmes in different districts and sub-divisions in the state.

4.10.38 CENTRAL INSTITUTE OF HORTICULTURE

Central Institute of horticulture was established in the year 2006 for the holistic development of horticulture sector in the North East Region. Located at Medziphema, Nagaland about 30 km from Dimapur city and 44 km from the

capital city Kohima the Institute spreads over an area of 43.50 hectare. The main thrust areas of the Institute are refinement and demonstration of identified technologies pertaining to the region; production and supply of quality seed and planting material; training and capacity building of state government officials, field functionaries and farmers on different aspects of horticulture development including organic farming, monitoring of centrally sponsored programmes in the area of horticulture, post harvest management, processing, value addition, marketing and agribusiness promotion.

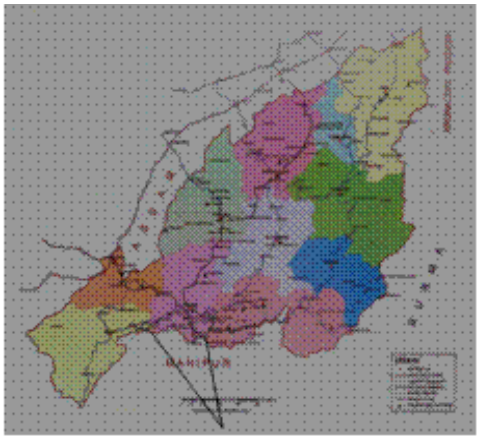
4.10.39 ABOUT KOHIMA DISTRICT

Kohima is the first seat of modern administration as the Headquarters of Naga Hills District (then under Assam) with the appointment of G.H. Damant as Political Officer in 1879. When Nagaland became a full fledged state on 1st December, 1963. Kohima was christened as the capital of the state. Since then, parts of Kohima district have been carved out thrice - the first in 1973 when Phek District was created, then in 1998 Dimapur was carved out and declared as a separate district and it was in 2004 for the third time that Kohima district once again gave birth to one of the youngest districts in the state called Peren District. The name Kohima is derives its name from "KEWHIRA" which is the name of the village where Kohima town is located. Kohima village , also called 'Bara Basti' is the second largest village in Asia and forms the North-Eastern part of Kohima Urban area today.

4.10.40 DEMOGRAPHIC

As of 2011 Census, Kohima district has a total geographical area of 1595 km^2. It is the oldest district with a total farming population of 1, 48,774 and a literacy rate of 74.00 per cent. The district is having 85 villages scattered in an altitude range of 600 MSL to 3048 MSL. The district is divided into 4 (four) Blocks namely, Kohima, Jakhama, Chiephobozou andTsemenyu Blocks

respectively. According to the 2011 census, Kohima district has a population of 267,988 of which 121,088 or 45.00 per cent lived in urban areas. This gives it a ranking of 576th in India (out of a total of 640). Kohima has a sex ratio of 928 females for every 1000 males, and a literacy rate of 85.00 per cent.



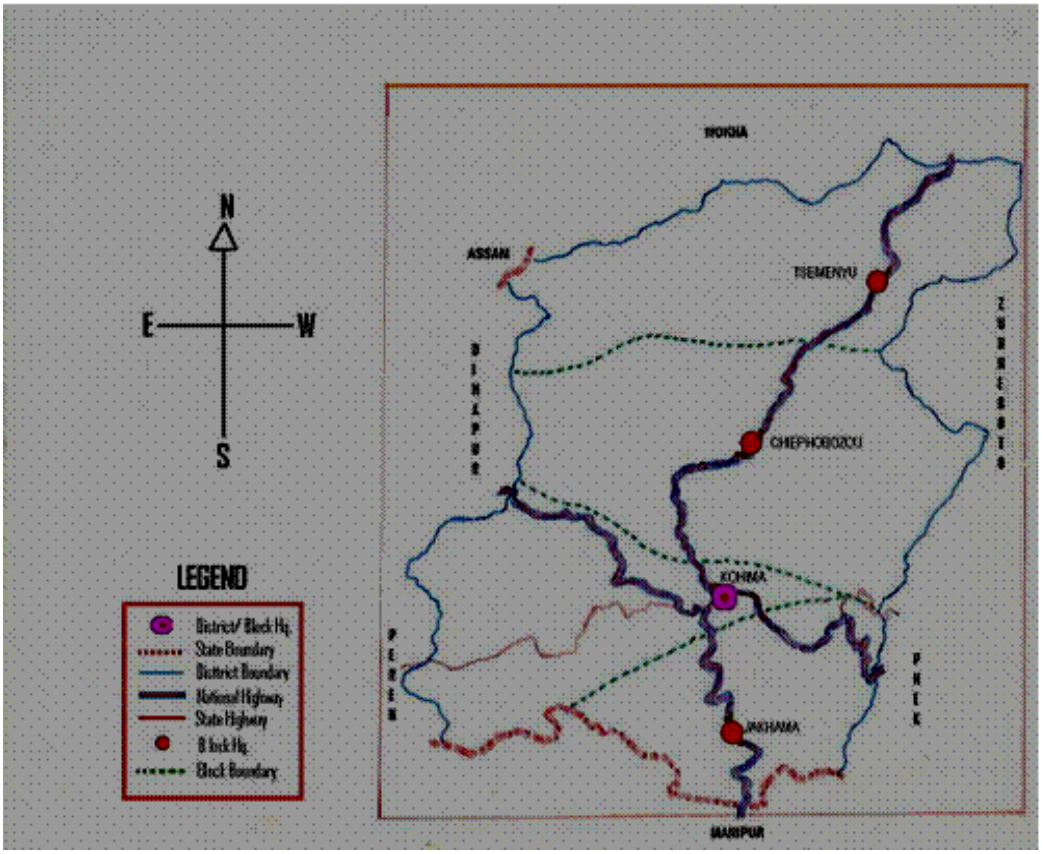


Figure 4.24 District Map of Kohima

Fig 4.25 DISTRICT PROFILE

Sl. No.	Particulars	Kohima District		Total
		Male	Female	
1.	Population	78850	69924	148774
2.	Literacy (%)			74.28
3.	Land Holding	Marginal (%)		47
		Small (%)		29
		Medium (%)		17
		Large (%)		7
4.	Total Geographical area (Excluding Peren) Sq. K.M			1595
5.	Irrigated (ha)			7040
6.	Jhum area (ha)			9159
7.	Forest Area (ha)			49268
8.	Others (ha) Townships/Villages/Roads/ Wastelands.			94033
9.	Altitude (metre above MSL)			1444
10.	Annual rainfall (mm)			1430

*Source***:** Krishi Vigyan Kendra, Kohima

40.10.41 PEOPLE

The main indigenous inhabitants of Kohima District are the Angami Nagas and the Rengma Nagas. But Kohima being the capital city, it is a cosmopolitan city with a pot pouri of all the tribes of Nagaland as well as mainland India residing here.

40.10.42 CLIMATE

The climate of Nagaland ranges from sub-tropical to sub-temperate which is highly congenial for growing varieties of agricultural and horticultural crops. The land is hilly and is covered mostly by forests, which are amongst the riches in the Indian sub-continent, so the state is considered as an area of rich agricultural heritage site. December and January are the coldest months when frost occurs and in the higher altitudes, snowfall occurs occasionally. During peak summer months from July-August, temperature ranges an average of 80-90 Fahrenheit. Heavy rainfall occurs during summer.

Fig 4.26 KOHIMA DISTRICT AT A GLANCE

Sl. No.	**Name of the block / Taluk / Mandal**	**Geographical Area (km^2)**	**No. of Gram Panchayat**	**No. of revenue villages**
1	Kohima	309	14	14
2	Jakhama	217	12	12
3	Chephobozou	508	27	27
4	Tsemenyu	564	33	33
Total		**1595**	**86**	**86**

*Source***:** ATMA, Kohima

4.10.43 TOPOGRAPHY

Kohima is located at 25º40’N 94º07’E 25.67ºN 94.12ºE. It has an average elevation of 1261 metres (4137 feet) and covers an area of 1,463 sq. km, with a density of 213 per sq. Km. Kohima town is located on the top of a high ridge and the town serpentines all along the top of the surrounding mountain ranges.

4.10.44 ECONOMIC SCENARIO OF THE DISTRICT

Major crops of the district include Terrace & Jhum Paddy , Potato, Ginger, Maize, Soybean, Ricebean, Vegetables and horticultural crops like Banana, Passion fruit, Guava, Temperate fruits. The produces are organic by default. There is therefore ample scope for production of organic fruits, vegetables and cereals in the district.

4.10.45 POTATO IN NAGALAND

After the introduction of Potato for the first time by the Portuguese during the 17th century at Gujarat on the West Coast and later to areas like Goa, potato was rapidly spread in all parts of the country. Compared to other crops grown in India, the growth rate of area under potatoes has been the fastest. Initially, potato was limited to certain few states, but with significant improvements in irrigation facilities and the seed varieties, potatoes are now being cultivated in almost all parts of the country.

Kohima district has got suitable agro-climatic conditions including soil pH ranging from 5.50 to 6.50. Kohima is known to be the leading cultivator of potato in the state, cultivating both for house hold as well as for marketing purpose. So, the district has a good potential for the potato production.

Kohima is amongst the top region for production of Potato in India. As of 2011, potato production in Kohima was 18,040 tonnes that accounts for 25.28% of India's potato production. The top 5 regions (others are Phek, Tuensang, Mokokchung, and Dimapur) account for 83.45 per cent of it. India's total area for growing potato was 2164 ha, and the potato production was estimated at 46546 MT in 2016 2017 (Anonymous, 2017).

4.10.46 ABOUT JAKHAMA BLOCK

Jakhama Block falls in the Kohima district of Nagaland and it is one among the 5 blocks in rural region of Nagaland under the Kohima district. The block has 17 villages and altogether there are 8665 families in this Block. The block is situated in the state boundary of Manipur.

4.10.47 POPULATION OF JAKHAMA BLOCK

As per Census 2011, Jakhama's population is 48186. Out of this, 25707 are males while the females count 22479 here. This block has 5511 kids in the age group of 0-6 years. Among them 2815 are boys and 2696 are girls.

4.10.48 LITERACY RATE OF JAKHAMA BLOCK

Literacy rate in Jakhama block is 71.00 per cent. 34383 out of total 48186 populations are educated here. In males the literacy rate is 77.00 per cent as 19807 males out of total 25707 are literate whereas female literacy ratio is 64.00 per cent as 14576 out of total 22479 females are literate in this block. The dark portion is that illiteracy ratio of Jakhama block is 28.00 per cent. Here 13803 out of total 48186 people are illiterate. Male illiteracy ratio here is 22.00 per cent as 5900 males out of total 25707 are illiterate. In females the illiteracy ratio is 35.00 per cent and 7903 out of total 22479 females are illiterate in this block.

4.10.49 AGRICULTURAL SCENARIO

Farming in their own lands for food, nutrition and livelihood is a way of life for the indigenous peoples living in the Jakhama village. Being bestowed by the nature, the land is suitable for the cultivation of various crops and the peoples of the area are cultivating Potato, cabbage and Squash. It is estimated that nearly $^{1}/_{4}^{th}$ of the people living in the Jakhama block have farming as their primary source of earning and they can easily effort their

livelihood from the crops they have cultivated in their traditional way. Of which, Potato, cabbage, Squash and rice are the main crops grown in their terraced and foothills land areas. The harvested products are marketed to district headquater, village or local markets and to Dimapur either by themselves or by the village traders and middlemen. The methods of cultivating these crops are mainly based on the traditional approach and they follow their forefather's patterns of crops cultivation which are mainly focussed on the community resource based inputs used.

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

The data collected for the study were analyzed with reference to the objective set and the results are presented and discussed in these chapter. For better understanding of the various facts of the subject the results are presented in the following headings:

4.1. Socio economic characteristics of the sample farmers,

4.2. To estimate the Costs and returns of the various levels of farm's for the selected horticultural crops *viz*. pineapple, potato and cabbage,

4.3. To analyze the resource-use-efficiency for the selected horticultural crops *viz*. pineapple, potato and cabbage,

4.4. To study the income and employment patterns for selected horticultural crops *viz*. pineapple, potato and cabbage,

4.5. To study the farmers' perception for the horticultural crops *viz*. pineapple, potato and cabbage, and

4.6. To analyze the problems and constraints faced by the various level of farm’s for selected horticultural crops *viz*. pineapple, potato and cabbage.

Socio-economic variable is also important parameters that determine the entrepreneurial development of the farmers and the farm. This is because, the enterprise vary in their level and types of resources requirements like labour, land, capital and the managerial skill which is indirectly related to their level of education also effect the farm income and nature of farm business. Hence a discussion on the socio economic variables of the sample respondents such as age, gender, family size, land holding, farm income, farm debit/loan, knowledge sources, farmers’ network, labour work-force and farmers’ training for technologies intervention etc; are discussed below:

4.1. Socio economic characteristics of the sample farmers

Table 4.1.1 reveals the age group of farm households with respect to their age and is categorized into 4 groups. The table shows that Manipur populations are higher than Nagaland, whereas on 3 categories Manipur state is leading with respect to sample size. Whereas comparing among the district Senapati district is having highest farm household/ population on category 3, even Thoubal district was recorded population with respect to 4 categories.

Table 4.1.2 reveals about the gender of farm households. The total male is 1165 and female are 1134, whereas, maximum count of male was recorded in Manipur state and minimum male in Nagaland state. Whereas the maximum male among the districts is recorded in Senapati district followed by kohima, Dimapur and it was least in Thoubal district of Manipur for male population. While female maximum count is recorded in Senapati district, followed by Kohima and Dimapur and least in Thoubal district.

Table 4.1.3 reveals that the family members of farm households, which was categorized into 4 categories. The maximum family members is recorded in Manipur on category 2, category 3 secures II rank, caterory IV in 3rd rank, followed by I category in Manipur state, while in Nagaland state maximum family members is recorded in categort II, followed by Category III, Category I and it was least on category IV. whereas, among the district, maximum family members is recorded in Kohima district, followed by Senapati and Thoubal district, while Dimapur is found to be least on category II. The category III is found maximum in Senapati district, followed by Dimapur and Kohima while Thoubal was found to be least in Category III. On category I, Kohima is found to be maximum followed by senapati and Dimapur district, while Thoubal district is nill on category I. while on category IV, Kohima is maximum, followed by Senapati and Dimapur district, followed by Thoubal with zero on category IV.

4.1. Socio-Economic Profile of the Farm Households

4.1.1. Age Group of Farm households

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	upto 12 years	150	196	346	157	241	398	744
2	13-18 years	62	167	229	45	187	232	461
3	19-59 years	154	315	469	159	364	523	992
4	60 & above	30	31	61	18	23	41	102
	total	396(**35**)	709(**64**)	1105	379(**31**)	815(**68**)	1194	2299

Figures inside the parentheses indicate percentage to the total

4.1.2. Gender of Farm households

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Male	203**(51)**	343**(48)**	546	201**(55)**	418**(51)**	619	1165
2	Female	193**(48)**	366**(51)**	559	178**(46)**	397**(48)**	575	1134
	total	396	709	1105	379	815	1194	2299

Figures inside the parentheses indicate percentage to the total

4.1.3. Family members of Farm households

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	5-6 members	2	16	18	0	4	4	22**(7)**
2	7 to 8 members	32	64	96	40	60	100	196**(65)**
3	9 to 10 members	14	13	27	10	31	41	68**(22)**
4	Above 10 members	2	7	9	0	5	5	14**(4)**
	total	50	100	150	50	100	150	300

Figures inside the parentheses indicate percentage to the total

4.1.4. Land Holding Size of the of Farm households

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Small	33	61	94	18	64	82	176**(58)**
2	Medium	14	27	41	28	30	58	99**(33)**
3	Large	3	12	15	4	6	10	25**(8)**
	total	50	100	150	50	100	150	300

Figures inside the parentheses indicate percentage to the total

Table 4.1.4 shows the land holding size of the farm households, which is categorize into 3 categories. The maximum land holding size is found to be maximum in small category, followed by medium category and large category respectively. Among the district, maximum households are recorded in Senapati followed by Kohima and dimapur district while it was least in thoubal on Small farm group, whereas, in the medium farm group, Senapati district recorded the highest households followed by Thoubal, Kohima and Dimapur. In case of large category, Kohima district recoreded the highest land holding followed by Senapati, Thoubal and Dimapur district, respectively.

Table 4.1.5 shows the farm income of the households and it was categorize into Low; Medium and High. The table shows that the maximum numbers of households comes under the Medium category followed by low and high category respectively. In the low category, Thoubal district recorded the highest income followed by Dimapur, Kohima and Senapati. Whereas in the medium category, it was recorded highest in Senapati followed Kohima, Thoubal and Dimapur district. In case of high category, Dimapur district recorded the highest income followed by Kohima, Senapati and Thoubal district, respectively.

Table 4.1.6 reveals the farmers' debit / loan status of the sample respondents with 2 categories (Yes & No). The table shows that the maximum number of sample respondents falls in the II (No) - category followed by I (Yes) - category. In the I-category, Senapati district recorded the maximum numbers of household followed by Kohima, Dimapur and Thoubal district respectively. Whereas, Kohima district recorded the highest which was followed by Senapati, Thoubal and Dimapur district respectively.

Table 4.1.7 shows the distribution of the sample respondent and their sources of knowledge and it is being classified into low, medium and high categories. The distribution reveals that the maximum numbers of household

4.1.5. Farm Income of households

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Low	13	12	25	22	9	31	56**(19.00)**
2	Medium	17	70	87	25	76	101	188**(62.00)**
3	High	20	18	38	3	15	18	56(**19.00**)
	total	50	100	150	50	100	150	300(**100.00**)

Figures inside the parentheses indicate percentage to the total

4.1.6. Farmers' Debit/ Loan Status of the sample respondents

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Yes	18	19	37	3	22	25	62**(20.00)**
2	No	32	81	113	47	78	125	238**(79.00)**
	Total	50	100	150	50	100	150	300(**100.00**)

Figures inside the parentheses indicate percentage to the total

4.1.7. Source of Knowledge of the sample respondents

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Low	28	36	64	12	42	54	118**(39.33)**
2	Medium	16	52	68	17	50	67	135**(45.00)**
3	High	6	12	18	21	8	29	47**(15.67)**
	Total	50	100	150	50	100	150	300**(100.00)**

4.1.8. Head Education level of the sample respondents

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Illiterate	3	18	21	11	19	30	51**(17.00)**
2	Upto Primary	14	32	46	14	30	44	90**(30.00)**
3	Pre-matric	17	24	41	13	25	38	79**(26.00)**
4	Matric	13	7	20	12	20	32	52**(17.33)**
5	Intermediate	2	10	12	0	5	5	17**(5.00)**
6	Graduate & Above	1	9	10	0	1	1	11**(3.00)**
	total	50	100	150	50	100	150	300 (**100.00**)

Figures inside the parentheses indicate percentage to the total

comes in the medium-category followed by low and high categories. In the low category, Senapati district was recorded highest followed by Kohima, Dimapur and Thoubal district respectively. Whereas, in the medium category, Kohima district rank first followed by Senapati, Thoubal and Dimapur. In case of high category, Thoubal district was recorded maximum followed by Kohima, Senapati and Dimapur districts respectively.

Table 4.1.8 reveals the educational standard of the farmer is also an important parameter that determines the productivity of different crops grown by the farmers. It helps the farmers in judicious allocation of different inputs for better productions performances of horticultural crops, also the head education level of the sample respondents and it is categorized into 6 categories (*i.e.* illiterate, upto primary, pre-matric, matric, intermediate and graduate & above). The table shows that the maximum numbers of sample respondent head's education level comes under the II category (upto primary) followed by III-category (pre-matric), IV-category (matric), I-category (Illiterate), V-category (intermediate) and VI- category (graduate & above) respectively.

In the illiterate category, Senapati district is the maximum followed by Kohima, Thoubal and Dimapur district. Whereas, Kohima district recorded maximum in the II-category (upto primary) followed by Senapati and interstingly both Dimapur and Thoubal district rank equally. In case of III-category (Pre-matric), Senapati district is the highest followed by Kohima, Dimapur and Thoubal respectively. In the IV-category(matric), Senapati is found to be recorded maximum which is followed by Dimapur, Thoubal and Kohima respectively. Again in the V-category (intermediate), Kohima district is the maximum followed by Senapati and Dimapur and there are no respondents from Thoubal in this category. In the VII-category (graduate & above), Kohima district has the highest numbers of sample respondents

followed equally by Senapati and Dimapur and there is no graduate respondents in the Thoubal district.

Table 4.1.9 shows the distribution of farmers' network of the sample respondents and it is categorized into 3 categories as low, medium and high categories. The table reveals that the maximum respondents is found in the medium (II- category), followed by low and high categories respectively. In the low category, Kohima district is found to be maximum followed by Senapati, Thoubal and Dimapur. In the medium category, Senapati is the highest followed by Kohima, Thoubal and Dimapur, whereas in the high category, Dimapur district is the highest followed by Kohima, Thoubal and Senapati, respectively.

Table 4.1.10 reveals the distribution of the sample respondents and their frequency of extension visits. The table shows the categorization of respondents into low, medium and high categories with the maximum numbers of respondents on the low category followed by medium and high categories respectively. In the low category, Kohima district is found to be maximum followed by Senapati, Thoubal and Dimapur districts. Whereas in the medium category, Dimapur district is found to be maximum followed by Senapati, Thoubal and Kohima districts. In the high category, Dimapur district is recorded highest followed by Senapati, Kohima and Thoubal district, respectively.

Table 4.1.11 shows the distribution of the Sample respondents in organic cultivation training and it is categorized into 3 categories, as low, medium and high respectively. The table reveals that the maximum numbers of the sample respondents are in the medium category followed by low category and high category respectively. In the low category, Senapati district is the highest followed by Thoubal, Kohima and Dimapur, respectively; whereas in the medium category, Kohima district is found to be maximum followed by

4.1.9. Farmers' Network of the sample respondents

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Low	4	41	45	12	37	49	94 **(31.33)**
2	Medium	20	48	68	31	59	90	158 **(52.67)**
3	High	26	11	37	7	4	11	48 **(16.00)**
	Total	50	100	150	50	100	150	300 **(100.00)**

4.1.10. Frequency of the Extension Visits on the sample respondents farm

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Low	12	82	94	29	73	102	196 **(65.00)**
2	Medium	23	13	36	17	19	36	72 **(24.00)**
3	High	15	5	20	4	8	12	32 **(10.00)**
	Total	50	100	150	50	100	150	300 **(100.00)**

Figures inside the parentheses indicate percentage to the total

4.1.11. Farmers' training in Organic Cultivation on the sample respondents farm

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Low	12	19	31	29	65	94	125**(41.00)**
2	Medium	22	73	95	17	27	44	139**(46.00)**
3	High	16	8	24	4	8	12	36**(12.00)**
	Total	50	100	150	50	100	150	300 **(100.00)**

Figures inside the parentheses indicate percentage to the total

4.1.12. Number of labours /work-force of the sample respondents

Sl. No	Category	Dimapur	Kohima	Nagaland	Thoubal	Senapati	Manipur	Total
1	Only 1	0	1	1(0.66)	0	0	0	1
2	2-3 labour	59	20	79(52)	24	41	65(43)	144
3	4-5 labour	41	27	68(45)	25	54	79(52)	147
4	6 & Above	0	2	2(1.33)	1	5	6(4)	8
	Total	100	50	150	50	100	150	300

Senapati, Dimapur and Thoubal district. In case of high category, Dimapur district rank first followed equally by Senapati and Kohima and Thoubal district, respectively.

Table 4.1.12 reveals the distribution of the numbers of labours work-force of the sample respondents with 4 categories (*i.e*. only 1; 2 to 3 labours; 4to 5 labours and 6 & above labours) respectively. The table shows that the maximum numbers of labours work-force comes under the III-category (*i.e*. 4 to 5 labours) followed by II-category (2 to 3 labours), IV- category (6 & above) and I-category (only 1 labour). In the I-category, only Kohima district has labour with 1 member, whereas in the II-category, Dimapur district is having the maximum number of work-force followed by Senapati, Thoubal and Kohima districts respectively. In the Case of III-category, Senapati district is the highest followed by Dimapur, Kohima and Thoubal districts. Again, in the IV-category, Senapati district is found to be highest followed by Kohima and Thoubal district, respectively.

4.2. To estimate the Costs and returns of the various levels of farm's for the selected horticultural crops *viz*. pineapple, potato and cabbage,

Table 4.2.1 shows the cost structures of different horticulture crops (pineapple, potato and cabbage) in Nagaland state. Further the cost concepts reveal that maximum cost investment is on labour charges followed by seed, FYM, interest on working capital, depreciation on farm implements while least cost is found on plant protection measures on different farm size groups. Whereas on pineapple farm, maximum cost is recorded with increase in farm size group as a trend, and even it was the same trend on potato and cabbage farm size group. Therefore, the cost follows increasing trend with the increase in the farm size group in the Nagaland state. The total cost also follows almost the same trend. Among the different horticulture Crops, potato is high input investment crop as compare to pineapple and cabbage. Even the different cost

Table 4.2.1 Cost structure for different horticultural crops in Nagaland state

S N.	Items of cost	Pineapple				Potato				Cabbage			
		Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.
1.	Seeds	3770 (10.32)	3699 (9.11)	3466.6 (8.62)	3645.2 (9.12)	10665 (20.56)	11725 (21.54)	12160 (23.02)	12015 (22.42)	2300 (5.66)	1870.89 (4.37)	1765.57 (4.07)	1978.79 (4.66)
2.	FYM	-	2000 (4.92)	1560 (3.88)	1780 (4.40)	3000 (5.78)	3450 (8.33)	3657 (6.92)	3369 (6.28)	2000 (4.92)	2100 (4.90)	2300 (5.31)	2133.3 (5.02)
3.	Fertilizer	-	-	-	-	-	-	-	-	-	-	-	-
4.	Plant protection measures	-	300 (0.73)	450 (1.10)	375 (0.93)	-	-	-	-	-	-	-	-
5.	Stacking materials	--	-	-		1230 (2.37)	1400 (2.57)	1000 (1.89)	1210 (2.25)	-	-	-	-
6.	Labour i)Haired	7006.5 (19.19)	8619.5 (21.23)	9785 (24.34)	8470.33 (21.21)	8308.5 (16.01)	9930.5 (18.24)	10940.7 (20.72)	9726.56 (18.15)	7997.5 (19.68)	8317.9 (19.44)	8619.5 (19.90)	8311.63 (19.58)
7.	Deprecation,implement	410.74 (1.12)	662.55 (1.63)	754.55 (1.87)	609.28 (1.52)	358.81 (0.69)	408.45 (0.75)	457.79 (0.86)	424.64 (0.79)	670.65 (1.65)	641.43 (1.49)	543.54 (1.25)	618.54 (1.45)
8.	Int on work capital	671.12 (1.83)	916.86 (2.25)	760.96 (1.8)	892.78 (2.23)	1413.73 (2.72)	1614.8 (2.96)	1692.92 (3.20)	1604.71 (2.99)	778.08 (1.91)	775.81 (1.81)	793.71 (1.83)	982.53 (2.31)
9.	Total cost A_1	11858.36 (32.48)	16197.91 (40.02)	16777.11 (41.74)	15772.59 (39.50)	24976.04 (48.15)	28528.78 (52.41)	29908.41 (56.64)	28349.92 (52.91)	13746.23 (33.83)	13706.03 (32.08)	14022.32 (32.38)	14024.79 (33.04)
10.	Cost A_2	11858.36	16197.91	16777.11	15772.59	24976.04	28528.78	29908.41	28349.92	13746.23	13706.03	14022.32	14024.79
11.	Rental value of owned land	1295 (3.54)	1200 (2.95)	1150 (2.86)	1215 (3.04)	1200 (2.31)	1300 (2.30)	1250 (2.36)	1250 (2.33)	1350 (3.30)	1400 (3.27)	1400 (3.20)	1383.33 (3.20)
12.	Cost B	13153.36 (36.02)	17397.91 (42.85)	17927.11 (44.60)	16987.59 (42.54)	26176.04 (50.46)	29828.78 (54.80)	31158.41 (59.01)	29599.92 (55.24)	15096.23 (37.15)	15106.03 (35.30)	15422.32 (35.62)	15408.12 (36.60)
13.	Imputed value of family labour	23355 (63.97)	23199.3 (57.14)	22265.1 (55.39)	22939.8 (57.09)	25690.5 (49.53)	24600.6 (45.19)	21642.3 (40.98)	23977.8 (44.75)	25534.8 (62.84)	27679 (64.69)	27870.3 (64.37)	27028.03 (63.69)
14.	Cost C	36508.36 (100.00)	40597.21 (100.00)	40192.21 (100.00)	39927.39 (100.00)3	51866.54 (100.00)	54429.38 (100.00)	52800.71 (100.00)	53577.71 (100.00)	40631.03 (100.00)	42785.03 (100.00)	43292.62 (100.00)	42436.15 (100.00)

items also follow the same trend. The cost C also have maximum on potato farm followed by cabbage and it was least on pineapple crop.

Table 4.2.2 reveals the cost, return, yield and benefit cost ratio of various horticulture crops (Pineapple, Potato and Cabbage) across different farm size groups (in Rs) for Nagaland state. The average yield of potato is maximum followed by cabbage and it was least in pineapple crop, while the average price is highest in pineapple followed by cabbage and least on potato fam. Even the gross return per hectare is maximum on potato farm followed by cabbage and least on pineapple, while the net returns also shows the same trend having maximum income on potato followed by cabbage and pineapple, but the net return per quintal was found maximum on pineapple followed by potato and least on cabbage farm. The farm business income is maximum on potato, followed by cabbage and least on pineapple farm. Same trend is followed for gaining farm labour income and its investment. The benefit cost ratio shows that pineapple is most profitable venture/enterprise followed by potato and cabbage. This trend shows that small size farm group gain more benefit as compare to marginal, medium pineapple farm, and even small farm also benefit more as compare to marginal and medium farm on cabbage crop, but on potato, marginal farmers manage well to get more benefit as compare to small and medium farm respectively.

Table 4.2.3 shows the cost structures of different horticulture crops (pineapple, potato and cabbage) in Manipur state. The table reveals that the maximum cost investment are in Seed and labour followed by fertilizers, FYM, interest on working capitals, plant protection measures and the least cost is found in the depreciation and repairs of farm implements on different farm size groups. Whereas on pineapple farm, maximum cost is recorded with increase in farm size group as a trend, and even it is the same trend on potato and

Table 4.2.2 Yield, Cost and Return of various horticultural crops across farm size group of Nagaland

S N.	Items of cost	Pineapple				Potato				Cabbage			
		Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.
1.	Average yield (q)	28.28	25.53	24.39	26.06	257.5	243.7	239.8	247	85.6	82.3	78.17	82.02
2.	Average price (per q)	3875	3875	4250	4000	1200	1200	1150	1183.33	1523.1	1632.4	1689.7	1615.067
3.	Gross income per hectare(Rs.)	109585	98928.75	110755	104240	309000	292440	275770	292287.51	130377.36	134346.52	132083.85	132467.79
4.	Net Income(Rs.)	73076.64	58331.54	70562.79	64312.6	452833.46	468307.12	469483.69	462995.88	89746.33	91561.49	88791.23	90031.63
5.	Net returns (Rs/q)	2584.03	2284.82	2893.10	2467.86	1758.57	1921.65	1957.81	1874.47	1048.43	1112.53	1135.87	1097.67
6.	Farm business income(Rs.)	97726.44	82730.84	93977.89	88467.41	479723.96	494207.72	492375.99	488223.68	116671.33	120640.49	118061.53	118443
7.	farm labour income(Rs.)	96431.64	81530.84	92827.89	87252.41	478523.96	492907.72	491125.99	486973.68	115281.13	119240.49	116661.53	117059.67
8.	Farm investment income(Rs.)	74371.64	59531.54	71712.79	65527.6	454033.5	469607.1	470733.7	464245.9	91096.33	92961.49	90191.23	91414.96
9.	B:C Ratio	1: 3.323	1: 3.423	1: 3.275	1: 3.241	1: 2.713	1: 2.566	1: 2.399	1: 2.494	1: 2.321	1: 2.531	1: 2.305	1: 2.412

Table 4.2.3 Cost structure for different horticultural crops in Manipur state

S N.	Items of cost	Pineapple				Potato				Cabbage			
		Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.
1.	Seeds	5660 (10.60)	6550 (9.68)	7392 (9.67)	6534 (9.69)	18559 (23.79)	18701 (19.1)	18218 (17.54)	18492.67 (19.63)	7447 (11.18)	7899 (11.00)	8109 (10.45)	7818.33 (10.72)
2.	FYM	-	2000 (2.95)	1560 (2.04)	1780 (2.64)	3000 (3.85)	3450 (3.52)	3657 (3.52)	3369 (3.57)	2000 (3.00)	2100 (2.92)	2300 (2.96)	2133.3 (2.92)
3.	Fertilizer	2100 (3.93)	6500.25 (9.61)	8400.32 (10.99)	5666.857 ((8.40)	1200 (1.54)	9456.78 (9.66)	12208.90 (11.78)	7621.89 (8.09)	6894 (10.35)	7175 (9.99)	7251 (9.34)	7106.66 (9.74)
4.	Plant protection measures	678.4 (1.27)	1345.98 ((1.9)	2000 (2.62)	1341.46 (1.99)	1228.75 (1.57)	2566.6 (2.62)	3276.6 (3.15)	2357.31 ((2.50)	898.81 (1.35)	942.31 (1.31)	1774.25 (2.28)	1205.12 (1.65)
5.	Stacking materials	--	-	-						-	-	-	-
6.	Labour i)Hired	6000 (11.23)	6750 (9.98)	9250 (12.10)	7333.33 (10.87)	9250 (11.86)	12500 (12.77)	13250 (12.76)	11666.67 (12.38)	6250 (9.38)	7250 (10.10)	9000 (11.59)	7500 (10.28)
7.	Deprecation, repair of implements etc.	910.74 (1.70)	1062.55 (1.57)	1094.55 (1.43)	1022.61 (1.51)	358.81 (0.46)	408.45 (0.41)	457.79 (0.44)	408.35 (0.43)	760.65 (1.14)	883.43 (1.2)	943.54 (1.22)	862.54 (1.18)
8.	Interest on working capital	920.94 (1.72)	1452.52 (2.14)	1781.81 (2.33)	1420.69 (2.10)	2015.79 (2.58)	2824.96 (2.88)	3064.09 (2.95)	2634.95 (2.79)	1455.02 (2.18)	1574.98 (2.19)	1762.66 (2.27)	1597.55 (2.19)
9.	Total cost A1	16270.08 (30.47)	25661.3 (37.95)	31478.68 (41.18)	25098.95 (37.23)	35612.35 (45.66)	49907.79 (51.00)	54132.38 (52.13)	46550.84 (49.42)	25705.48 (38.60)	27824.72 (38.76)	31140.45 (40.13)	28223.51 (38.68)
10.	Cost A2	16270.08	27961.3	34978.68	27998.95	35612.35	52207.79	57632.38	49450.84	25705.48	30124.72	34640.45	31123.51
11.	Rental value of owned land	3375 (6.30)	3400 (5.02)	3450 (4.51)	3408.3 (5.05)	3375 (4.32)	3400 (3.47)	3450 (3.32)	3408.3 (3.61)	3375 (5.06)	3400 (4.73)	3450 (4.44)	3408.3 (4.67)
12.	Cost B	19645.08 (36.79)	31361.3 (46.38)	38428.68 (50.28)	31407.25 (46.59)	38987.35 (49.99)	55607.79 (56.82)	61082.38 (58.82)	52859.14 (56.11)	29080.48 (43.67)	33524.72 (46.70)	38090.45 (49.09)	34531.81 (47.33)
13.	Imputed value of family labour	33750 (63.20)	36250 (53.61)	38000 (49.71)	36000 (53.40)	39000 (50.01)	42250 (43.17)	42750 (41.17)	41333.33 (43.88)	37500 (56.32)	38250 (53.29)	39500 (50.90)	38416.67 (52.66)
14.	Cost C	53395.08 (100.00)	67611.3 (100.00)	76428.68 (100.00)	67407.25 (100.00)	77987.35 (100.00)	97857.79 (100.00)	103832.4 (100.00)	94192.48 (100.00)	66580.48 (100.00)	71774.72 (100.00)	77590.45 (100.00)	72948.48 (100.00)

(Figure in the parentheses indicate percentage to the total)

cabbage farm size group. Therefore, the cost follows increasing trend with the increase in the farm size group in the Manipur state. The total cost also follows almost the same trend. Among the different horticulture Crops, potato is high input investment crop as compare to pineapple and cabbage. Even the different cost items also follow the same trend. The cost C also have maximum on potato farm followed by cabbage and it was least on pineapple crop.

Table 4.2.4 reveals the cost, return, yield and benefit cost ratio of various horticulture crops (Pineapple, Potato and Cabbage) across different farm size groups (in Rs) for Manipur state. The average yield of potato is maximum followed by cabbage and it was least in pineapple crop, while the average price is highest in potato followed by pineapple and least on cabbage fam. Even the gross income per hectare is maximum on potato farm followed by cabbage and least on pineapple, while the net returns also shows the same trend having maximum income on potato followed by cabbage and pineapple, but the net return per quintal was found maximum on potato followed by pineapple and least on cabbage farm. The farm business income is maximum on potato, followed by cabbage and least on pineapple farm and the same trend is followed for farm family labour income and farm investment income. The benefit cost ratio shows that cabbage is most profitable venture/enterprise followed by potato and pineapple. Also the small size farm group gain more benefit as compare to marginal, medium in pineapple farm, and even small farm also benefit more as compare to marginal and medium farm on potato crop, but on cabbage, medium farmers manage well to get more benefit as compare to small and marginal farmers respectively.

Table 4.2.4 Yield, Cost and Return of various horticultural crops across size group of Manipur

S N.	Items of cost	Pineapple				Potato				Cabbage			
		Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.	Marginal	Small	Medium	Avg.
1.	Average yield (q)	63.38	65.34	67.45	58.38	107.5	114.8	123.81	98.70	122.3	124.3	128.9	115.5
2.	Average price (per q)	2300	2212	2000	2170	3100	3045	3040	3061.67	1660	1500	1652	1604
3.	Gross income per hectare(Rs.)	145774	144532.08	134900	126684.6	333250	349566	376382.4	302186.82	203018	186450	212942.8	200803.6
4.	Net profits(Rs.)	92378.92	76920.8	58471.32	59277.35	255262.7	251708.2	272550	207994.3	136437.5	114675.3	135352.4	127855.1
5.	Farm business income(Rs.)	129503.9	118870.8	103421.3	101585.7	297637.7	299658.2	322250	255636	177312.5	158625.3	181802.4	172580.1
6.	Family labour income(Rs.)	126128.9	113170.8	96471.32	95277.35	294262.7	293958.2	315300	249327.7	173937.5	152925.3	174852.4	166271.8
7.	Farm investment income(Rs.)	95753.92	80320.8	61921.32	62685.65	258637.7	255108.2	276000	211402.6	139812.5	118075.3	138802.4	131263.4
8.	BCR on paid out cost	1:8.91	1:5.63	1:4.28	1:5.04	1:9.35	1:7	1:6.95	1:6.49	1:7.8	1:6.7	1:6.8	1:7.1
9.	BCR on total cost	1: 2.732	1: 2.613	1: 2176	1: 2.187	1: 2.427	1: 2.357	1: 2.362	1: 2.352	1: 2.304	1: 2.549	1: 2.724	1: 2.475

4.3 To analyze the resource-use-efficiency for the selected horticultural crops *viz*. pineapple, potato and cabbage

Cobb-Douglas Production Functions have been used in the present study for the assessment of the resource use efficiency of different horticultural crops *viz*; pineapple, potato and cabbage crops on different farm size groups in the selected area. The production function of different enterprises were fitted as regressing gross return (y), x_1, x_2, x_3, x_4, x_5 and x_6 in terms of rupees as independent variables on marginal, small and medium farm size groups as well as overall farm size group.

A. Resource production of horticultural production enterprise

The ordinary least square (O.L.S.) estimates of parameters of Cobb-Douglas type of production with respect to different farm size groups and overall farm size samples are presented in Table 4.3.1.

It is clear from the table that the value of co-efficient of multiple determinations (R^2) ranged from 99.56 per cent as maximum in marginal size group of Manipur state farm to 87.08 per cent as minimum of the selected sample in small farm size group of Nagaland state farm, which will be explaining the variation in the dependent variables by the selected independent variable chosen in the equation in different farm size groups and in overall farms too. Even in the Nagaland state the overall horticultural crop for farm size group was also explained 99.76 per cent of the sample farms, which shows as good fit of the selected model and found to be statistically significant at 1 per cent. The remaining variation of dependent variable might be due to other variables, which have been used in excess or not properly used.

The regression co-efficient of constant (a), along with inputs x_3 & x_5 all were found to be positively significant at 1 per cent level, which indicate that the model is good fit, while the inputs x_1, x_2 & x_4 were also found to be

Table 4.3.1 Elasticity Co-efficient of horticultural crops farm size groups in Nagaland

Sl. No.	No's of observation	Variables	Regression Co-efficiency	t-Statistics	R2
(i).	**Marginal farm size group**				
1.		a	-16384NS (5.09E+10)	-3.2E-07NS	0.995627*** (312.048)
2.		x1	0.025571NS (0.038727)	0.660283NS	
3.		x2	33.91158* (24.25238)	1.398279*	
4.		x3	3.17E+16NS (2.96E+16)	1.072674NS	
5.		x4	-42.0953NS (27.14217)	-1.55092NS	
6.		x5	44.36427*** (30.91366)	1.435103***	
7.		x6	244.4481*** (131.2289)	1.862762***	
	(Figures in Parenthesis indicates the Standard Error of regression Co-efficient) *(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent)*				

(ii).	***Small farm size group***				
1.		a	2723.806*** (3.912539)	1.886113***	
2.		x1	0.19939* (0.088797)	2.245466*	
3.		x2	4.847295* (3.912539)	1.238913*	
4.		x3	53.15255* (259.3595)	0.204938*	0.870789*** (1527.016)
5.		x4	-11.1585NS (67.17767)	-0.1661NS	
6.		x5	-1.0825NS (1.791139)	-0.60436NS	
7.		x6	6.654108* (17.58313)	0.378437*	
	(Figures in Parenthesis indicates the Standard Error of regression Co-efficient) *(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent)*				

(iii).	**Medium farm size group**				
1.		a	-5750.69NS (5319.275)	-1.0811NS	
2.		x1	0.095459NS (0.204114)	0.467673NS	
3.		x2	7.061947* (6.164715)	1.145543*	
4.		x3	25.75573*** (15.20491)	1.693909***	0.99505*** (849.6419)
5.		x4	16.18642*** (2.428331)	6.665657***	
6.		x5	45.66887*** (37.39815)	1.221153***	
7.		x6	4.768853* (3.139343)	1.519061*	
	(Figures in Parenthesis indicates the Standard Error of regression Co-efficient) *(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent)*				

(iv).	Overall farm size group				
1.	150	a	716.0078*** (947.6455)	3.246245***	0.947637*** (1787.897)
2.		x1	0.245545* (0.07564)	0.755565*	
3.		x2	1.398507* (1.995703)	0.700759*	
4.		x3	9.466241*** (4.491117)	2.10777***	
5.		x4	2.708045* (1.695795)	1.596917*	
6.		x5	10.34837** (15.08908)	0.685819**	
7.		x6	-0.38046NS (1.41825)	-0.26826NS	

(Figures in Parenthesis indicates the Standard Error of regression Co-efficient)
*(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent)*

positively significant at 10 per cent level, which indicate that overall model is good fit on the overall farm size group, respectively. Even the negative inputs returns and non-significant values, indicate that constant have very little role towards the gross return, besides the contribution of the constant is having the importance if all the selected inputs variables were kept as constant.

The regression co-efficient of x_5 & x_6 both were found to be highly significant at 1 per cent level of significance, x_2 is also found to be significant on the marginal farm size group, while other inputs on the farms has contributes less role on gross income, which was found to be statistically non-significant indicate that their role is very less to the return, even the investment of some inputs were found to be negative impact, so it is better to re-allocate the input variables for further investment and have the meaningful contribution with regard to the input investment by re-investment to the potential areas on marginal farm size group, respectively.

The regression co-efficient of input a (constant) was found to be positive with significant at 1 per cent level on small farm size group, which indicate that overall model is good fit, also the regression co-efficient of x_1, x_2, x_3 & x_6 all were found to be significant at 10 per cent level of significance on the small farm size group, even the negative inputs returns and non-significant values, indicate that constant have very little role towards the gross return, besides the contribution of the constant is having the importance if all the selected inputs variables were kept as constant.

Even the regression co-efficient of inputs x_3, x_4 & x_5 were found to be positive highly significant at 1 per cent level, which indicate that overall model is good fit, also the regression co-efficient of x_2 & x_6 both were found to be significant at 10 per cent level of significance on the marginal farm size group, respectively, even the negative inputs returns and non-significant values, indicate that constant have very little role towards the gross return, besides the

contribution of the constant is having the importance if all the selected inputs variables were kept as constant.

It is clear from the table 4.3.2. that the value of co-efficient of multiple determinations (R^2) ranged from 99.99 per cent as maximum in marginal size group of Manipur state farm to 94.55 per cent as minimum of the selected sample in medoum farm size group of Manipur state farms, which will be explaining the variation in the dependent variables by the selected independent variable chosen in the equation in different farm size groups and in overall farms too. Even in the Manipur state the overall horticultural crop for farm size group was also explained 99.97 per cent of the sample farms, which shows as good fit of the selected model and found to be statistically significant at 1 per cent. The remaining variation of dependent variable might be due to other variables, which have been used in excess or not properly used. By aggregating the cross-sectional data of all the farms in various farm size groups, production has been estimated for all the selected sample farms.

The regression co-efficient of constant (a) and inputs viz; x_2, x_3 and x_5 on overall farm size group were found to be statistically significant at 10 per cent level, the inputs were found statistically non-significant, shows less role of the input towards the gross return. The negative values indicate an alarm and also shows that either those inputs were utilized in excess amount or not used in the properly manner, so it is better to invest more to those prospect areas to get the better returns.

Even the regression co-efficient of constant (a) and input x_6 both were found to be positive highly significant at 1 per cent level, which indicate that overall model is good fit and the regression co-efficient of x_2 is found to be significant at 5 per cent level of significance, even the regression co-efficient of x_1 is also found to be significant at 10 per cent level of significance on the

Table 4.3.2 Elasticity Co-efficient of different farm size groups in Manipur

Sl. No.	No's of observation	Variables	Regression Co-efficiency	t- Statistics	R^2
(i).	**Marginal farm size group**				
1.		a	722.6128^{***} (241.2675)	2.995069^{***}	0.999967^{***} (16.71651)
2.		x_1	0.942542^{*} (0.023498)	40.11149^{*}	
3.		x_2	1.156315^{**} (0.122511)	9.438457^{**}	
4.		x_3	-0.6849^{NS} (0.770485)	-0.88892^{NS}	
5.		x_4	-7.75261^{NS} (2.923082)	-2.6522^{NS}	
6.		x_5	-9.39066^{NS} (4.15061)	-2.26248^{NS}	
7.		x_6	12.74165^{***} (3.522442)	3.617278^{***}	
	(Figures in parenthesis indicates the Standard Error of regression Co-efficient) *(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent level)*				

(ii).	**Small farm size group**				
1.		a	261.4756^{***} (98.52987)	2.65377^{***}	0.998825^{***} (66.51042)
2.		x_1	0.96716^{**} (0.016182)	59.76906^{**}	
3.		x_2	1.102792^{*} (0.198469)	5.55649^{*}	
4.		x_3	-0.57408^{NS} (0.696591)	-0.82413^{NS}	
5.		x_4	0.653858^{NS} (0.376943)	1.734635^{NS}	
6.		x_5	1.1719^{*} (0.250646)	4.675523^{*}	
7.		x_6	0.51656^{NS} (0.217086)	2.379517^{NS}	
	(Figures in parenthesis indicates the Standard Error of regression Co-efficient) *(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent level)*				

(iii).	**Medium farm size group**				
1.		a	-2863.69^{NS} (1538.522)	-1.86133^{NS}	
2.		x_1	0.203841^{NS} (0.06347)	3.211612*	
3.		x_2	3.841157** (1.680644)	2.285527**	
4.		x_3	4.266043* (4.18209)	1.020074*	
5.		x_4	-41.692^{NS} (33.66562)	-1.23842^{NS}	
6.		x_5	-3.62684^{NS} (3.485446)	-1.04057^{NS}	
7.		x_6	8.827077*** (1.386537)	6.366275***	0.945508*** (713.0072)
	(Figures in parenthesis indicates the Standard Error of regression Co-efficient) *(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent level)*				

(iv).	**Overall farm size group**				
1.	150	a	16.16413* (42.62756)	0.379194*	0.999662*** (69.96485)
2.		x_1	0.993629^{NS} (0.0084)	118.2938^{NS}	
3.		x_2	1.066331* (0.086997)	12.2571*	
4.		x_3	1.036308* (0.166168)	6.236491*	
5.		x_4	0.952754^{NS} (0.267153)	3.566325*	
6.		x_5	1.27755* (0.247783)	5.155922*	
7.		x_6	0.21086^{NS} (0.207801)	1.014721^{NS}	

(Figures in parenthesis indicates the Standard Error of regression Co-efficient)
*(*** Significant at 1 per cent, ** significant at 5 per cent and * significant at 10 per cent level)*

marginal farm size group, respectively, even the negative inputs returns and non-significant values, indicate that constant have very little role towards the gross return, besides the contribution of the constant is having the importance if all the selected inputs variables were kept as constant.

While the regression co-efficient of constant (a) was found to be positive highly significant at 1 per cent level, which indicate that overall model is good fit and the regression co-efficient of x_1, also found to be significant at 5 per cent level of significance and the regression co-efficient of x_2 and x_5 both were also found to be significant at 10 per cent level of significance on the small farm size group, respectively, even the negative inputs returns and non-significant values, indicate that constant have very little role towards the gross return, besides the contribution of the constant is having the importance if all the selected inputs variables were kept as constant.

Whereas the regression co-efficient of input x_6 is found to be positive highly significant at 1 per cent level, which indicate the model is good fit and the regression co-efficient of x_2 is found to be significant at 5 per cent level of significance and the regression co-efficient of x_3 is also found to be significant at 10 per cent level of significance on the small farm size group, respectively, even the negative inputs returns and non-significant values, indicate that constant have very little role towards the gross return, besides the contribution of the constant is having the importance if all the selected inputs variables were kept as constant.

B. Resource use efficiency

To evaluate how efficiently the farmers in Nagaland state of the study area have been utilizing their resources, the marginal value product (MVP) of an input was compared with its respective factor cost. An optimal use of that factor was indicated as the ratio approach unity. The value of ratio greater than unity meant that returns could be increased by using more of that resource and

for value of ratio will be less than unity indicates improper use of the resources. The marginal value products of a particular resource indicate the expected addition of that resource to the gross return caused by an addition of one unit of that resource, while other inputs are held constant. The marginal value products of these factors were computed by multiplying the regression coefficient of that resource with the geometric mean of gross return to the geometric mean of each resource. The computed MVP of different strategic variables is shown in table 4.3.3.

The value of MVP for x_2, x_5, x_6 and y all were found to be positive statistically significant in the Nagaland state towards the horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 4.20 to 147.00 in rupees towards the gross return on the overall farm size group, respectively, so it may be continue in future.

While the value of MVP for x_2, x_5 and x_6 all were found to be positively and statistically significant in the Nagaland state for horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 40.00 to 61.00 in rupees towards the gross return on the marginal farm size group, respectively, so it may be continue in future.

Whereas the value of MVP for x_2, x_4 and y all were found to be positively and statistically significant in the Nagaland state for horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 7.90 to 93.00 in rupees towards the gross return on the small farm size group, respectively, so it may be continue in future.

Even the value of MVP for x_2, x_3 and x_6 all were found to be positively and statistically significant in the Nagaland state for horticultural crops on

Table 4.3.3 Result of Marginal Value Product analysis of different farm size groups in Nagaland

S. No.	Variables	Geometric Mean	MVP	MFC	Efficiency
(i).	**Marginal farm**				
1.	x_1	7712.69	4.21915	98	0.04305
2.	x_2	239.363	932.569	23	40.5465
3.	x_3	49.4956	-420.76	22	-19.126
4.	x_4	118.756	7E+17	17	4.1E+16
5.	x_5	406.416	-11576	200	-57.881
6.	x_6	260.841	244.003	4	61.0008
7.	y	6635.75	-450560	24	-18773

(ii).	**Small farm**				
1.	x_1	10404.1	44.8628	98	0.45778
2.	x_2	1146.43	181.774	23	7.9032
3.	x_3	48.933	-182.76	22	-8.3072
4.	x_4	305.331	1594.58	17	93.7986
5.	x_5	1188.44	-4184.5	200	-20.922
6.	x_6	929.477	-8.1187	4	-2.0297
7.	y	16865.6	102143	24	4255.95

(iii).	**Medium farm**				
1.	x_1	14158.1	16.1802	98	0.1651
2.	x_2	1956.09	199.5	23	8.67391
3.	x_3	57.1146	727.599	22	33.0727
4.	x_4	516.804	-2339.4	17	-137.61
5.	x_5	1953.82	-3004.2	200	-15.021
6.	x_6	1713.19	91.4533	4	22.8633
7.	y	28374.6	-162457	24	-6769

(iv).	**Overall farm**				
1.	x_1	10419.3	45.7941	98	0.46729
2.	x_2	965.251	43.4703	10	4.34703
3.	x_3	50.306	-58.865	22	-2.6757
4.	x_4	284.781	-735.4	17	-43.259
5.	x_5	1079.68	2942.42	200	14.7121
6.	x_6	832.766	16.835	4	4.20875
7.	y	15744.8	22255.9	24	927.33

different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 22.86 to 86.00 in rupees towards the gross return on the medium farm size group, respectively, so it may be continue in future.

Also, similarly to evaluate how efficiently the farmers in Manipur state of the study area of have been utilizing their resources, the marginal value product (MVP) of an input was compared with its respective factor cost. An optimal use of that factor was indicated as the ratio approach unity. The value of ratio greater than unity meant that returns could be increased by using more of that resource and for value of ratio will be less than unity indicates improper use of the resources. The marginal value products of a particular resource indicate the expected addition of that resource to the gross return caused by an addition of one unit of that resource, while other inputs are held constant. The marginal value products of these factors were computed by multiplying the regression coefficient of that resource with the geometric mean of gross return to the geometric mean of each resource. The computed MVP of different strategic variables is shown in table 4.3.4.

The value of MVP for x_1, x_2, x_3, x_4, x_5 and y all were found to be positive statistically significant in the Nagaland state towards the horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 1.39 to 1.98 in rupees towards the gross return on the overall farm size group, respectively, so it may be continue in future.

While the value of MVP for x_1, x_2, x_6 and y all were found to be positively and statistically significant in the Nagaland state for horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 1.38 to

Table 4.3.4 Result of Marginal Value Product analysis of different farm size groups in Manipur

S. No.	Variables	Geometric Mean	MVP	MFC	Efficiency
(i).	**Marginal farm**				
1.	x_1	2757.18	155.519	98	1.58693
2.	x_2	330.073	31.7986	23	1.38255
3.	x_3	36.312	-18.835	22	-0.8561
4.	x_4	98.3419	-170.56	17	-10.033
5.	x_5	369.376	-2582.4	200	-12.912
6.	x_6	283.641	70.0791	4	17.5198
7.	y	4652.31	19871.9	24	827.994

(ii).	**Small farm**				
1.	x_1	4976.64	217.611	98	2.22052
2.	x_2	583.298	41.3547	23	1.79803
3.	x_3	36.2255	-21.528	22	-0.9786
4.	x_4	95.5636	19.6157	17	1.15387
5.	x_5	762.246	439.463	200	2.19731
6.	x_6	550.167	3.8742	4	0.96855
7.	y	8418.94	9805.34	24	408.556

(iii).	**Medium farm**				
1.	x_1	7772.05	34.5511	98	0.35256
2.	x_2	919.278	108.513	23	4.71794
3.	x_3	78.0913	120.516	22	5.47799
4.	x_4	88.9051	-942.24	17	-55.426
5.	x_5	1284.39	-1024.6	200	-5.1229
6.	x_6	963.289	49.873	4	12.4682
7.	y	13452.2	-80899	24	-3370.8

(iv).	**Overall farm**				
1.	x_1	5336.71	185.312	100	1.85312
2.	x_2	629.176	33.1451	23	1.44109
3.	x_3	46.8111	32.2119	22	1.46418
4.	x_4	93.6476	23.6918	17	1.39364
5.	x_5	823.528	397.105	200	1.98553
6.	x_6	607.041	1.24531	4	0.31133
7.	y	9094.06	497.411	24	20.7255

1.75 in rupees towards the gross return on the marginal farm size group, respectively, so it may be continue in future.

Whereas the value of MVP for x_1, x_2, x_4, x_5 and y all were found to be positively and statistically significant in the Nagaland state for horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 1.15 to 2.20 in rupees towards the gross return on the small farm size group, respectively, so it may be continue in future.

Even the value of MVP for x_2, x_3, x_5 and x_6 all were found to be positively and statistically significant in the Nagaland state for horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 4.71 to 12.46 in rupees towards the gross return on the medium farm size group, respectively, so it may be continue in future.

4.4. To study the income and employment patterns for selected horticultural crops *viz*. pineapple, potato and cabbage

Table 4.4.1 highlighted the employment (Mandays / annum) and income (Rs / annum) levels of the sample respondents in Nagaland and Manipur state. The employment level of the farm households have been respectively categorized into 3 groups (low-upto 180; medium-181 to 237 and high-230 & above). It is found that the maximum numbers of farm households for the selected horticultural crops of Nagaland is in the high category followed by medium category and the least is in the low category. The same pattern is also found in the state of Manipur as high, medium and low level of employments.

In case of the pineapple crop, maximum employment to the farm households is in the medium category wherein Dimapur district is the highest

Table 4.4.1 Income and Employment level of Sample respondents in the study area

(N = 300)

S. N.	Particulars	Pineapple crop		Potato crop		Cabbage crop		Overall	
		Dimapur	Thoubal	Kohima	Senapati	Kohima	Senapati	Nagaland	Manipur
A.	**Employment (Mandays / Annum)**								
1.	Low (180<)	8	12	21	32	19	22	29	44
2.	Medium (181 - 237)	24	22	34	29	47	37	58	51
3.	High (238 <)	18	16	45	39	34	41	63	55
Total		50	50	100	100	100	100	150	150
B.	**Income (Rs. / Annum)**								
1.	Low (< 11058)	9	11	22	33	20	24	31	44
2.	Medium (11058 - 18456)	24	23	35	31	45	37	59	54
3.	High (18456<)	17	16	43	36	35	39	60	52
Total		50	50	100	100	100	100	150	150

followed by Thoubal district and least employment is in the low category. But in potato crop, maximum employment is offered to the high category group of which Nagaland Kohima district farm household is the highest and followed by Senapati district of Manipur respectively. However, the employment level given by the cabbage crop is maximum to the medium category wherein Kohima district is the highest followed by the Senapati district, respectively.

The income level (Rs / annum) of the farm households for the selected horticultural crops is also categorized into 3 groups (*i.e*. low-upto Rs. 11058; medium-Rs. 11058 to Rs. 18456 and high-Rs. 18456 & above). For the Nagaland state, the maximum number of farm households comes under the high category and followed by medium and low categories respectively. Whereas, it is found maximum in the medium level category and followed by high and low categories respectively for the state of Manipur.

In case of the pineapple crop, maximum households come into the medium category of which Dimapur district of Nagaland is the highest and followed by Thoubal district of Manipur and the least comes into the low category farm households. Whereas, the maximum households come into the high level farm households of Kohima district for the potato crops followed by medium level and the least is found in the low level.

For the potato crop, maximum farm households comes in the high level of income of which Kohima district is the highest and followed by Senapati district respectively whereas the least farm households comes in the low level of income groups.

Again for the Cabbage crop, the highest number of farm households is in the medium income level of which Kohima district of Nagaland rank first and followed by the Senapati district of Manipur respectively. The least farm households come under the low income level group.

Table 4.4.2 shows the impact of income and employment status during the selected period of Nagaland and Manipur. Further the data reveals that potato farming in Manipur is more profitable than Nagaland and it's almost 50.00 per cent of total investment which was found statistically significant at 1.00 per cent. Again, pineapple enterprise is also found profitable and it is around 26.00 per cent of the investment in Manipur as compare to Nagaland whereas cabbage crop also show 10.00 per cent enhancement against the input investment in Manipur as compare to Nagaland respectively. All the selected crops (Potato, Pineapple and Cabbage) are found statistically significant at 1.00 per cent with respect to income.

Even the employment also shows same trend of income with an increment of 45.00 per cent additional profit of employment due to the management and labour cost, whereas pineapple also shows 27.00 per cent additional employment in Manipur as compare to Nagaland. Even the cabbage enterprise also shows 10.00 per cent additional employment as compare to Nagaland in Manipur. All the selected crops (Potato, pineapple, cabbage) are found statistically significant at 1.00 per cent with respect to employment.

Table 4.4.3 highlighted the impact on employment and income status over a selected period for the selected horticultural crops of Nagaland and Manipur. Overall, for the impact on income is concerned, Nagaland has gain 42.00 per cent as against the 36.67 per cent in Manipur on high income group and among the medium income group is concerned, Nagaland has achieved 38.67 per cent as compare to 34.00 per cent of Manipur. Again it is recorded 29.33 per cent on Manipur as against the 19.33 per cent in Nagaland for enhancement in low income group and employment generation during the study period.

In case of the different crops, maximum employment is gained on medium group for pineapple crop followed by potato crops. Whereas among

Table 4.4.2 Impact on Income and Employment Status over a Selected Period of three years

S. No	Parameters	Nagaland		Manipur		% Change	't' test
		Mean	SD	Mean	SD		
A.	**Income (Rs.)**						
1.	Pineapple crop	3192.50	1218.01	4330.05	2062.34	26.271	4.577963 **
2.	Potato crop	14670.83	9784.27	28279.17	21990.56	48.121	6.702508 **
3.	Cabbage crop	975.33	351.35	1093.33	481.83	10.793	3.085567 **
Total		20349.38	11415.22	35422.00	24216.08	42.552	4.942874 **
B.	**Employment (Rs.)**						
1.	Pineapple crop	21.283	8.120	28.867	13.749	27.327	5.215270 **
2.	Potato crop	58.683	39.137	113.117	87.962	45.251	5.679833 **
3.	Cabbage crop	21.867	9.636	24.383	8.784	10.126	2.260137 **
Total		110.39	55.53	170.73	101.21	35.339	4.156683 **

*NS - Non Significant & ** - Significant at 1 per cent level of significance.*

Table 4.4.3 Impact on Income and Employment Status over a Selected Period

S. N.	Particulars	Pineapple crop				Potato crop				Cabbage crop				Overall			
		Medziphema	Per cent	Thoubal	Per cent	Zakhama	Per cent	Mao-maram	Per cent	Zakhama	Per cent	Mao-maram	Per cent	Nagaland	Per cent	Manipur	Per cent
A.	Employment (Mandays / Annum)																
1	Low (180<)	8	16.00	12	24.00	21	21.00	32	32.00	19	19.00	22	22.00	29	19.33	44	29.33
2	Medium (181 - 237)	24	48.00	22	44.00	34	34.00	29	29.00	47	47.00	37	37.00	58	38.67	51	34.00
3	High (238 <)	18	36.00	16	32.00	45	45.00	39	39.00	34	34.00	41	41.00	63	42.00	55	36.67
Total		**50**	**100.00**	**50**	**100.00**	**100**	**100.00**	**100**	**100.00**	**100**	**100.00**	**100**	**100.00**	**150**	**100.00**	**150**	**100.00**
B.	Income (Rupees / Annum)																
1	Low (< 11058)	9	18.00	11	22.00	22	22.00	33	33.00	20	20.00	24	24.00	31	20.67	44	29.33
2	Medium (11058 - 18456)	24	48.00	23	46.00	35	35.00	31	31.00	45	45.00	37	37.00	59	39.33	54	36.00
3	High (18456<)	17	34.00	16	32.00	43	43.00	36	36.00	35	35.00	39	39.00	60	40.00	52	34.67
Total		**50**	**100.00**	**50**	**100.00**	**100**	**100.00**	**100**	**100.00**	**100**	**100.00**	**100**	**100.00**	**150**	**100.00**	**150**	**100.00**

the district is concerned, maximum employment gain is recorded in pineapple crop, followed by cabbage and the least is on the potato crop. The total employment is recorded maximum at Medziphema district and least in Thoubal. Whereas, it is found maximum for potato crop at Zakhama and followed by Mao-Maram in Manipur. Again, it is zakhama having maximum employment gain as compare to Mao-Maram.

However, the impact on income in Nagaland is concerned; it is recorded around 40.00 per cent enhancement on high income group followed by medium group and least on low income group, whereas in Manipur, 36.00 per cent income gain is recorded on medium group followed by high income group with 35.00 per cent and least on low income group.

So far crop income is concerned, it was recorded maximum on pineapple crop with 48.00 per cent at Medziphema towards medium income group followed by cabbage crop with 45.00 per cent at Zakhama, even in Manipur state, Thoubal district is also leading within the state for gaining maximum income with 46.00 per cent enhancement, followed by 39.00 per cent gain for cabbage crop at Mao-Maram on high income group. Again for the minimum income enhancement is concerned, it is Zakhama with the minimum of 20.00 per cent gain as compare to 22.00 per cent increase at Thoubal towards the low income group.

4.5. To study the farmers' perception for the selected horticultural crops viz. pineapple, potato and cabbage, and

Table 4.5.1 reveals the number and area allocated under selected horticulture crops on different farm size group. The total cultivated area is found maximum in Nagaland as compare to Manipur. The total overall land holding in Nagaland is recorded as 106.25 ha while in Manipur it is 92.18 ha of land recorded as per the data, wherein on medium farm, it has maximum holding

Table 4.5.1 Numbers and Area allocated under Horticultural crops cultivation on different farm size

S. N.	Area under horticultural crops cultivation (ha)	Nagaland				Manipur			
		Marginal	**Small**	**Medium**	**Total**	**Marginal**	**Small**	**Medium**	**Total**
1.	Pineapple crop	14	17	19	50	18	16	16	50
2.	Potato crop	22	32	46	100	43	34	23	100
3.	Cabbage crop	21	36	43	100	42	36	22	100
Total Cultivated area (ha)		6.16	10.71	17.10	33.97	8.10	10.40	13.60	32.10
Total area (ha)		9.68	23.04	39.56	106.25	19.35	22.10	18.63	92.18

with 39.56 ha, 23.04 ha on small farm and 9.68 ha on marginal farm in Nagaland. As Manipur is concerned, small farm with 22.10 ha of land is the highest followed by marginal with 19.35 ha and it was least on medium with 18.63 ha of land.

As households is concerned it was recorded maximum on medium farm, followed by small and marginal in Nagaland, while in Manipur, marginal farmers are maximum with equal no of small and medium group for pineapple crop. For the potato crop is concerned, maximum is found on medium group followed small and marginal in Nagaland. In case of Manipur, maximum is found on the marginal followed by small and medium respectively. Again for the cabbage crop growers, it was found maximum on medium, followed by small and the least in marginal in Nagaland. As Manipur is concerned, maximum growers was found for marginal followed by small and least on medium farm size group.

Table 4.5.2 reveals the numbers of ploughing / leveling for land preparation on the selected horticultural crops of Nagaland and Manipur. In Nagaland, up to 2 ploughing is found maximum followed by 3 ploughing and very few with 4 ploughing are found for pineapple crop. While in Manipur state, maximum ploughing is recorded at marginal farmers with 2 ploughing, followed by small and medium farm size group, as 3 times ploughing is concerned, marginal farmers are maximum followed equally by small and medium, whereas 4 ploughing is concerned, very few are doing 4 & above ploughing in Nagaland for the pineapple crop. Overall, up to 2 ploughing is found maximum in both the state followed by 3 ploughing and 4 & above ploughing, respectively.

Table 4.5.2 Numbers of ploughing / Level for land preparation

Sl. No.	Numbers of Ploughing / level for land	Nagaland				Manipur			
		Marginal	Small	Medium	Total	Marginal	Small	Medium	Total
(a).	**Pineapple crop:**								
1.	Up to 2	12	11	12	35	11	10	9	30
2.	2 to 3	2	6	5	13	5	4	4	13
3.	4 and above	0	0	2	2	2	2	3	7
	Total	14	17	19	50	18	26	16	50
(b).	**Potato crop:**								
1.	Up to 2	3	5	8	16	5	4	3	12
2.	3 to 4	17	23	31	71	36	27	18	81
3.	5 and above	2	4	7	13	2	3	2	7
(c).	**Cabbage crop:**								
1.	Up to 2	4	5	5	14	4	3	2	9
2.	3 and above	18	27	41	96	39	31	21	91

For the potato crop, 3 to 4 ploughing are found maximum in both the state. For 2 ploughing, maximum are found on medium and marginal for Nagaland and Manipur respectively. Very few are adopting 5 & more ploughng for potato crop in Manipur whereas it is found maximum in medium farm size group.

In case of cabbage, maximum is found with 3 & above ploughing on medium farm size followed by small and marginal in Nagaland state whereas in Manipur it is found maximum on marginal farm followed by small and medium. Less farm households practices 2 times ploughing in both the states.

Fig 4.5.3 reveal the extent of adoption of farm yard manure (in t / ha) across the different farm size group of Nagaland and Manipur. The data shows that the selected farm households use the FYM and are categorized as high (2.50 t & above), medium (1.26 t to 2.50 t) and low rate (up to 1.25 t) adopters respectively.

Even for the pineapple crop, maximum FYM is used by the medium adopters, followed by low adopter and very few are found in the high adopter of Nagaland state. With respect to the state of Manipur, maximum are medium rate adopter followed by low rate and it is least on high adopter of pineapple crop.

As for potato crop is concerned, medium farms were found maximum for medium rate adopter of FYM followed by low rate and very few are under high rate of adopter in Nagaland state. As Manipur is concerned, it is also found in the same trend with maximum on medium, followed by low and least on high rate adopter of FYM for potato crop.

As cabbage crop is concerned, it is also following the sane trend of pineapple and potato with maximum on medium rate, followed by low rate and

Table 4.5.3 Extent of adoption of FYM for the selected horticultural crops

Sl. No.	Average FYM rate (t/ha)	Nagaland				Manipur			
		Marginal	Small	Medium	Total	Marginal	Small	Medium	Total
(a).	**Pineapple crop**								
1.	High rate (≥2.51)	0	0	1	1	0	1	2	3
2.	Medium (1.26 - 2.50)	11	12	11	34	12	11	9	32
3.	Low (up to 1.25)	3	5	7	15	6	4	5	15
(b).	**Potato crop:**								
1.	High rate (≥2.51)	1	0	2	3	0	0	3	3
2.	Medium (1.26 - 2.50)	18	24	41	83	39	29	18	86
3.	Low (up to 1.25)	3	8	3	14	4	5	2	11
(c).	**Cabbage crop:**								
1.	High rate (≥2.51)	0	0	4	4	1	1	2	4
2.	Medium (1.26 - 2.50)	20	23	40	83	39	28	18	85
3.	Low (up to 1.25)	2	9	2	13	3	5	3	11

least on high rate on cabbage in Nagaland state. Even the Manipur also follow the same trend for cabbage crop.

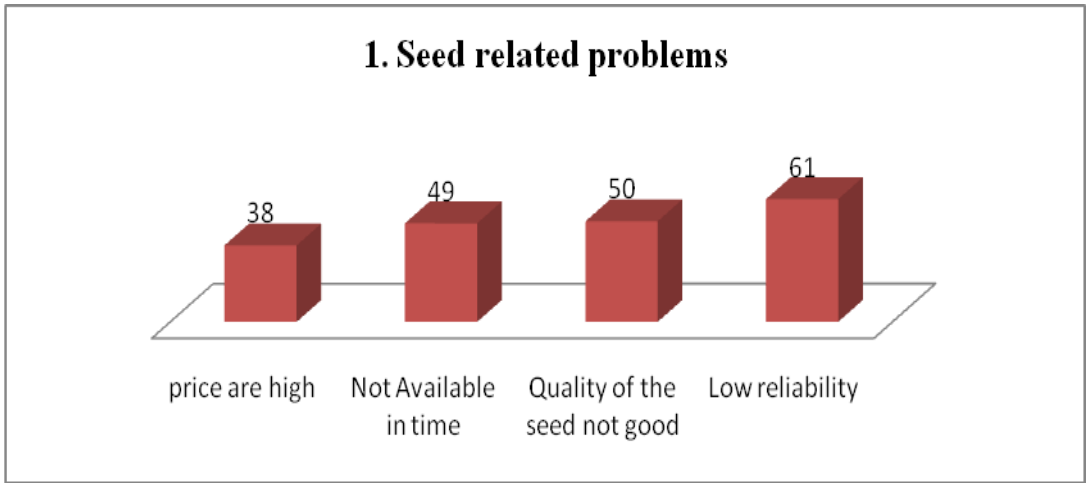
4.6. To analyze the problems and constraints faced by the various level of farm's for selected horticultural crops *viz*. pineapple, potato and cabbage

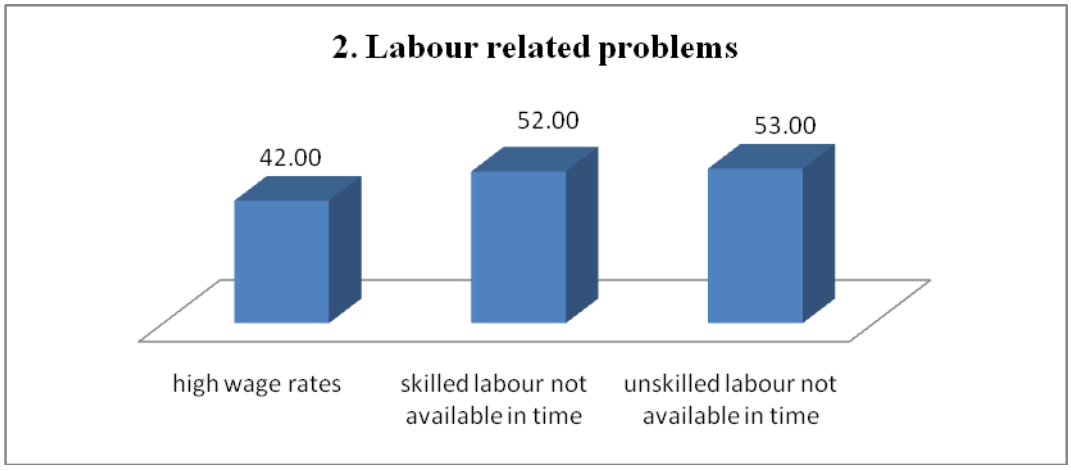
Table 4.6.1.A reveals the production related problems and constraints faced by the farm households for the pineapple crop of Manipur. The table highlighted the various problems / constraints; total score; average score and Garette ranking for the pineapple crop of Manipur. The problems and constraints are categorized into seed; labour; irrigation; manures & fertilizers; PPCs and other related problems.

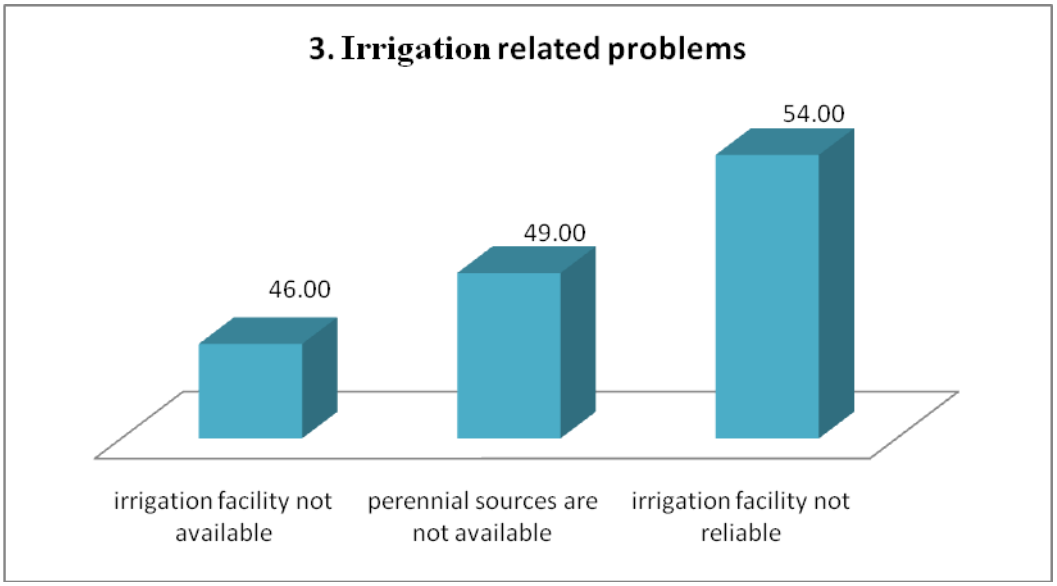
The results of the analysis shows that the high price of the seed ranked first followed by not available in time; inferior quality of seed and low reliability. In case of labour related problems, high wage rates of labour ranked first followed by the skilled labour not available in time and unskilled labour not available in time. Irrigation facility not available; perennial sources are not available and irrigation facility not reliable ranked I; II and III respectively in the irrigation related problems. In the manures and fertilizers related problems, high prices of organic sources; high transportation costs; inorganic fertilizers are not suitable; not available in proper time and desired brand not available ranked I; II; III; IV and V respectively. Again for the PPCs related problems, high price; don't know proper dose, time of application; don't know proper method of spraying; lack of knowledge about chemicals and desired brand not available ranked I; II; III; IV and V respectively. Among the other related problems, weeds, animals, anti-social & ethnic problems and Pests & Diseases ranked I, II, III and IV respectively.

Table 4.6.1.B depicted the production related problems and constraints faced by the farm households for the pineapple crop of Nagaland. The table

Fig (i): Graphs of Production Problems & Constraints of Pineapple-Manipur



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49.00
54.00
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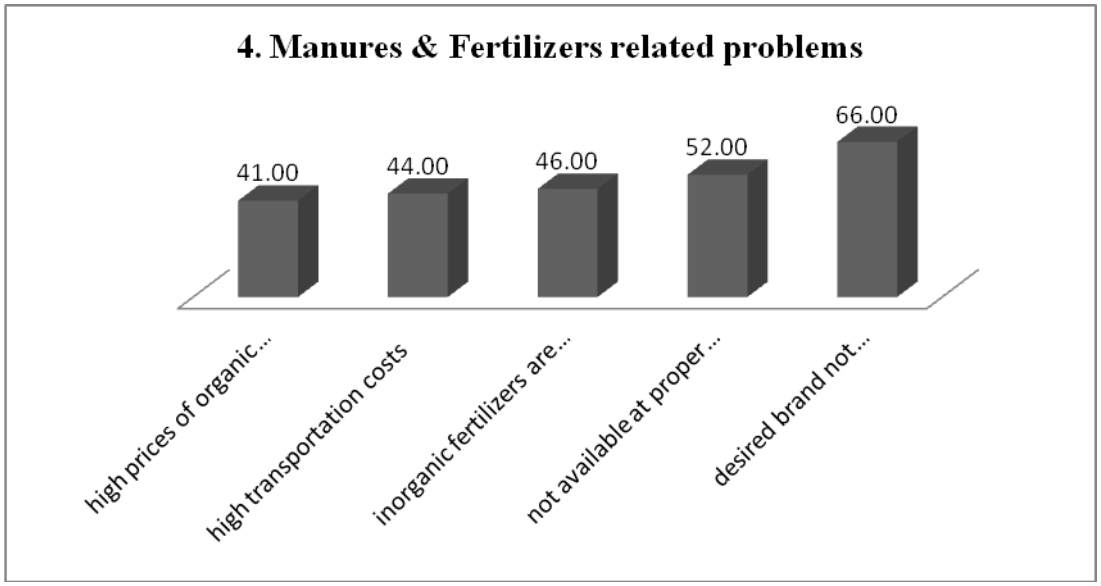
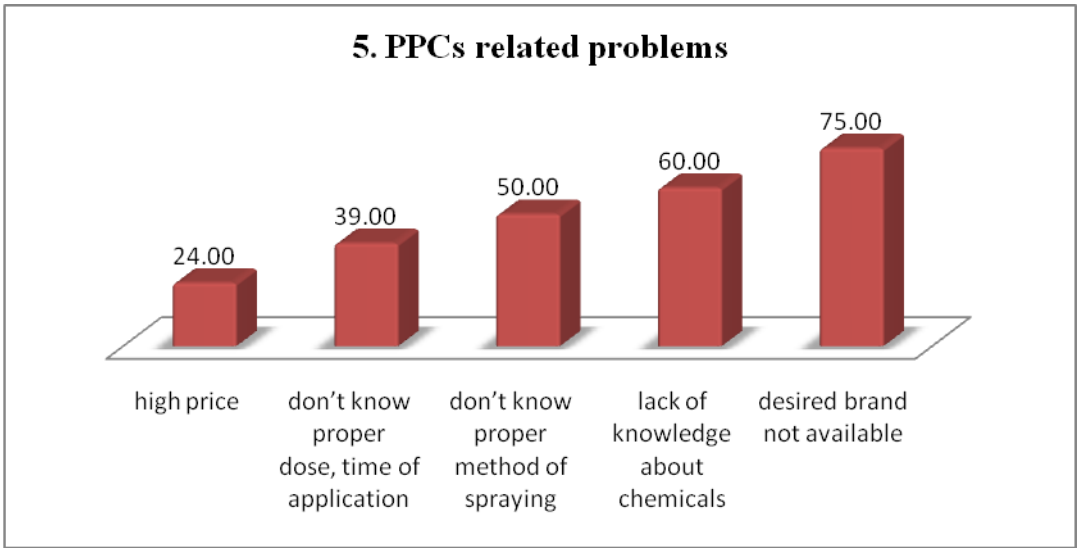
perennial sources are not available
irrigation facility not reliable


4. Manures & Fertilizers related problems
41.00
44.00
46.00
52.00
66.00
high prices of organic...
high transportation costs
inorganic fertilizers are...
not available at proper...
desired brand not...


5. PPCs related problems
24.00
39.00
50.00
60.00
75.00
high price
don't know proper dose, time of application
don't know proper method of spraying
lack of knowledge about chemicals
desired brand not available

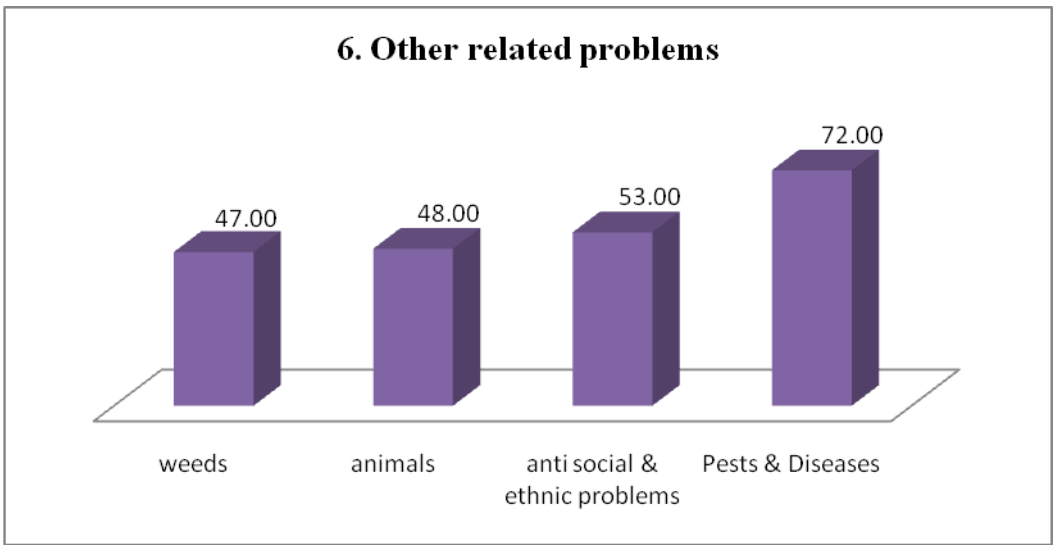
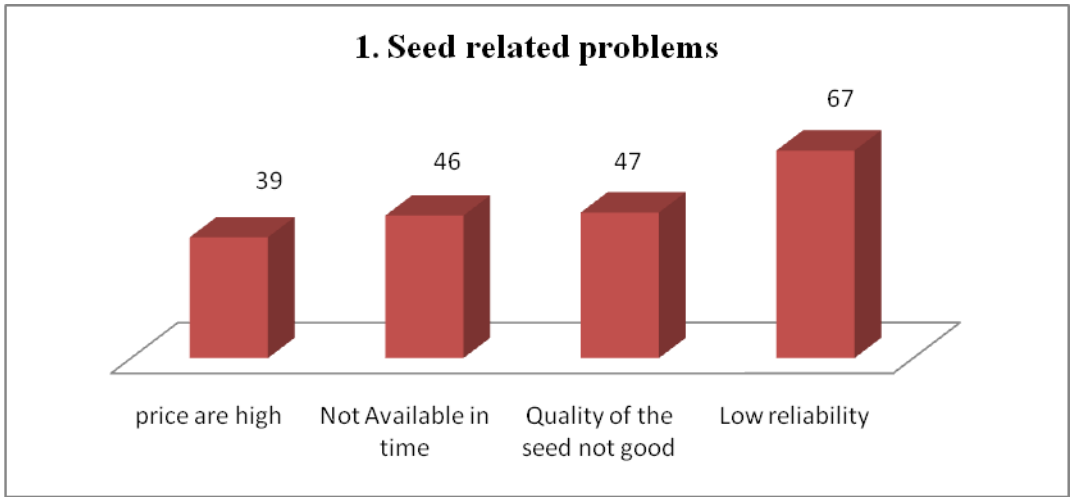

6. Other related problems
47.00
48.00
53.00
72.00
weeds
animals
anti social & ethnic problems
Pests & Diseases

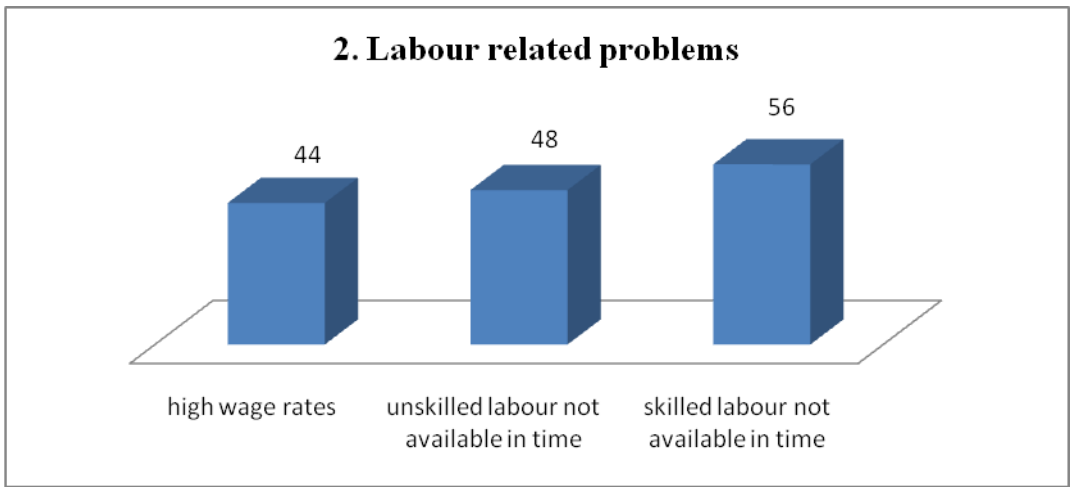
Table 4.6.1 Production related problems and constraints faced by the farmers

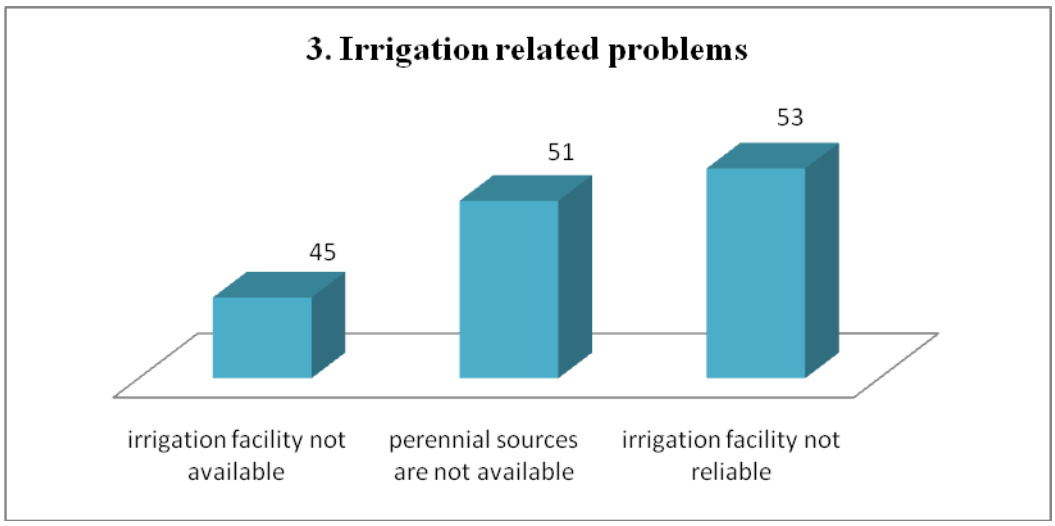
A. Production problems of pineapple for Waithou-Chiru Village-Manipur

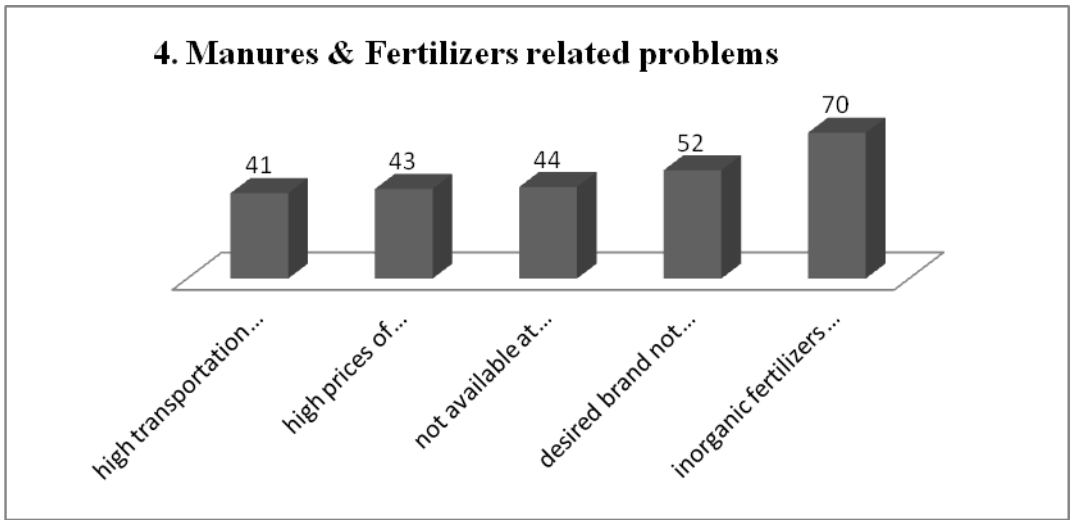
Sl. No	Problem / Constraints	Total Score	Average Score	Garette Ranking
1.	**Seed related**			
a.	Price are high	3625	38	I
b.	Not available in time	2525	49	II
c.	Quality of the seed not good	2450	50	III
d.	Low reliability	1400	61	IV
2.	**Labour related**			
b.	High wage rates	3233.33	42.00	I
a.	Skilled labour not available in time	2166.67	52.00	II
c.	Unskilled labour not available in time	2100.00	53.00	III
3.	**Irrigation related**			
A	Irrigation facility not available	2833.33	46.00	I
B	Perennial sources are not available	2600.00	49.00	II
C	Irrigation facility not reliable	2066.67	54.00	III
4.	**Manures & Fertilizers related**			
A	High prices of organic sources	3320.00	41.00	I
B	High transportation costs	3040.00	44.00	II
C	Inorganic fertilizers are not suitable	2820.00	46.00	III
D	Not available at proper time	2280.00	52.00	IV
E	Desired brand not available	1040.00	66.00	V
5.	**PPCs related**			
A	High price	4500.00	24.00	I
B	Don’t know proper dose, time of application	3500.00	39.00	II
C	Don’t know proper method of spraying	2500.00	50.00	III
D	Lack of knowledge about chemicals	1500.00	60.00	IV
E	Desired brand not available	500.00	75.00	V
6.	**Other related problems**			
A	Weeds	2760.00	47.00	I
B	Animals	2620.00	48.00	II
C	Anti social & ethnic problems	2120.00	53.00	III
D	Pests & diseases	625.00	72.00	IV

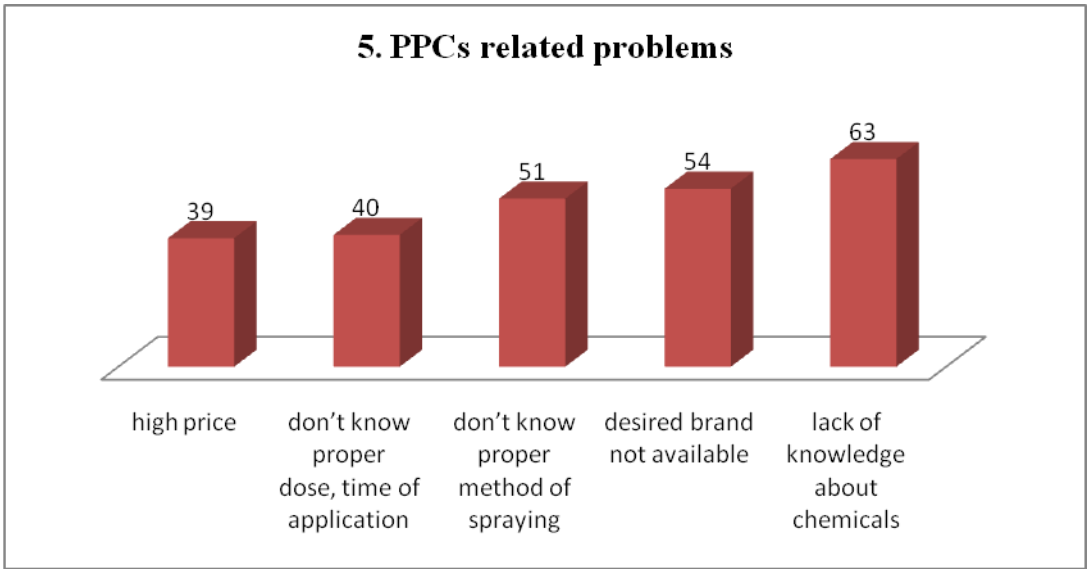
Fig (ii): Graphs of Production Problems & Constraints of Pineapple-Nagaland

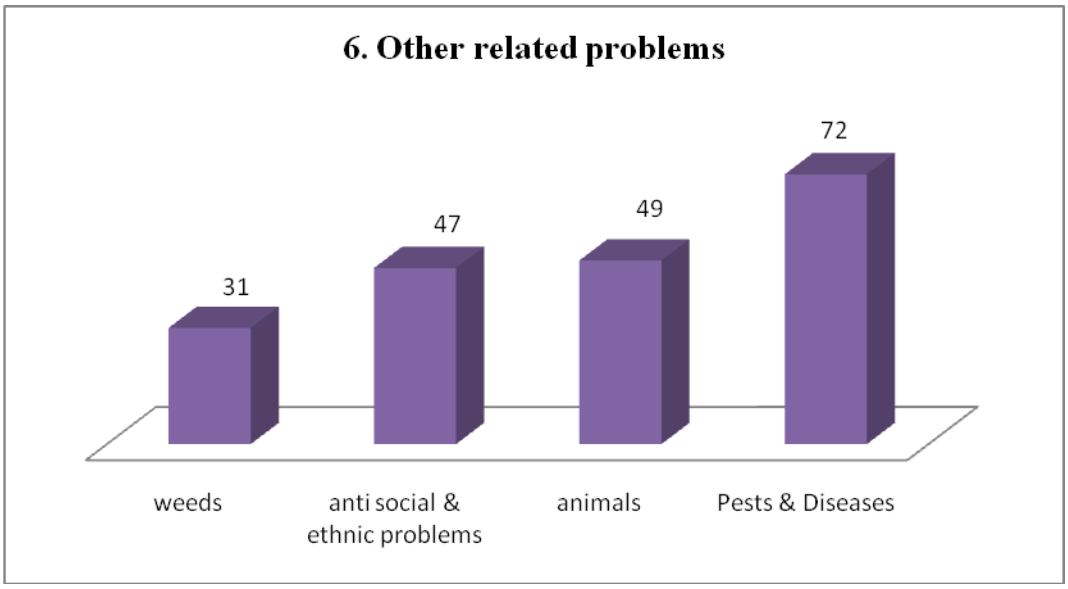





3. Irrigation related problems
45
51
53
irrigation facility not available
perennial sources are not available
irrigation facility not reliable


4. Manures & Fertilizers related problems
41
43
44
52
70
high transportation...
high prices of...
not available at...
desired brand not...
inorganic fertilizers...


5. PPCs related problems
39
40
51
54
63
high price
don't know proper dose, time of application
don't know proper method of spraying
desired brand not available
lack of knowledge about chemicals


6. Other related problems
31
47
49
72
weeds
anti social & ethnic problems
animals
Pests & Diseases

B. Production problems of pineapple for Molvom Village-Nagaland

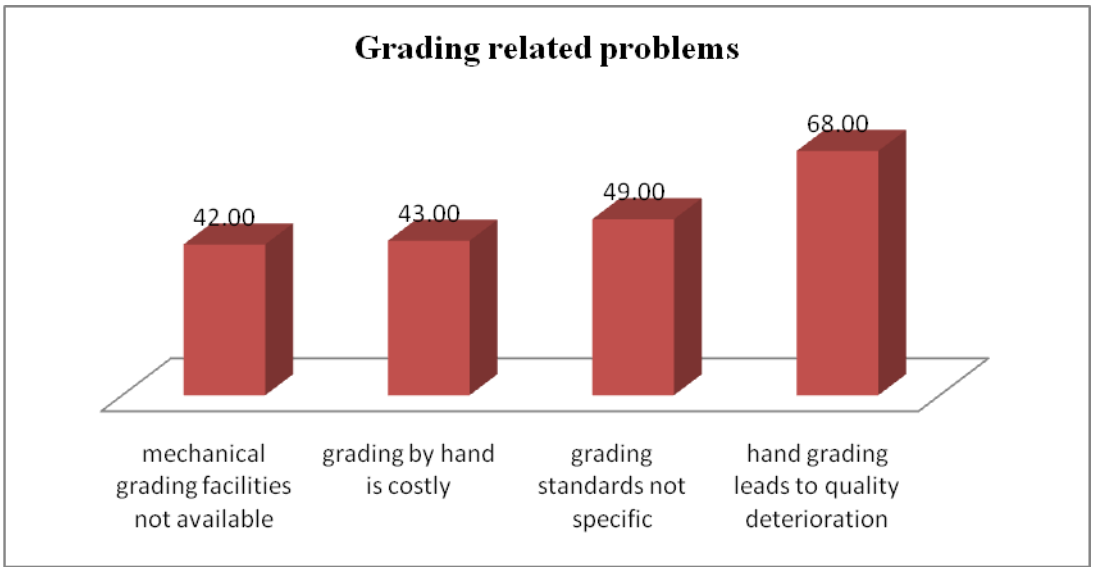
Sl. No	Problem/ Constraints	Total Score	Average Score	Garette Ranking
1.	**Seed related**			
a.	Low reliability	925	67	I
b.	Quality of the seed not good	2775	47	II
c.	Not available in time	2825	46	III
d.	Price are high	3475	39	IV
2.	**Labour related**			
a.	Skilled labour not available in time	1833.33	56	I
b.	High wage rates	3033.33	44	III
c.	Unskilled labour not available in time	2633.33	48	II
3.	**Irrigation related**			
a.	Irrigation facility not available	2966.67	45	I
b.	Perennial sources are not available	2366.67	51	II
c.	Irrigation facility not reliable	2166.67	53	III
4.	**Manures & Fertilizers related**			
A	High transportation costs	3320.00	41	I
B	High prices of organic sources	3160.00	43	II
C	Not available at proper time	3060.00	44	III
D	Desired brand not available	2220.00	52	IV
E	Inorganic fertilizers are not suitable	740.00	70	V
5.	**PPCs related**			
A	High price	3480.00	39	I
B	Don’t know proper dose, time of application	3400.00	40	II
C	Don’t know proper method of spraying	2380.00	51	III
D	Desired brand not available	2040.00	54	IV
E	Lack of knowledge about chemicals	1200.00	63	V
6.	**Other related problems**			
A	Weeds	4100.00	31	I
B	Anti social & ethnic problems	2750.00	47	II
C	Animals	2525.00	49	III
D	Pests & diseases	625.00	72	IV

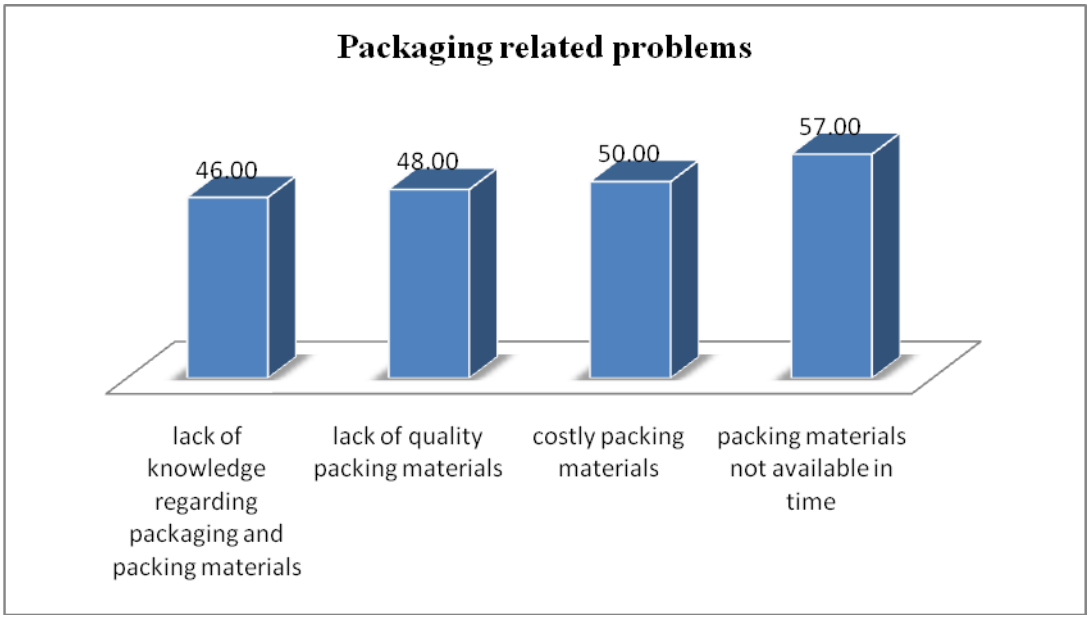
highlighted the various problems / constraints; total score; average score and Garette ranking for the pineapple crop of Manipur. The problems and constraints are categorized into seed; labour; irrigation; manures & fertilizers; PPCs and other related problems.

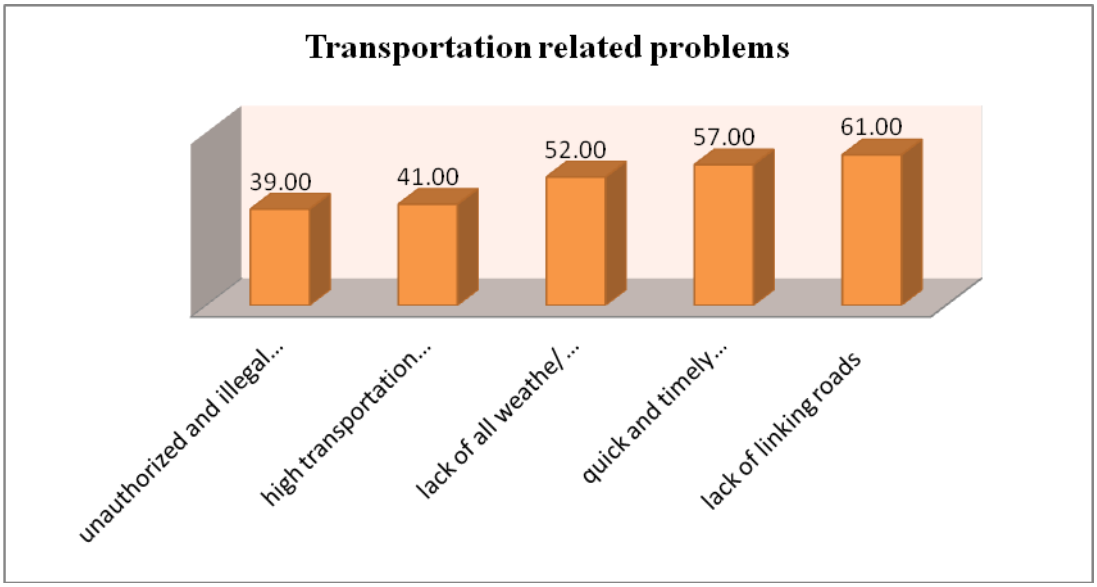
The results of the analysis shows that the low reliability of the seed ranked first, followed by quality of seed not good; not available in time and high price of the seed. In case of labour related problems, skilled labour not available in time ranked first followed by high wage rates of labour and unskilled labour not available in time. Irrigation facility not available; perennial sources are not available and irrigation facility not reliable ranked I; II and III respectively in the irrigation related problems. In the manures and fertilizers related problems, high transportation costs; high prices of organic sources; not available in proper time; desired brand not available and inorganic fertilizers are not suitable ranked I; II; III; IV and V respectively. Again for the PPCs related problems, high price; don't know proper dose, time of application; don't know proper method of spraying; desired brand not available and lack of knowledge about chemicals ranked I; II; III; IV and V respectively. Among the other related problems, weeds, anti-social & ethnic problems; animals and Pests & Diseases ranked I; II; III and IV respectively.

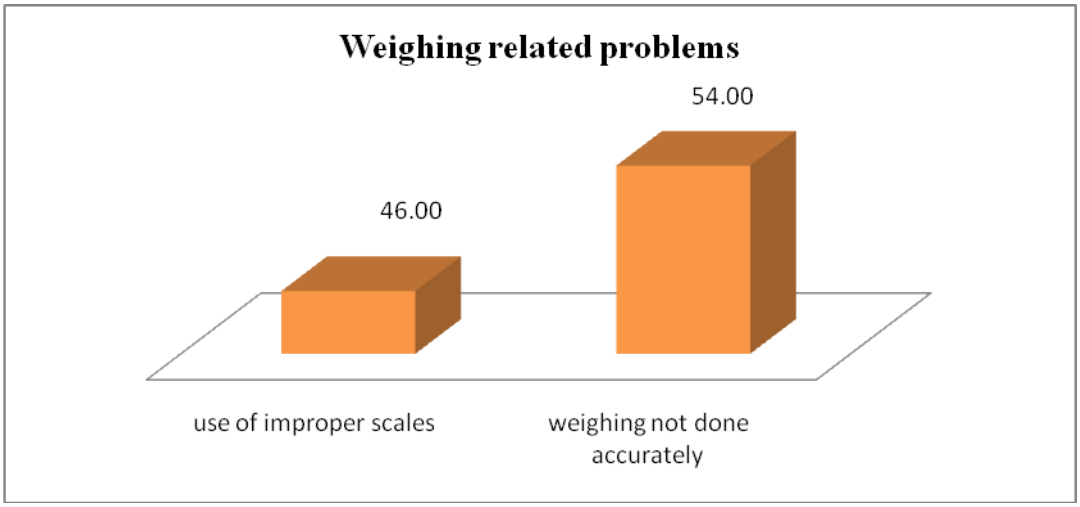
Table 4.6.2.A reveals the market related problems and constraints faced by the pineapple growers in the study area of Manipur. The table highlighted the grading; packaging; transportation; weighing; price; market information and other related problems along with the total score, average score and Garette ranking. The results of the analysis shows that mechanical grading facilities not available; grading by hand is costly; grading standards not specific and hand grading leads to quality deterioration ranked I; II; III and IV respectively in the grading related problems. In the packaging related problems, lack of knowledge regarding packaging and packing materials rank first followed by

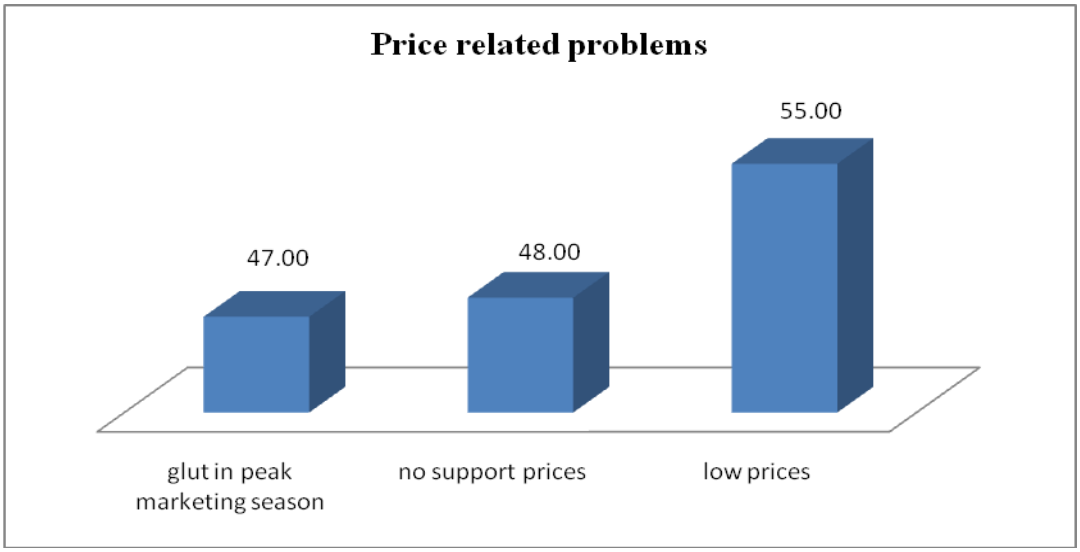
Fig (iii) Marketing Problems & Constraints of Pineapple- Manipur

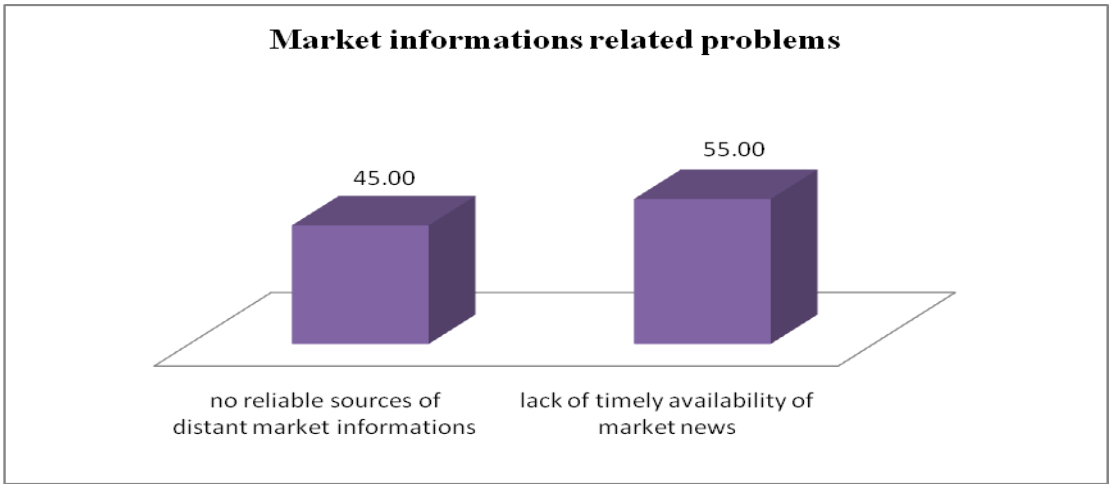





Transportation related problems
39.00
41.00
52.00
57.00
61.00
unauthorized and illegal...
high transportation...
lack of all weathe/...
quick and timely...
lack of linking roads


Weighing related problems
46.00
54.00
use of improper scales
weighing not done accurately


Price related problems
55.00
47.00
48.00
glut in peak marketing season
no support prices
low prices


Market informations related problems
55.00
45.00
no reliable sources of distant market informations
lack of timely availability of market news

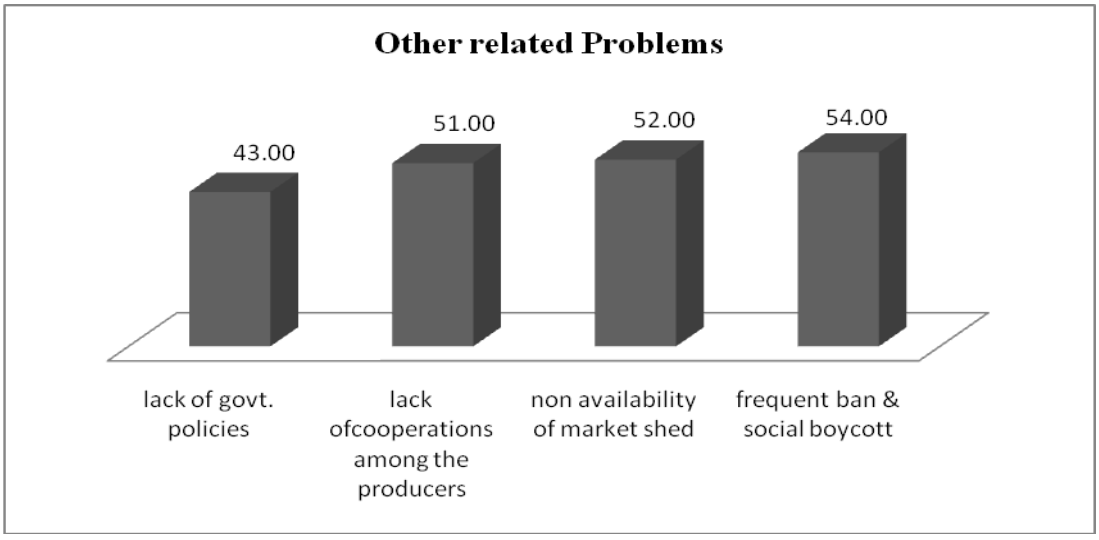

Other related Problems
51.00
52.00
54.00
43.00
lack of govt. policies
lack ofcooperations among the producers
non availability of market shed
frequent ban & social boycott

Table 4.6.2 Market related problems and constraints faced by the farmers

A. Marketing problems/constraints of pineapple for Waithou-Chiru Village-Manipur

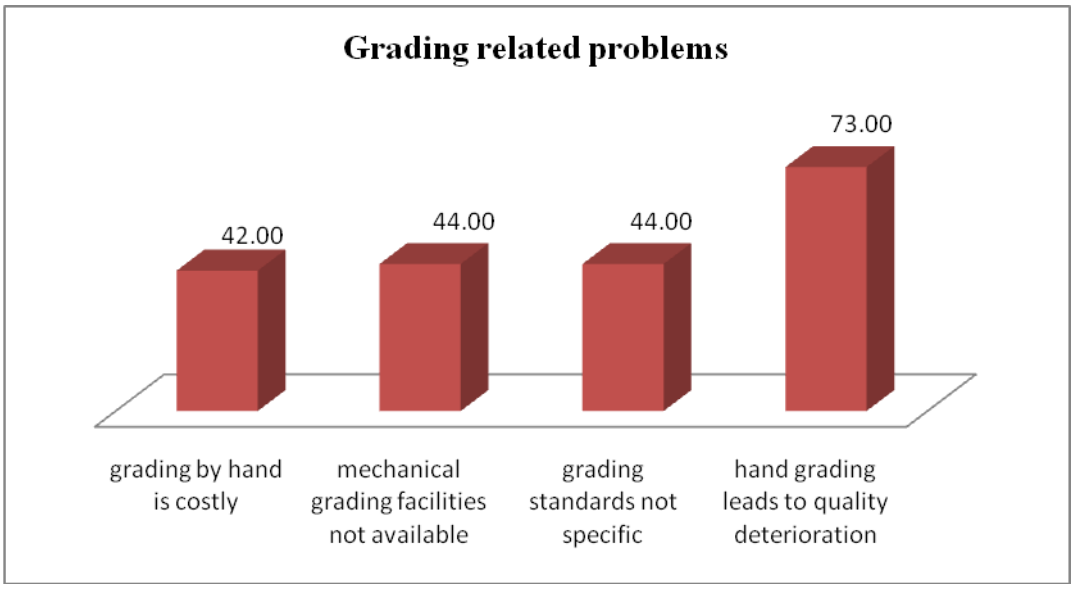
Sl. No	Problem/ Constraints	Total Score	Average Score	Garette Ranking
1.	**Grading related**			
A	Mechanical grading facilities not available	3275.00	42.00	I
B	Grading by hand is costly	3250.00	43.00	II
C	Grading standards not specific	2550.00	49.00	III
D	Hand grading leads to quality deterioration	925.00	68.00	IV
2.	**Packaging related**			
A	Lack of knowledge regarding packaging and packing materials	2925.00	46.00	I
B	Lack of quality packing materials	2725.00	48.00	II
C	Costly packing materials	2550.00	50.00	III
D	Packing materials not available in time	1800.00	57.00	IV
3.	**Transportation related**			
A	Unauthorized and illegal taxes	3560.00	39.00	I
B	High transportation charges	3400.00	41.00	II
C	Lack of all weather/ metallic roads	2280.00	52.00	III
D	Quick and timely transportation facilities not available	1840.00	57.00	IV
E	Lack of linking roads	1420.00	61.00	V
4.	**Weighing related**			
A	Use of improper scales	2950.00	46.00	I
B	Weighing not done accurately	2050.00	54.00	II
5.	**Price related**			
A	Glut in peak marketing season	2800.00	47.00	I
B	No support prices	2700.00	48.00	II
C	Low prices	2000.00	55.00	III
6.	**Market informations related**			
A	No reliable sources of distant market informations	3000.00	45.00	I
B	Lack of timely availability of market news	2000.00	55.00	II
7.	**Other related Problems**			
A	Lack of govt. policies	3200.00	43.00	I
B	Lack of cooperations among the producers	2450.00	51.00	II
C	Non availability of market shed	2300.00	52.00	III
D	Frequent ban & social boycott	2050.00	54.00	IV

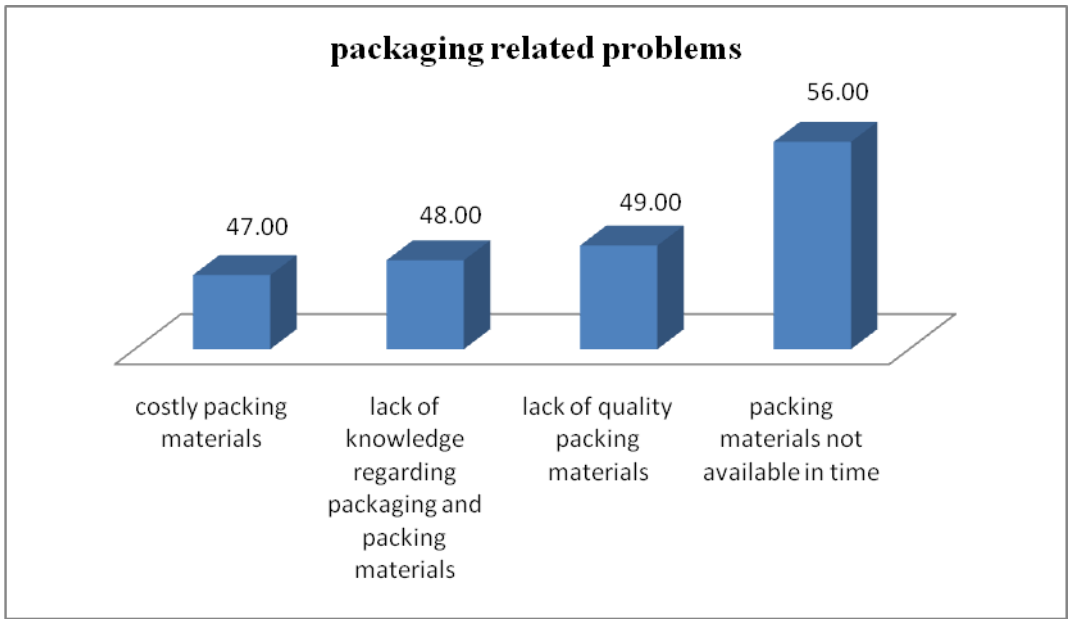
lack of quality packing materials; costly packing materials and packing material not available in time. Unauthorized and illegal taxes; high transportation charges, lack of weather / metallic roads and quick and timely transportation facilities not available and lack of linking roads ranks I; II; III; IV and V respectively for the transportation related problems.

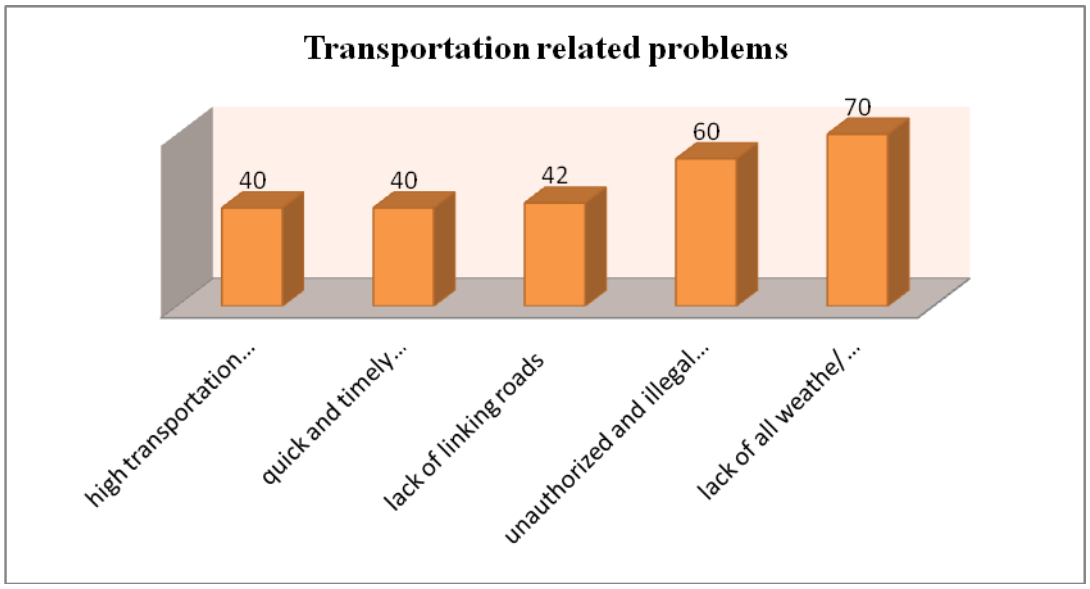
In the weighing related problems, use of improper scales and weighing is not done accurately rank I and II respectively. Also the glut in peak marketing season, no support prices and low prices rank I; II and III respectively in the price related problems. In case of market information related problems, no reliable sources of distant market information rank first followed by lack of timely availability of market news. Among the other related problems, lack of govt. policies; lack of cooperation among the producers; non availability of market shed and frequent ban & social boycott rank I; II; III and IV, respectively.

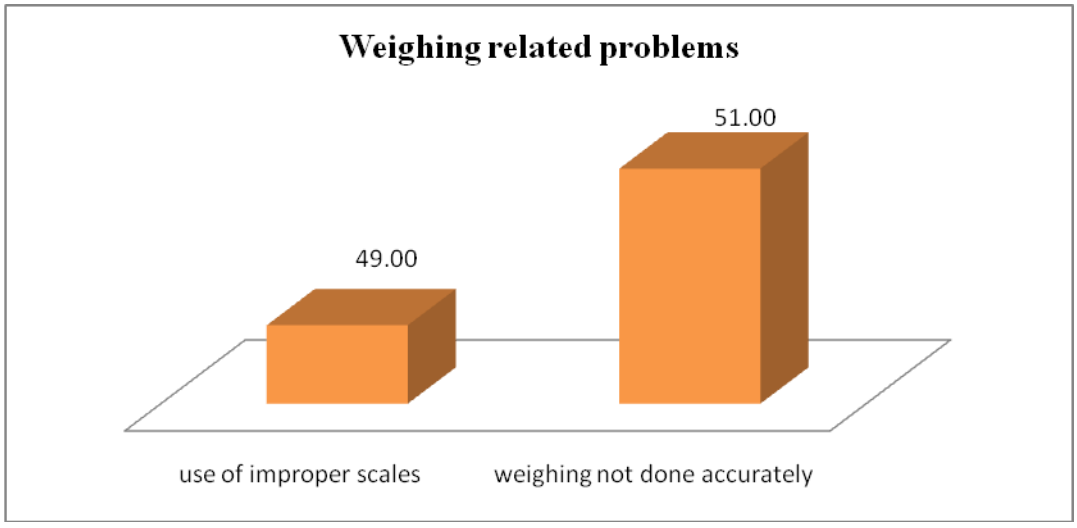
Table 4.6.2.B reveals the market related problems and constraints faced by the pineapple growers in the study area of Nagaland. The table highlighted the grading; packaging; transportation; weighing; price; market information and other related problems along with the total score, average score and garette ranking. The results of the analysis shows that grading by hand is costly, mechanical grading facilities not available; grading standards not specific and hand grading leads to quality deterioration ranked I; II; III and IV respectively. In the packaging related problems, costly packing materials rank first followed by lack of knowledge regarding packaging and packing materials; lack of quality packing materials; and packing material not available in time. High transportation charges; quick and timely transportation facilities not available ; lack of linking roads; unauthorized and illegal taxes and lack of weather /

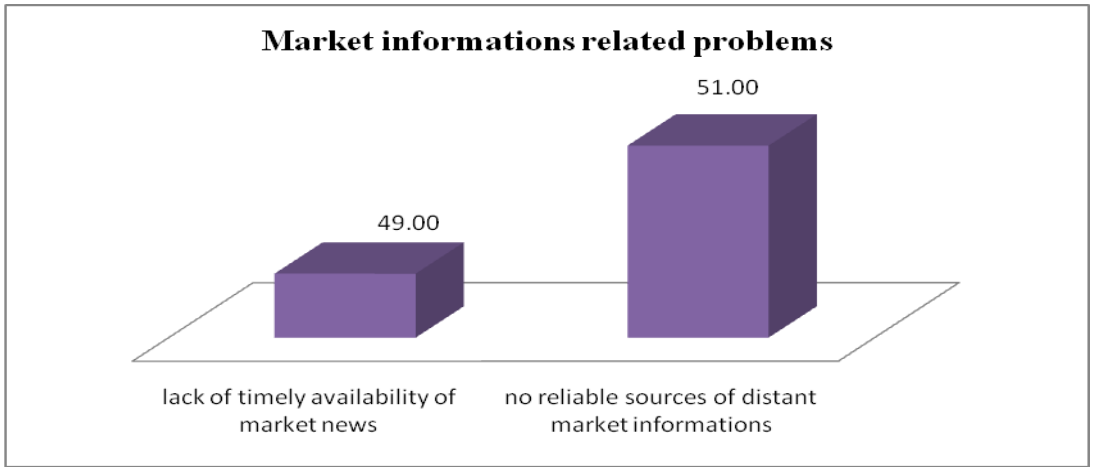
Fig (iv): Marketing Problems & Constraints of Pineapple- Nagaland

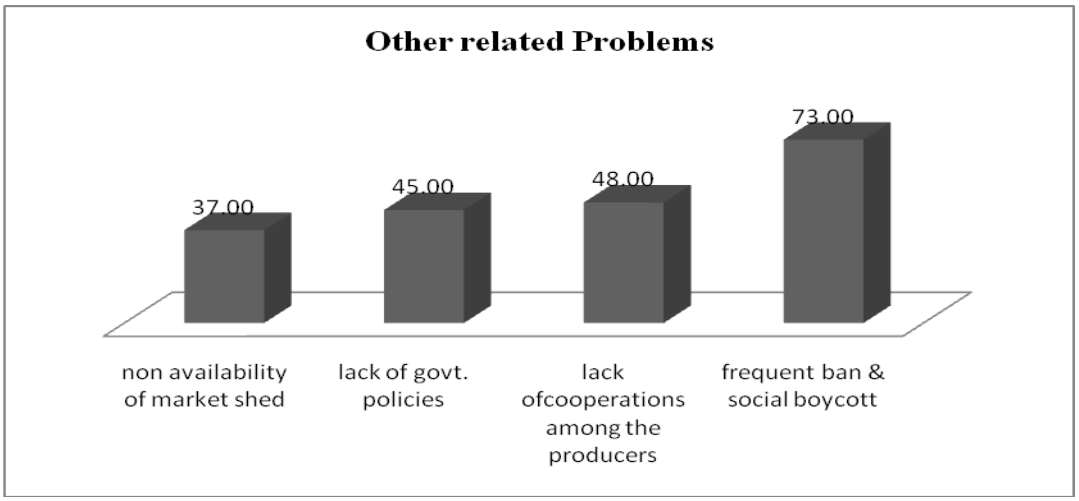


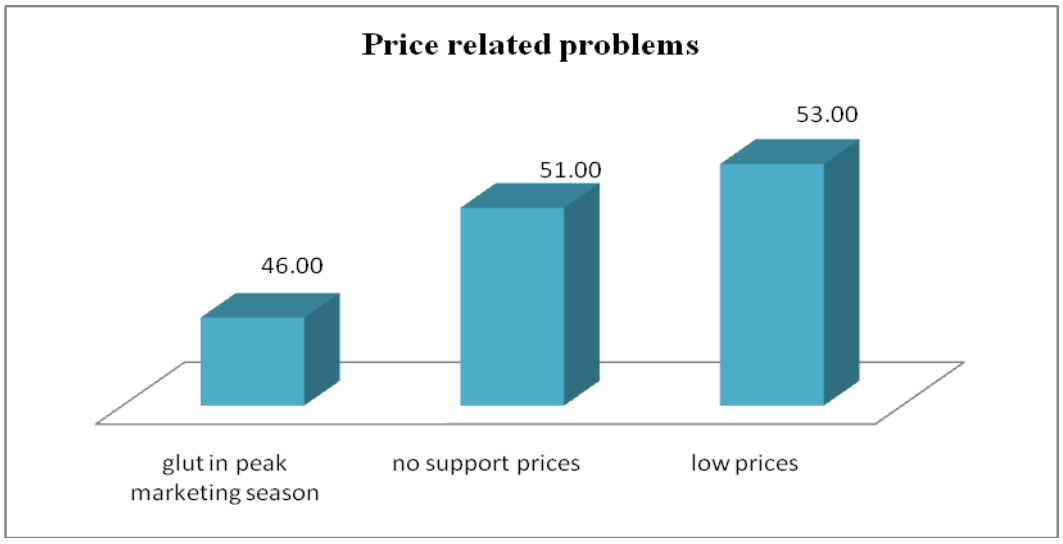



Transportation related problems
40
40
42
60
70
high transportation...
quick and timely...
lack of linking roads
unauthorized and illegal...
lack of all weathe/...


Weighing related problems
49.00
51.00
use of improper scales
weighing not done accurately


Market informations related problems
51.00
49.00
lack of timely availability of market news
no reliable sources of distant market informations


Other related Problems
73.00
48.00
45.00
37.00
non availability of market shed
lack of govt. policies
lack ofcooperations among the producers
frequent ban & social boycott


Price related problems
53.00
51.00
46.00
glut in peak marketing season
no support prices
low prices

B. Marketing problems/constraints of pineapple for Molvom Village-Nagaland

Sl. No	Problem / Constraints	Total Score	Average Score	Garette Ranking
1	**Grading related**			
A	Grading by hand is costly	3225.00	42.00	I
B	Mechanical grading facilities not available	3100.00	44.00	II
C	Grading standards not specific	3050.00	44.00	III
D	Hand grading leads to quality deterioration	625.00	73.00	IV
2.	**Packaging related**			
A	Costly packing materials	2775.00	47.00	I
B	Lack of knowledge regarding packaging and packing materials	2725.00	48.00	II
C	Lack of quality packing materials	2600.00	49.00	III
D	Packing materials not available in time	1900.00	56.00	IV
3.	**Transportation related**			
A	High transportation charges	3520.00	40.00	I
B	Quick and timely transportation facilities not available	3420.00	40.00	II
C	Lack of linking roads	3280.00	42.00	III
D	Unauthorized and illegal taxes	1500.00	60.00	IV
E	Lack of all weather/ metallic roads	780.00	70.00	V
4.	**Weighing related**			
A	Use of improper scales	2600.00	49.00	I
B	Weighing not done accurately	2400.00	51.00	II
5.	**Price related**			
A	Glut in peak marketing season	2866.67	46.00	I
B	No support prices	2433.33	51.00	II
C	Low prices	2200.00	53.00	III
6.	**Market informations related**			
A	Lack of timely availability of market news	2600.00	49.00	I
B	No reliable sources of distant market informations	2400.00	51.00	II
7.	**Other related Problems**			
A	Non availability of market shed	3675.00	37.00	I
B	Lack of govt. policies	3000.00	45.00	II
C	Lack ofcooperations among the producers	2700.00	48.00	III
D	Frequent ban & social boycott	625.00	73.00	IV

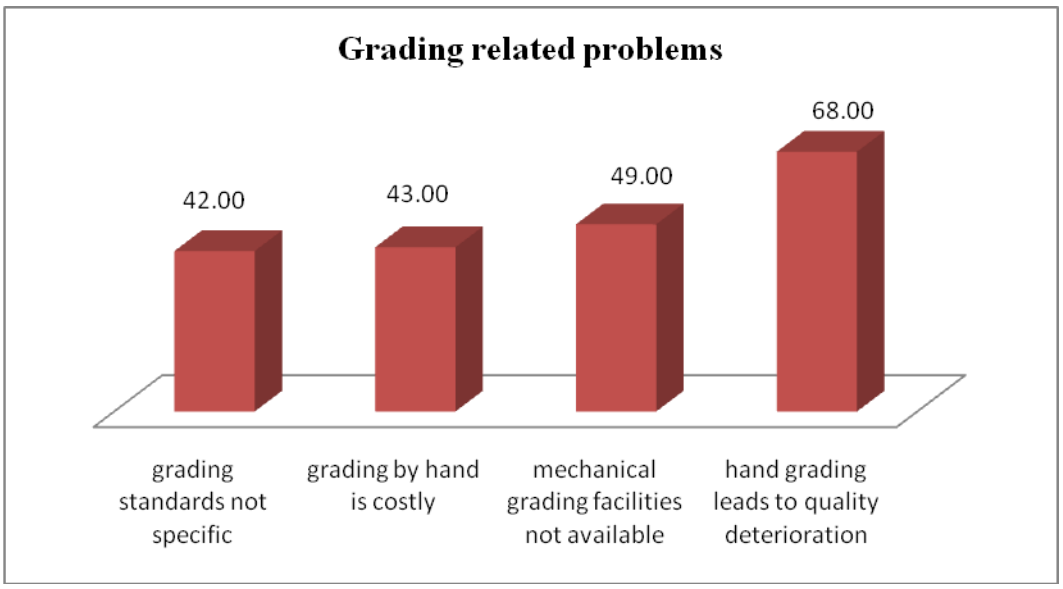
metallic roads ranks I; II; III; IV and V respectively. In the weighing related problems, use of improper scales and weighing is not done accurately rank I and II respectively. Also the glut in peak marketing season, no support prices and low prices rank I; II and III respectively in the price related problems. In case of market information related problems, lack of timely availability of market news rank first followed by no reliable sources of distant market information. Among the other related problems, non availability of market shed; lack of govt. policies; lack of cooperation among the producers and frequent ban & social boycott rank I; II; III and IV respectively.

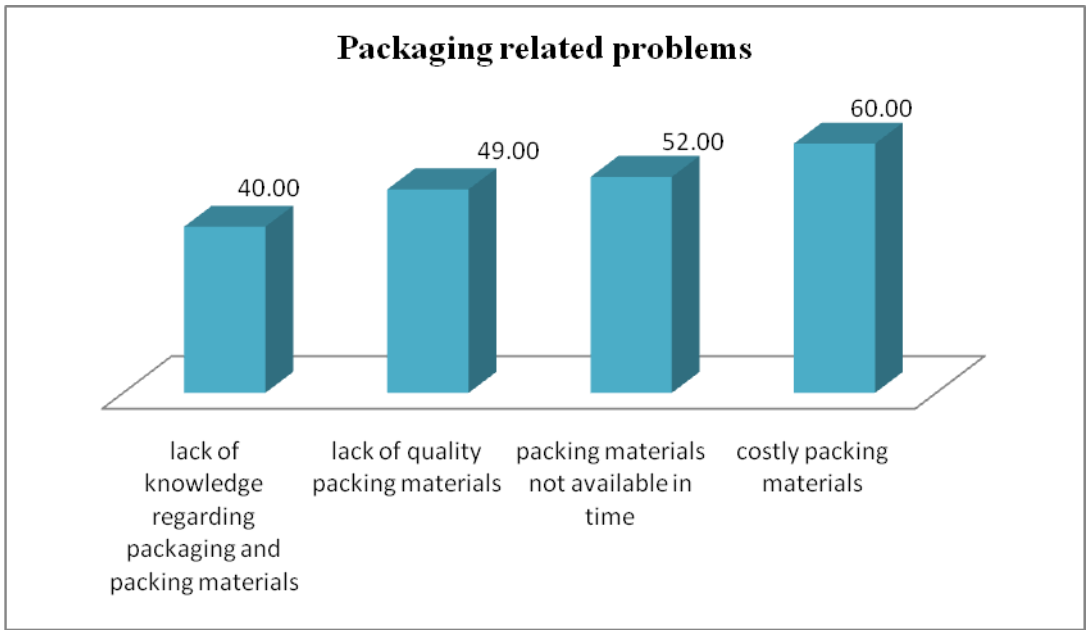
Table 4.6.3.A shows the market related problems and constraints faced by the potato and cabbage growers in the study area of Manipur. The table highlighted the grading; packaging; transportation; weighing; price; market information and other related problems along with the total score, average score and garette ranking.

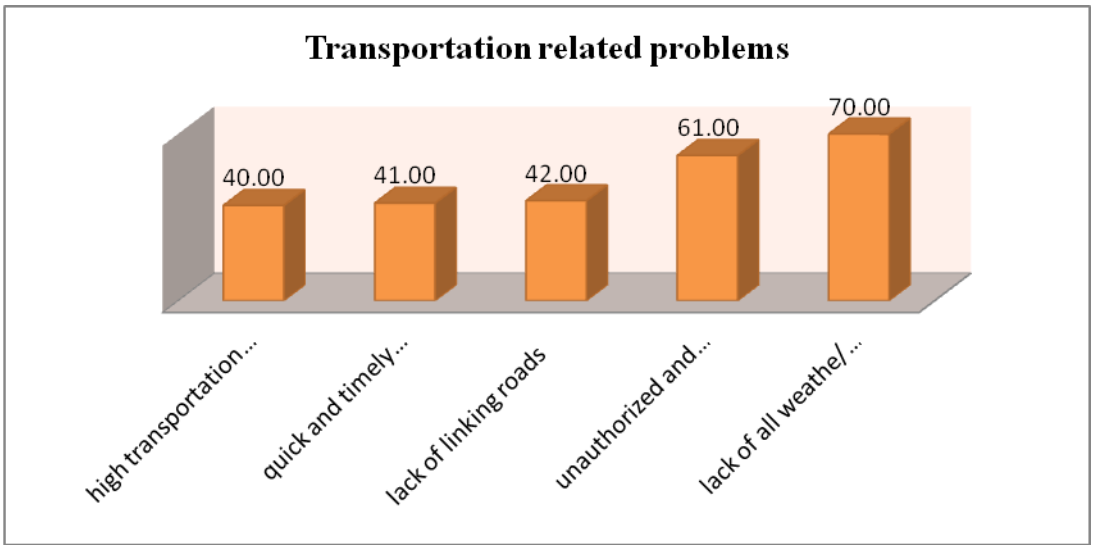
The results of the analysis shows that grading standards is not specific and grading by hand is costly, mechanical grading facilities not available and hand grading leads to quality deterioration ranked I; II; III and IV respectively for the grading related problems. In case of the packaging, lack of knowledge regarding packaging and packing materials rank first followed by lack of quality packing materials; packing material not available in time and costly packing materials. High transportation charges, quick and timely transportation facilities not available, lack of linking roads, unauthorized and illegal taxes, and lack of weather / metallic roads ranks I; II; III; IV and V respectively.

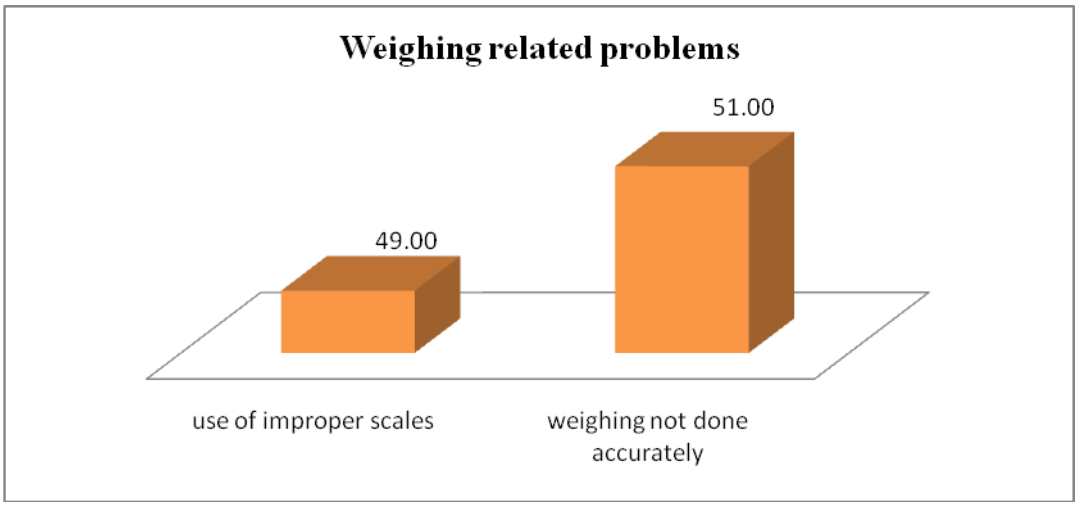
In the weighing related problems, use of improper scales and weighing is not done accurately rank I and II respectively. Also the glut in peak marketing season, no support prices and low prices rank I; II and III respectively in the price related problems. In case of market information

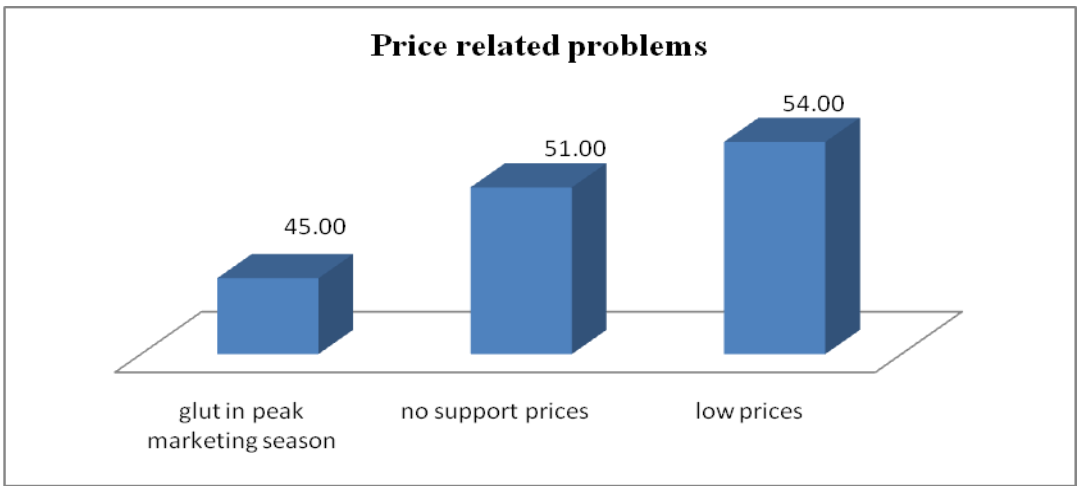
Fig (vi): Graphs of Marketing Problems & Constraints of Potato & Cabbage- Manipur

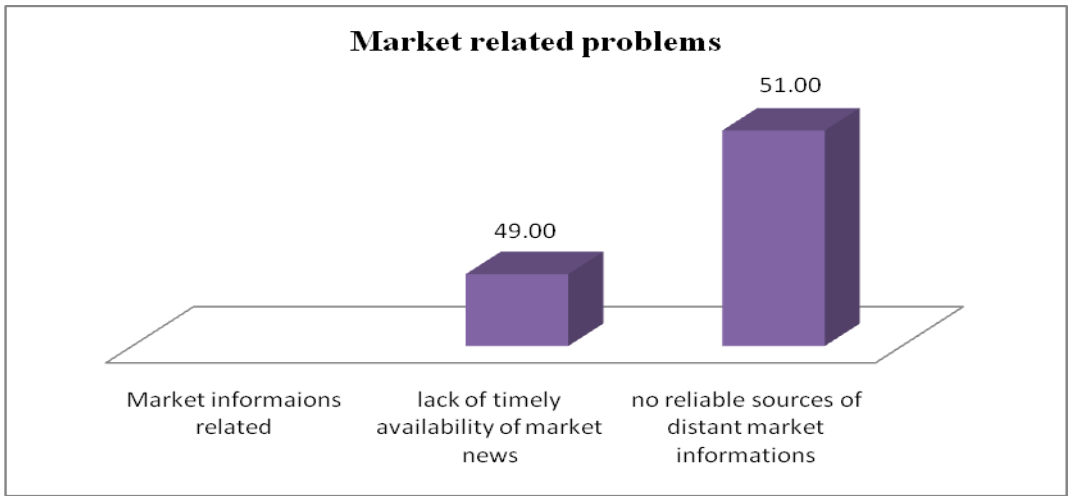





Transportation related problems
40.00
41.00
42.00
61.00
70.00
high transportation...
quick and timely...
lack of linking roads
unauthorized and...
lack of all weathe/...


Weighing related problems
49.00
51.00
use of improper scales
weighing not done accurately


Price related problems
45.00
51.00
54.00
glut in peak marketing season
no support prices
low prices


Market related problems
49.00
51.00
Market informaions related
lack of timely availability of market news
no reliable sources of distant market informations

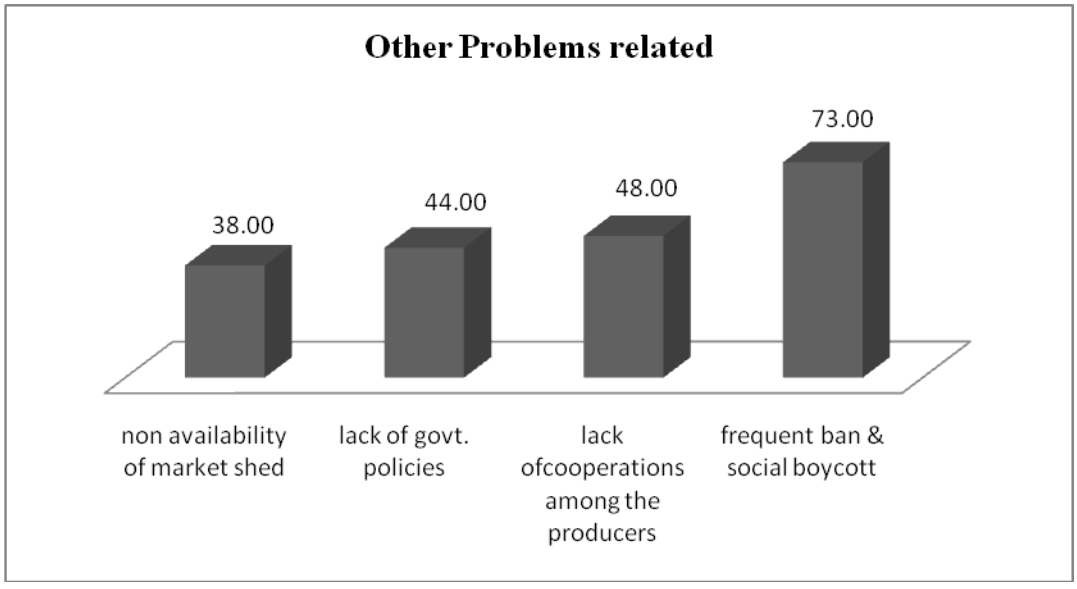

Other Problems related
38.00
44.00
48.00
73.00
non availability of market shed
lack of govt. policies
lack ofcooperations among the producers
frequent ban & social boycott

Table 4.6.3 Marketing related problems and constraints faced by the farmers

A. Marketing problems / constraints for Cabbage & Potato-Manipur

Sl. No	Problem/ Constraints	Total Score	Average Score	Garette Ranking
1.	**Grading related**			
A	Grading standards not specific	6550.00	42.00	I
B	Grading by hand is costly	6350.00	43.00	II
C	Mechanical grading facilities not available	5250.00	49.00	III
D	Hand grading leads to quality deterioration	1850.00	68.00	IV
2.	**Packaging related**			
A	Lack of knowledge regarding packaging and packing materials	6900.00	40.00	I
B	Lack of quality packing materials	5325.00	49.00	II
C	Packing materials not available in time	4675.00	52.00	III
D	Costly packing materials	3100.00	60.00	IV
3.	**Transportation related**			
A	High transportation charges	6980.00	40.00	I
B	Quick and timely transportation facilities not available	6880.00	41.00	II
C	Lack of linking roads	6580.00	42.00	III
D	Unauthorized and illegal taxes	2980.00	61.00	IV
E	Lack of all weather/ metallic roads	1580.00	70.00	V
4.	**Weighing related**			
A	Use of improper scales	5200.00	49.00	I
B	Weighing not done accurately	4800.00	51.00	II
5.	**Price related**			
A	Glut in peak marketing season	6100.00	45.00	I
B	No support prices	4800.00	51.00	II
C	Low prices	4100.00	54.00	III
6.	**Market informaions related**			
A	Lack of timely availability of market news	5250.00	49.00	I
B	No reliable sources of distant market informations	4750.00	51.00	II
7.	**Other Problems related**			
A	Non availability of market shed	7350.00	38.00	I
B	Lack of govt. policies	6000.00	44.00	II
C	Lack of cooperations among the producers	5400.00	48.00	III
D	Frequent ban & social boycott	1250.00	73.00	IV

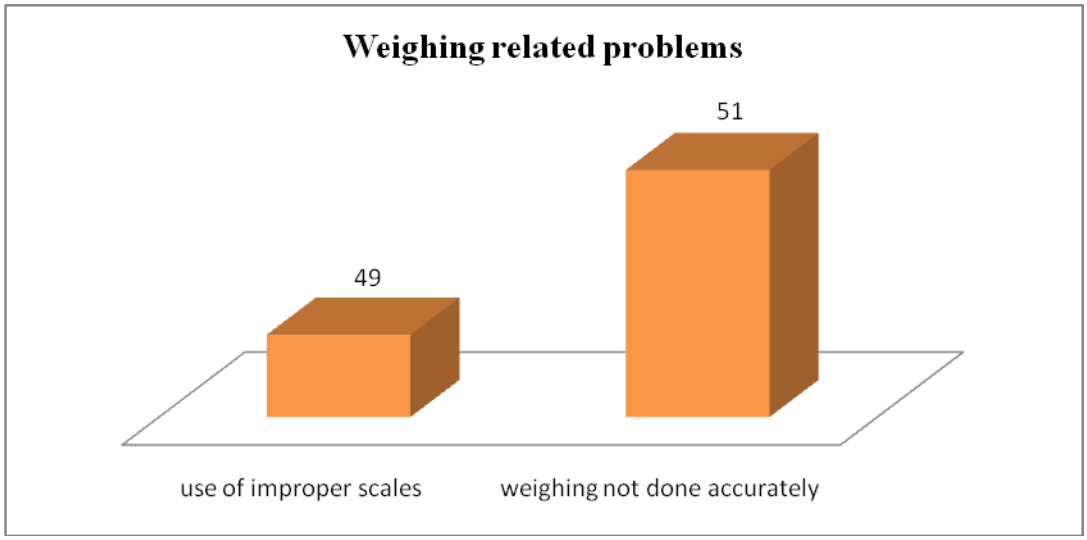
related problems, lack of timely availability of market news rank first followed by no reliable sources of distant market information. Among the other related problems, non availability of market shed; lack of govt. policies; lack of cooperation among the producers; and frequent ban & social boycott rank I; II; III and IV respectively.

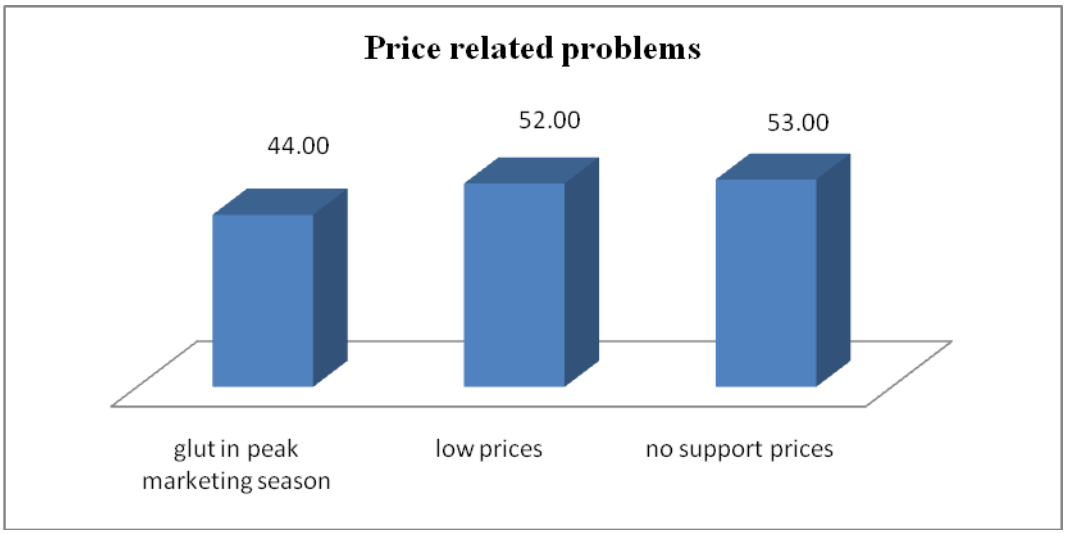
Table 4.6.3.B reveals the market related problems and constraints faced by the potato and cabbage growers in the study area of Nagaland. The table highlighted the grading; packaging; transportation; weighing; price; market information and other related problems along with the total score, average score and Garette ranking.

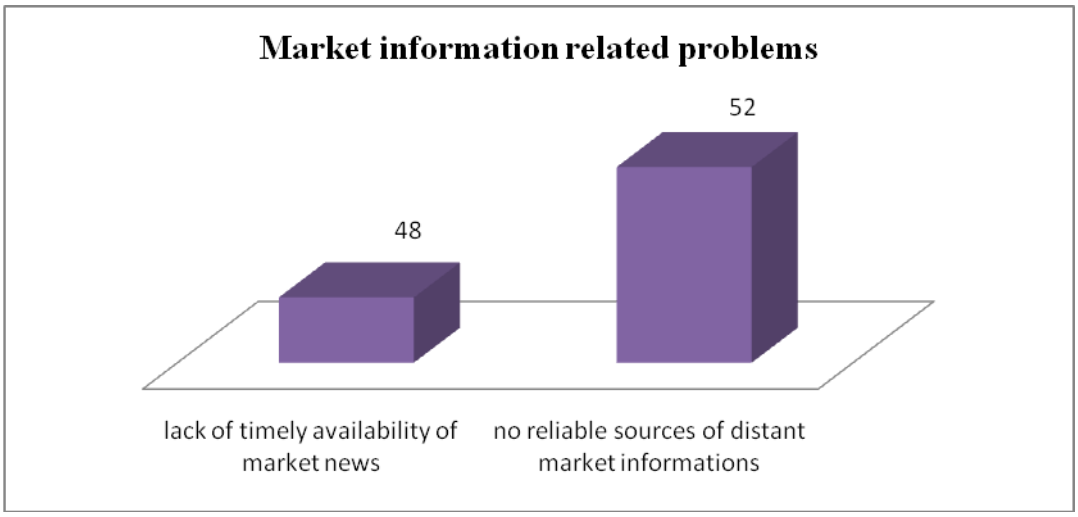
The results of the analysis show that grading standards not specific, grading by hand is costly, mechanical grading facilities not available and hand grading leads to quality deterioration ranked I, II, III and IV respectively for the grading related problems. In case of the packaging, lack of knowledge regarding packaging and packing materials rank first followed by lack of quality packing materials; packing material not available in time and costly packing materials. high transportation charges, quick and timely transportation facilities not available, lack of linking roads Unauthorized and illegal taxes;, and lack of weather / metallic roads ranks I, II, III, IV and V respectively.

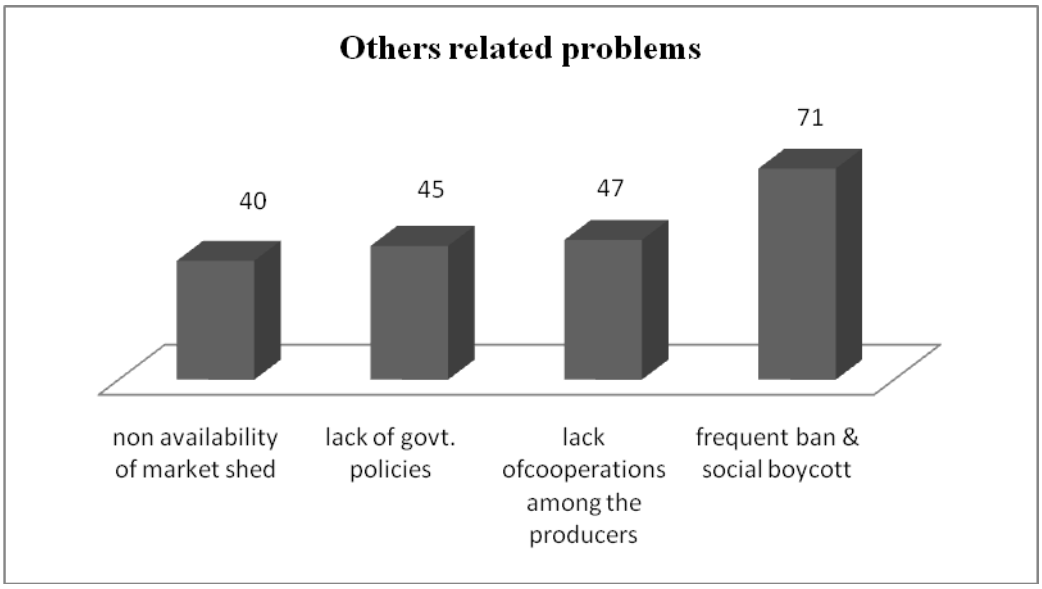
In the weighing related problems, use of improper scales and weighing is not done accurately rank I and II respectively. Also the glut in peak marketing season, low prices and no support prices rank I; II and III respectively in the price related problems. In case of market information related problems, lack of timely availability of market news rank first followed by no reliable sources of distant market information. Among the other related problems, non availability of market shed; lack of govt. policies; lack of

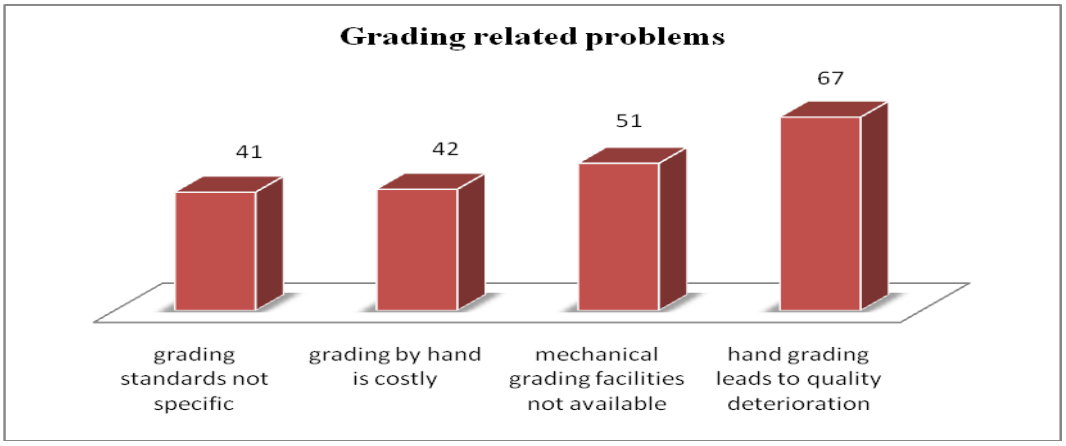
Fig (viii): Graphs of Marketing Problems & Constraints of Potato & Cabbage- Nagaland

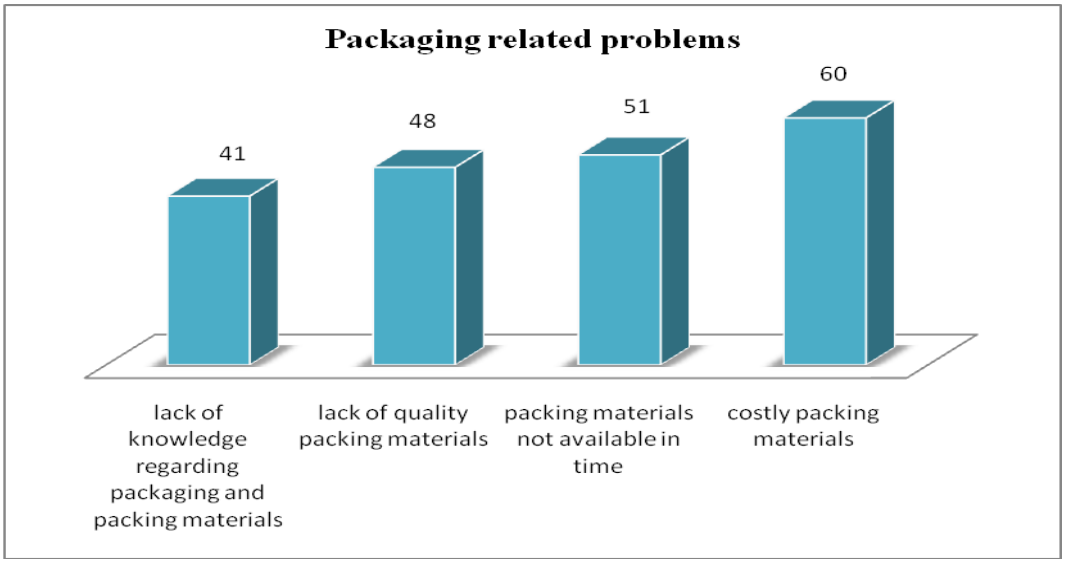


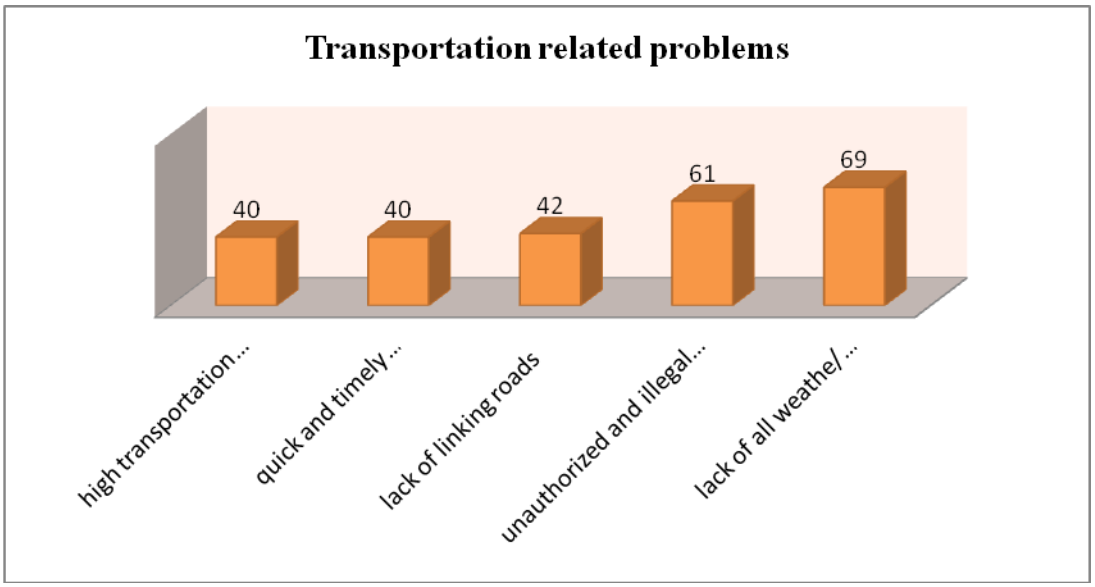



Market information related problems
48
52
lack of timely availability of market news
no reliable sources of distant market informations


Others related problems
40
45
47
71
non availability of market shed
lack of govt. policies
lack ofcooperations among the producers
frequent ban & social boycott


Grading related problems
41
42
51
67
grading standards not specific
grading by hand is costly
mechanical grading facilities not available
hand grading leads to quality deterioration


Packaging related problems
41
48
51
60
lack of knowledge regarding packaging and packing materials
lack of quality packing materials
packing materials not available in time
costly packing materials


Transportation related problems
40
40
42
61
69
high transportation...
quick and timely...
lack of linking roads
unauthorized and illegal...
lack of all weathe/...

4.6.3. B Marketing problems / constraints for Cabbage & Potato-Nagaland

Sl. No	Problem/ Constraints	Total Score	Average Score	Garette Ranking
1	**Grading related**			
A	Grading standards not specific	6750	41	I
B	Grading by hand is costly	6575	42	II
C	Mechanical grading facilities not available	4775	51	III
D	Hand grading leads to quality deterioration	1900	67	IV
2.	**Packaging related**			
A	Lack of knowledge regarding packaging and packing materials	6650	41	I
B	Lack of quality packing materials	5450	48	II
C	Packing materials not available in time	4850	51	III
D	Costly packing materials	3050	60	IV
3.	**Transportation related**			
A	High transportation charges	7000	40	I
B	Quick and timely transportation facilities not available	6920	40	II
C	Lack of linking roads	6600	42	III
D	Unauthorized and illegal taxes	2880	61	IV
E	Lack of all weathe/ metallic roads	1600	69	V
4.	**Weighing related**			
A	Use of improper scales	5150	49	I
B	Weighing not done accurately	5150	51	II
5.	**Price related**			
A	Glut in peak marketing season	6166.67	44.00	I
B	Low prices	4500.00	52.00	II
C	No support prices	4333.33	53.00	III
6.	**Market information related**			
A	Lack of timely availability of market news	5400	48	I
B	No reliable sources of distant market informations	4600	52	II
7.	**Others related problems**			
A	Non availability of market shed	6975	40	I
B	Lack of govt. policies	6050	45	II
C	Lack of co-operations among the producers	5525	47	III
D	Frequent ban & social boycott	1450	71	IV

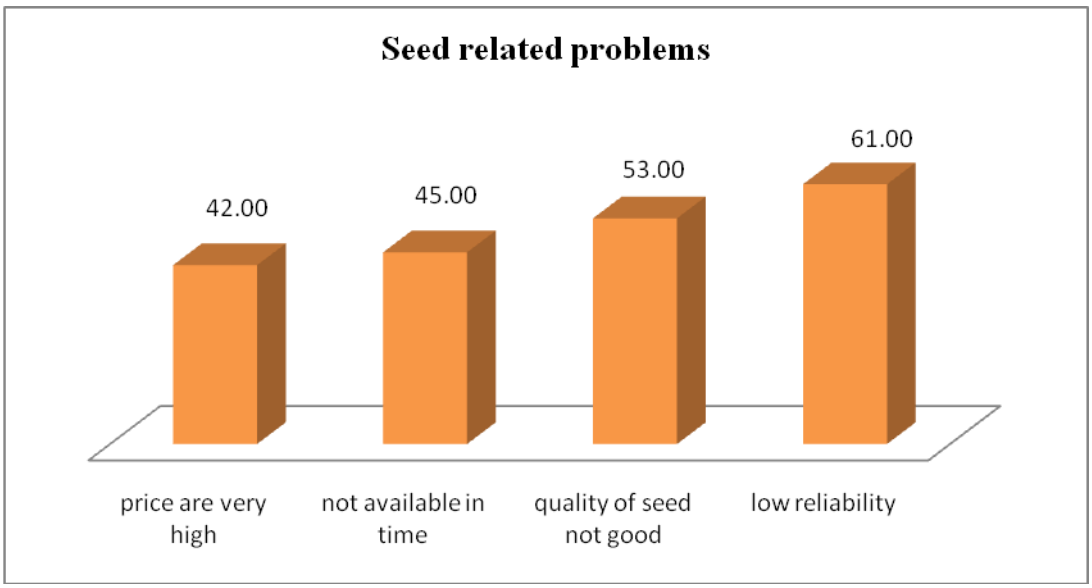
cooperation among the producers; and frequent ban & social boycott rank I, II, III and IV respectively.

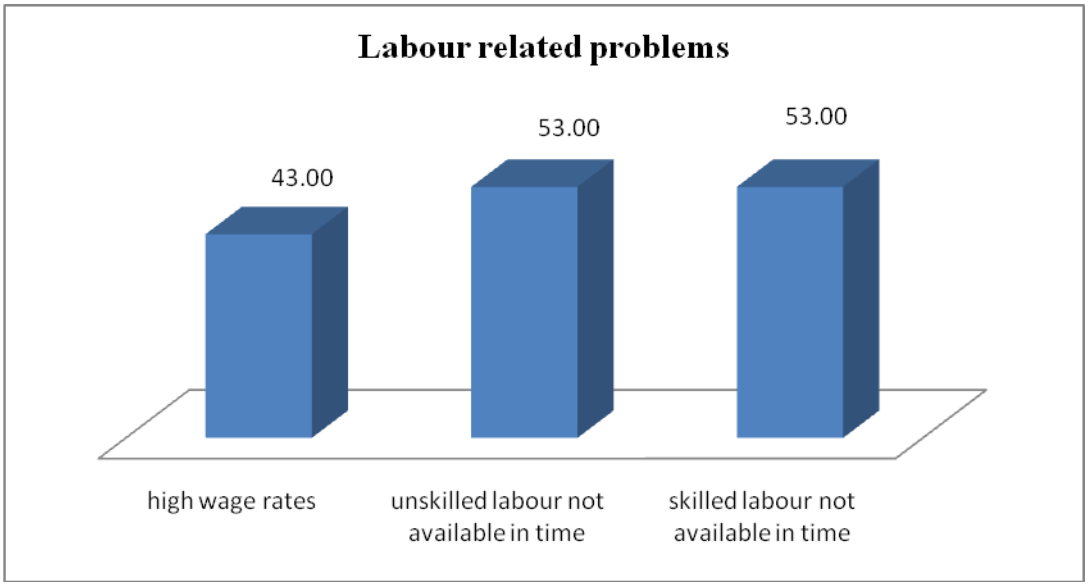
Table 4.5.4. A. reveals the production related problems and constraints faced by the farm households for the potato and cabbage growers of Manipur. The table highlighted the various problems / constraints; total score; average score and Garette ranking for the pineapple crop of Manipur. The problems and constraints are categorized into seed, labour, irrigation, manures & fertilizers, PPCs and other related problems.

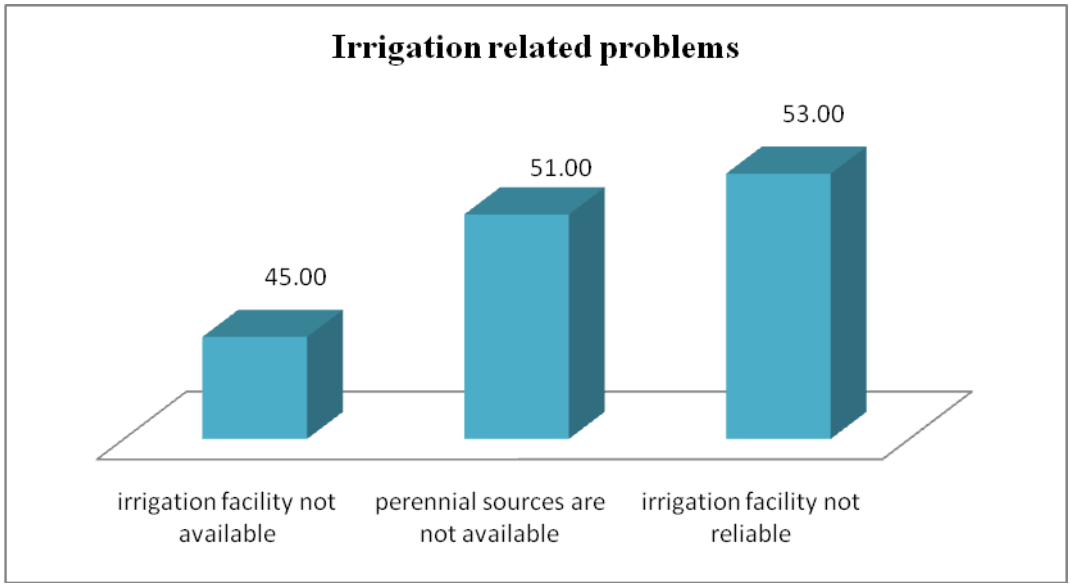
The results of the analysis shows that the high price of the seed ranked first followed by not available in time; inferior quality of seed and low reliability. In case of labour related problems, high wage rates of labour ranked first followed by the skilled labour not available in time and unskilled labour not available in time. Irrigation facility not available; perennial sources are not available and irrigation facility not reliable ranked I, II and III respectively in the irrigation related problems. In the manures and fertilizers, not available in proper time, high transportation costs, high prices of organic sources; and desired brand not available; inorganic fertilizers are not suitable ranked I, II, III, IV and V respectively. Again for the PPCs related problems, don't know proper dose, time of application, lack of knowledge about chemicals, high price; don't know proper method of spraying; and desired brand not available ranked I, II, III, IV and V, respectively. Among the other related problems, Pests & Diseases , animals , weeds and anti-social & ethnic problems ranked I, II, III and IV respectively.

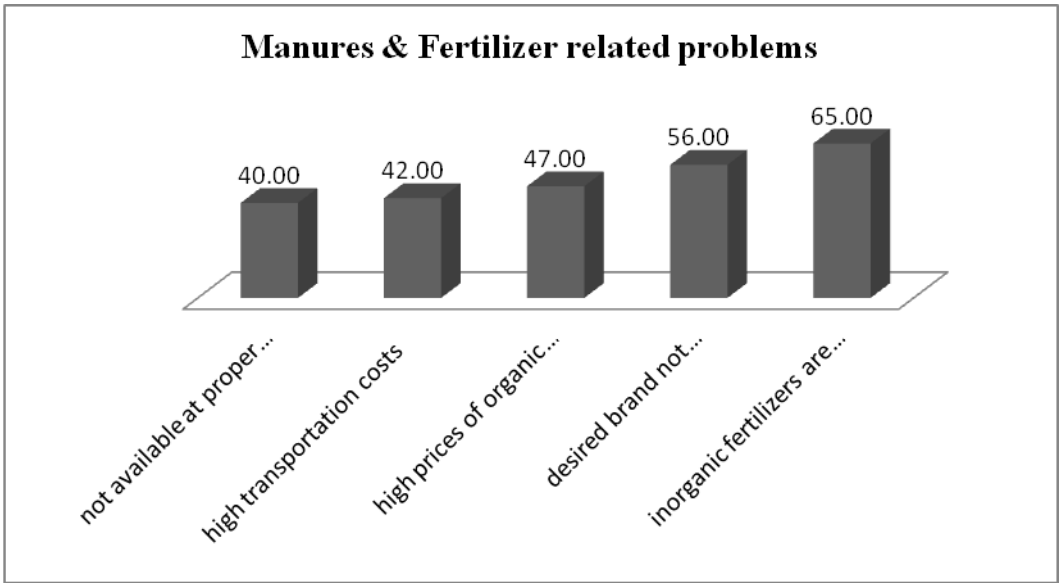
Table 4.5.4. B. reveals the production related problems and constraints faced by the farm households for the potato and cabbage growers of Nagaland. The table highlighted the various problems / constraints; total score; average score and Garette ranking for the pineapple crop of Manipur. The problems

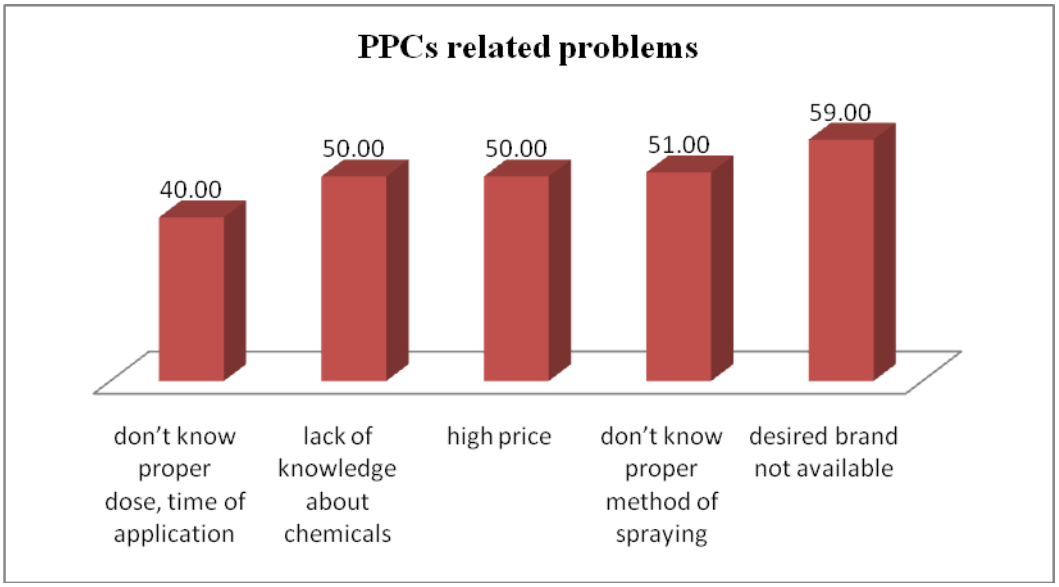
Fig (vii): Graphs of Production Problems & Constraints of Potato & Cabbage- Nagaland






Irrigation related problems
45.00
51.00
53.00
irrigation facility not available
perennial sources are not available
irrigation facility not reliable


Manures & Fertilizer related problems
40.00
42.00
47.00
56.00
65.00
not available at proper ...
high transportation costs
high prices of organic...
desired brand not...
inorganic fertilizers are...


PPCs related problems
40.00
50.00
50.00
51.00
59.00
don't know proper dose, time of application
lack of knowledge about chemicals
high price
don't know proper method of spraying
desired brand not available

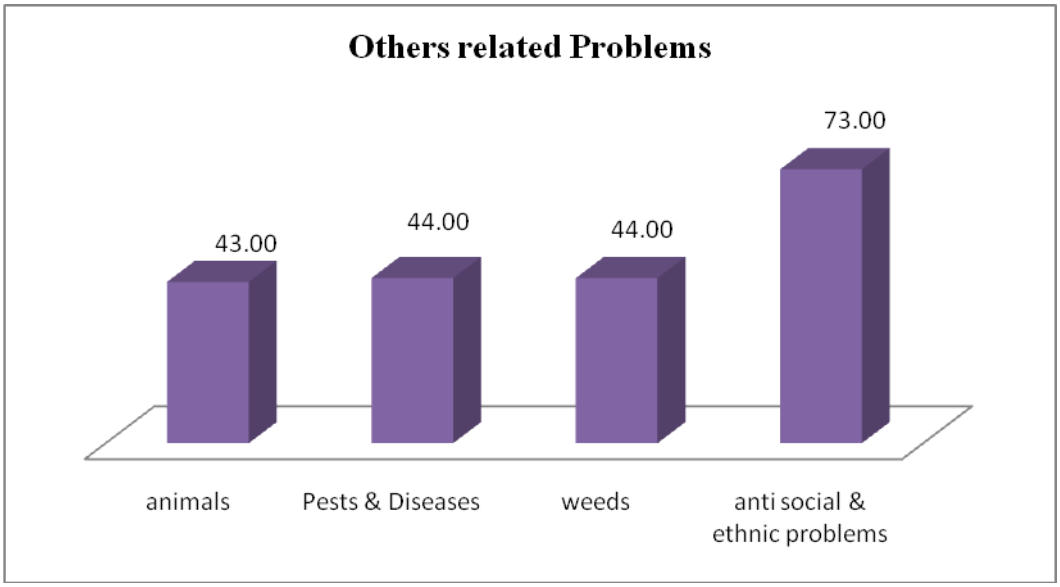
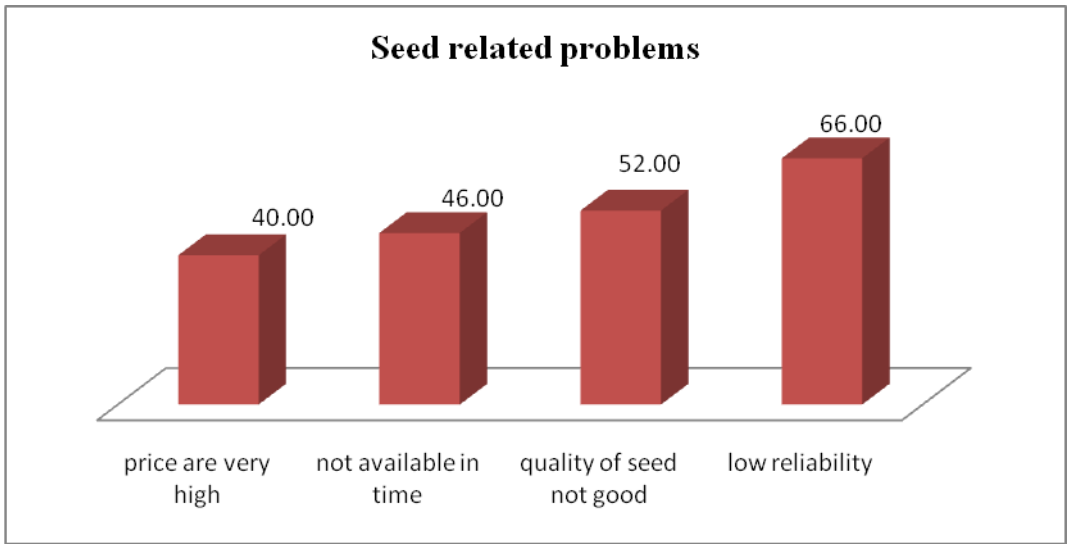
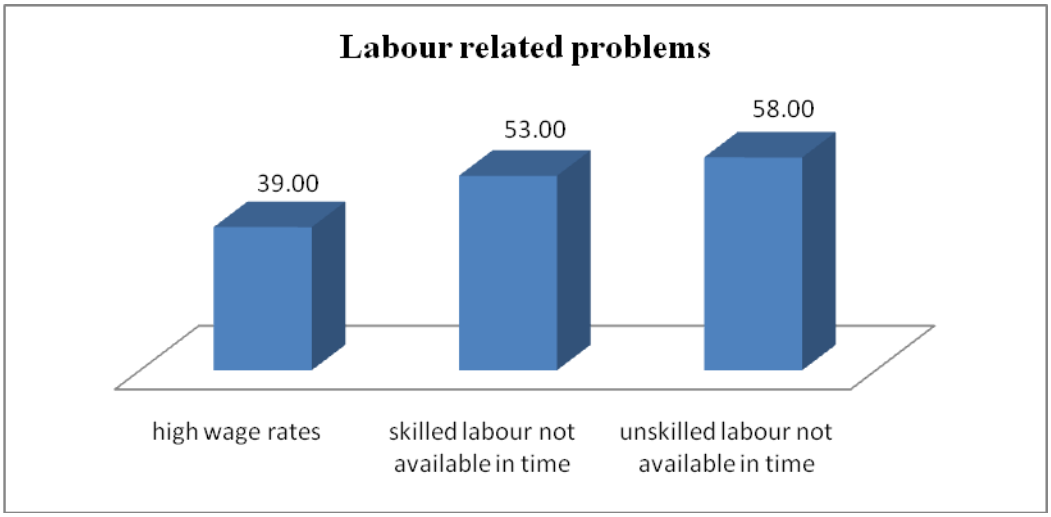

Others related Problems
43.00
44.00
44.00
73.00
animals
Pests & Diseases
weeds
anti social & ethnic problems

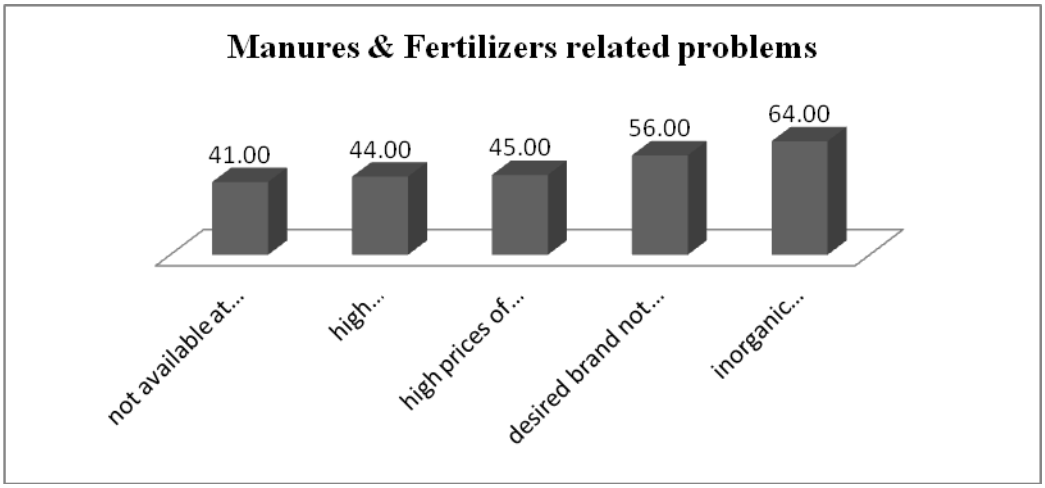
Fig 4.5.4 A Production problems / constraints for Cabbage & Potato-Nagaland

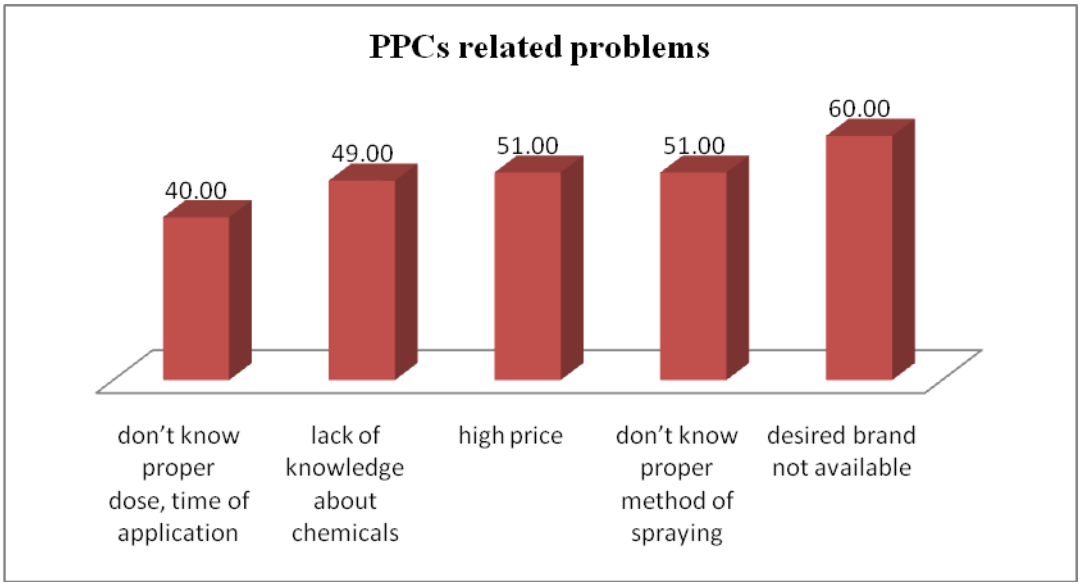
Sl. No	Problem / Constraints	Total Score	Average Score	Garette Ranking
1.	Seed related			
A	Price are very high	6675.00	42.00	I
B	Not available in time	6025.00	45.00	II
C	Quality of seed not good	4475.00	53.00	III
D	Low reliability	2825.00	61.00	IV
2.	**Labour related**			
A	High wage rates	6366.67	43.00	I
B	Unskilled labour not available in time	4366.67	53.00	II
C	Skilled labour not available in time	4266.67	53.00	III
3.	**Irrigation related**			
A	Irrigation facility not available	5933.33	45.00	I
B	Perennial sources are not available	4733.33	51.00	II
C	Irrigation facility not reliable	4333.33	53.00	III
4.	**Manures & Fertilizer related**			
A	Not available at proper time	6880.00	40.00	I
B	High transportation costs	6560.00	42.00	II
C	High prices of organic sources	5660.00	47.00	III
D	Desired brand not available	3760.00	56.00	IV
E	Inorganic fertilizers are not suitable	2140.00	65.00	V
5.	**PPCs related**			
A	Don’t know proper dose, time of application	6940.00	40.00	I
B	Lack of knowledge about chemicals	5080.00	50.00	II
C	High price	5040.00	50.00	III
D	Don’t know proper method of spraying	4660.00	51.00	IV
E	Desired brand not available	3280.00	59.00	V
6.	**Others related Problems**			
A	Animals	6475.00	43.00	I
B	Pests & diseases	6175.00	44.00	II
C	Weeds	6100.00	44.00	III
D	Anti social & ethnic problems	1250.00	73.00	IV

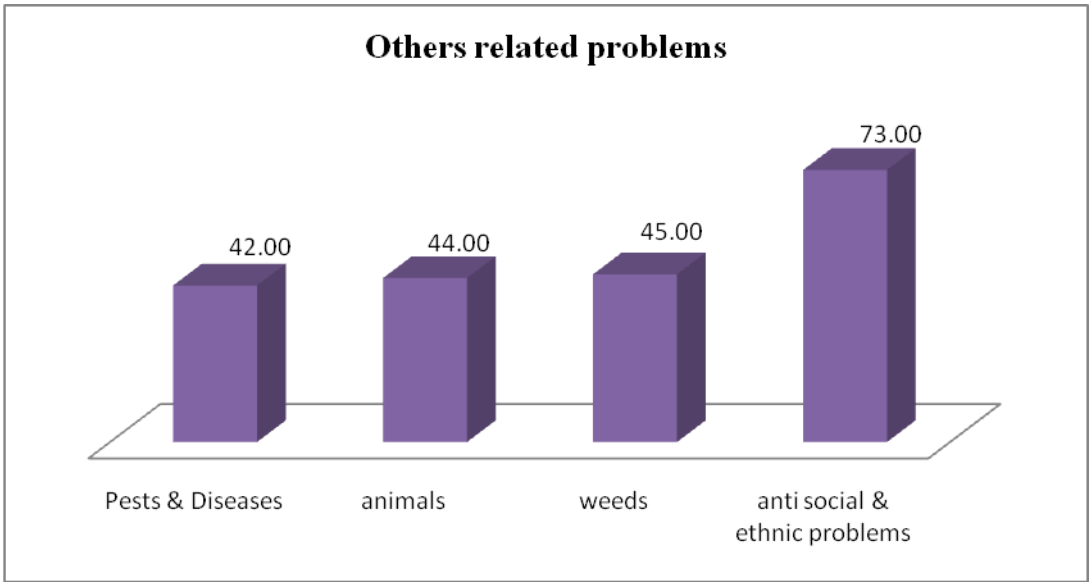
Fig (v): Graphs of Production Problems & Constraints of Potato & Cabbage- Manipur






Manures & Fertilizers related problems
41.00
44.00
45.00
56.00
64.00
not available at...
high...
high prices of...
desired brand not...
inorganic...


PPCs related problems
40.00
49.00
51.00
51.00
60.00
don't know proper dose, time of application
lack of knowledge about chemicals
high price
don't know proper method of spraying
desired brand not available


Others related problems
42.00
44.00
45.00
73.00
Pests & Diseases
animals
weeds
anti social & ethnic problems

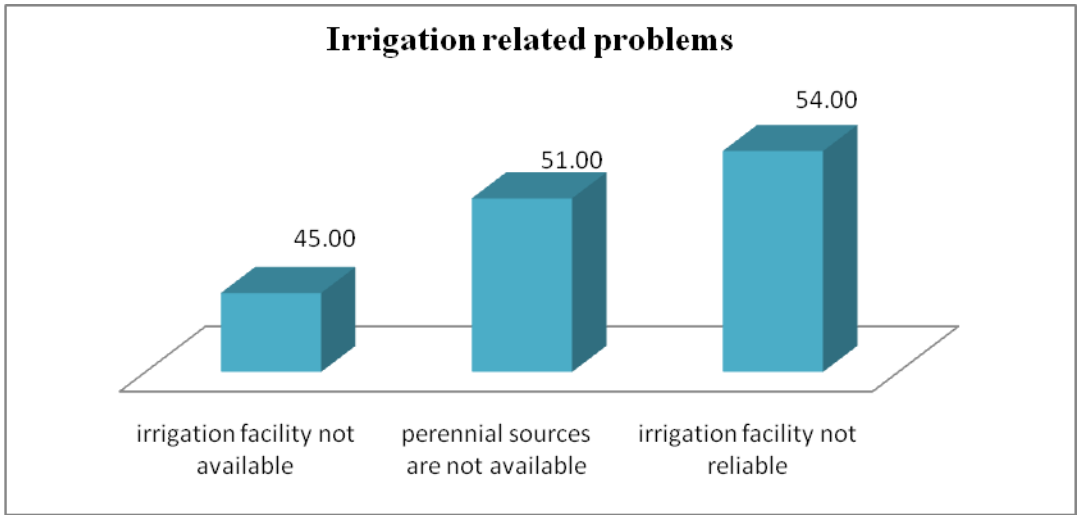

Irrigation related problems
45.00
51.00
54.00
irrigation facility not available
perennial sources are not available
irrigation facility not reliable

Table 4.5.4 B Production related problems and constraints faced by the farmers

B. Production problems / constraints for Cabbage & Potato- Manipur

Sl. No	Problem / Constraints	Total Score	Average Score	Garette Ranking
1.	**Seed related**			
A	Price are very high	6950.00	40.00	I
B	Not available in time	5675.00	46.00	II
C	Quality of seed not good	4650.00	52.00	III
D	Low reliability	2725.00	66.00	IV
2.	**Labour related**			
A	High wage rates	6366.67	43.00	I
B	Skilled labour not available in time	4650.00	52.00	II
	Unskilled labour not available in time	4366.67	53.00	III
C				
3	**Irrigation related**			
A	Irrigation facility not available	5933.33	45.00	I
B	Perennial sources are not available	4800.00	51.00	II
C	Irrigation facility not reliable	4266.67	54.00	III
4.	**Manures & Fertilizers related**			
A	Not available at proper time	6780.00	41.00	I
B	High transportation costs	6220.00	44.00	II
C	High prices of organic sources	5940.00	45.00	III
D	Desired brand not available	3760.00	56.00	IV
E	Inorganic fertilizers are not suitable	2300.00	64.00	V
5.	**PPCs related**			
A	Don’t know proper dose, time of application	7040.00	40.00	I
B	Lack of knowledge about chemicals	5340.00	49.00	II
C	High price	4860.00	51.00	III
D	Don’t know proper method of spraying	4780.00	51.00	IV
E	Desired brand not available	2980.00	60.00	V
6.	**Others related**			
A	Pests & diseases	6575.00	42.00	I
B	Animals	6275.00	44.00	II
C	Weeds	5900.00	45.00	III
D	Anti social & ethnic problems	1250.00	73.00	IV

and constraints are categorized into seed, labour, irrigation, manures & fertilizers, PPCs and other related problems.

The results of the analysis shows that the high price of the seed ranked first followed by not available in time; inferior quality of seed and low reliability. In case of labour related problems, high wage rates of labour ranked first followed by the unskilled labour not available in time and skilled labour not available in time. Irrigation facility not available, perennial sources are not available and irrigation facility not reliable ranked I, II and III respectively in the irrigation related problems. In the manures and fertilizers, not available in proper time, high transportation costs, high prices of organic sources and desired brand not available; inorganic fertilizers are not suitable ranked I, II, III, IV and V respectively. Again for the PPCs related problems, don't know proper dose, time of application, lack of knowledge about chemicals, high price; don't know proper method of spraying; and desired brand not available ranked I, II, III, IV and V respectively. Among the other related problems, animals, Pests & Diseases, weeds and anti-social & ethnic problems ranked I, II, III and IV respectively.

CHAPTER V

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Indian agriculture need to be more sustainable and productive system to support rural populations who depends for their livelihood. The instrumental for agricultural growth and its sustainability depends on better utilization of land and judicious use of water to achieve the agricultural sustainability. However, in India in the name of agricultural intensifications the farmers are applying excessive fertilizers and non-judicious usage of irrigation water results into soil and land degradation and also exploitations of groundwater in many parts of India at alarming rate. The north east region is characterized by undulating, highly erodible and degrading lands due to practice of jhum cultivation in many parts of the region. In the region, state governments took major initiatives in the past based on administrative units has failed to overcome the problems and it further exaggerated the exploitations of natural resources particularly water and land which impairs the productivity of the major agricultural crops in the locality thereby significant reduction in the income of farmers in the study region. The overall goal of the project is to reverse the process of degradation of the natural resource base and improve the productive potential of natural resources and incomes of the rural households in the project area by improving water resources, production systems, soil conservations ensures the sustainability of agriculture. In this context, considering the significance and relevance aforementioned facts, the present study entitled **"**Economic study on various levels of recommended practices in selected horticultural crops of Nagaland and Manipur**.**" with following specific objectives:

- To estimate the costs and returns of the various level of farm's for selected horticultural crops,
- To analyze the resource-use-efficiency for the selected horticultural crops,
- To study the income and employment patterns for the selected horticultural crops,
- To study the farmers' perception for the selected horticultural crops, and
- To analyze the problems and constraints faced by the various level of farm's for the selected horticultural crops.

The present study has been carried out in north east region of India by selecting two state *viz*. Manipur and Nagaland state by employing multistage random sampling method in selection of the households, further two district were selected and then blocks and villages and finally farm households to fulfill the specific objectives.

The data were encoded and analyzed by employing STAT software (Stata version 13). The profile of the farmers with regard to socio-economic, demographics, economic returns, employments from various activities and practices of selected horticultural crops across marginal, small and medium farmers for both the districts were collected and summarized by examining descriptive statistics (percent, mean, and crosstabs). According to the objectives laid down for the study to meet the objectives of the study.

Summary and Conclusion

Analysis of the farm households with respect to their age shows that Manipur populations are higher than Nagaland, whereas on 3 categories Manipur state is leading with respect to sample size. Whereas comparing among the district Senapati district is having highest farm household/ population on category 3, even Thoubal district was recorded population with respect to 4 categories respectively.

- The maximum family members are recorded in Manipur on category 2, while in Nagaland state maximum family members is recorded in category. whereas, among the district, maximum family members is recorded in Kohima district, followed by Senapati and Thoubal district, while Dimapur is found to be least on category II.

- The maximum land holding size is found to be maximum in small category, followed by medium category and large category across the different farm size respectively. Among the district, maximum households are recorded in Senapati followed by Kohima and dimapur district while it was least in thoubal on Small farm group, whereas, in the medium farm group, Senapati district recorded the highest households followed by Thoubal, Kohima and Dimapur. In case of large category, Kohima district recorded the highest land holding followed by Senapati, Thoubal and Dimapur district, respectively.

- The study on the farmer's access to farm loans shows that the maximum no of farmer are not availing the loans from the banks.

- In the illiterate category, Senapati district is the maximum followed by Kohima, Thoubal and Dimapur district. Whereas, Kohima district recorded maximum in the II-category (upto primary) followed by

- Senapati and interstingly both Dimapur and Thoubal district rank equally.
- In the VII-category (graduate & above), Kohima district has the highest numbers of sample respondents followed equally by Senapati and Dimapur and there is no graduate respondents in the Thoubal district.
- The results of the study on the head education level of the sample respondents shows that the maximum numbers of sample respondent head's education level comes under the II category (upto primary) followed by III-category (pre-matric), IV-category (matric), I-category (Illiterate), V-category (intermediate) and VI- category (graduate & above) respectively
- In case of farmer's exposure to extension facilities, Kohima district is found to be maximum followed by Senapati, Thoubal and Dimapur districts in low category of farmers. Whereas in the medium category, Dimapur district is found to be maximum followed by Senapati, Thoubal and Kohima districts. In the high category, Dimapur district is recorded highest followed by Senapati, Kohima and Thoubal district, respectively.
- The maximum numbers of labours work-force comes under the III-category (*i.e*. 4 to 5 labours) followed by II-category (2 to 3 labours), IV- category (6 & above) and I-category (only 1 labour). In the I-category, only Kohima district has labour with 1 member, whereas in the II-category, Dimapur district is having the maximum number of work-force followed by Senapati, Thoubal and Kohima districts respectively. In the Case of III-category, Senapati district is the highest followed by Dimapur, Kohima and Thoubal districts. Again, in the IV-category, Senapati district is found to be highest followed by Kohima and Thoubal district, respectively

- The maximum cost investment are in Seed and labour followed by fertilizers, FYM, interest on working capitals, plant protection measures and the least cost is found in the depreciation and repairs of farm implements on different farm size groups.

- The cost follows increasing trend with the increase in the farm size group in the Manipur state. The total cost also follows almost the same trend. Among the different horticulture Crops, potato is high input investment crop as compare to pineapple and cabbage. The cost C also have maximum on potato farm followed by cabbage and it was least on pineapple crop.

- The values of co-efficient of multiple determinations (R2) values are found to be highly significant at 1 percent across the different farm size.
- The value of MVP for x_1, x_2, x_3, x_4, x_5 and y all were found to be positive statistically significant in the Nagaland state towards the horticultural crops on different farm size groups, further data indicate that by adding of one unit to this input would be providing an adding income ranging from 1.39 to 1.98 in rupees towards the gross return on the overall farm size group, respectively, so it may be continue in future.
- The income level (Rs / annum) of the farm households for the selected horticultural crops range from Rs. 11058 to Rs. 18456 & above and is found maximum under the high category and followed by medium and low categories respectively. Whereas, it is found maximum in the medium level category and followed by high and low categories respectively for the state of Manipur.
- The gross income per hectare is maximum on potato farm followed by cabbage and least on pineapple, while the net returns also shows the same trend having maximum income on potato followed by cabbage and

pineapple, but the net return per quintal was found maximum on potato followed by pineapple and least on cabbage farm.

- The farm business income is maximum on potato, followed by cabbage and least on pineapple farm and the same trend is followed for farm family labour income and farm investment income. The benefit cost ratio shows that cabbage is most profitable venture/enterprise followed by potato and pineapple. Also the small size farm group gain more benefit as compare to marginal, medium in pineapple farm, and even small farm also benefit more as compare to marginal and medium farm on potato crop, but on cabbage, medium farmers manage well to get more benefit as compare to small and marginal farmers respectively.
- The impact of income and employment status during the selected period of Nagaland and Manipur shows that potato farming in Manipur is more profitable than Nagaland and it's almost 50.00 per cent of total investment which was found statistically significant at 1.00 per cent. Again, pineapple enterprise is also found profitable and it is around 26.00 per cent of the investment in Manipur as compare to Nagaland whereas cabbage crop also show 10.00 per cent enhancement against the input investment in Manipur as compare to Nagaland respectively. All the selected crops (Potato, Pineapple and Cabbage) are found statistically significant at 1.00 per cent with respect to income.
- When the impact on income is concerned, Nagaland has gain 42.00 per cent as against the 36.67 per cent in Manipur on high income group and among the medium income group is concerned, Nagaland has achieved 38.67 per cent as compare to 34.00 per cent of Manipur. Again it is recorded 29.33 per cent on Manipur as against the 19.33 per cent in Nagaland for enhancement in low income group and employment generation during the study period.

- Even the employment also shows same trend of income with an increment of 45.00 per cent additional profit of employment due to the management and labour cost, whereas pineapple also shows 27.00 per cent additional employment in Manipur as compare to Nagaland. Even the cabbage enterprise also shows 10.00 per cent additional employment as compare to Nagaland in Manipur. All the selected crops (Potato, pineapple, cabbage) are found statistically significant at 1.00 per cent with respect to employment.
- The total cultivated area is found maximum in Nagaland as compare to Manipur. The total overall land holding in Nagaland is recorded as 106.25 ha while in Manipur it is 92.18 ha of land recorded as per the data, wherein on medium farm, it has maximum holding with 39.56 ha, 23.04 ha on small farm and 9.68 ha on marginal farm in Nagaland. As Manipur is concerned, small farm with 22.10 ha of land is the highest followed by marginal with 19.35 ha and it was least on medium with 18.63 ha of land.
- The total overall land holding in Nagaland is recorded as 106.25 ha while in Manipur it is 92.18 ha of land recorded as per the data, wherein on medium farm, it has maximum holding with 39.56 ha, 23.04 ha on small farm and 9.68 ha on marginal farm in Nagaland. As Manipur is concerned, small farm with 22.10 ha of land is the highest followed by marginal with 19.35 ha and it was least on medium with 18.63 ha of land.
- In Nagaland, up to 2 ploughing is found maximum followed by 3 ploughing and very few with 4 ploughing are found for pineapple crop. While in Manipur state, maximum ploughing is recorded at marginal farmers with 2 ploughing, followed by small and medium farm size group, as 3 times ploughing is concerned, marginal farmers are maximum followed equally by small and medium, whereas 4 ploughing

- is concerned, very few are doing 4 & above ploughing in Nagaland for the pineapple crop. Overall, up to 2 ploughing is found maximum in both the state followed by 3 ploughing and 4 & above ploughing, respectively.
- The extent of adoption of farm yard manure (in t / ha) across the different farm size group of Nagaland and Manipur shows that the farm households use the FYM and is high in medium adopters of pineapple, cabbage and potato crops in both Nagaland and Manipur.

- The major economic obstacles encountered by the farmers across the categories are lack of quality seeds/ planting materials , labour problems, irrigation problems, pests & diseases, manures & fertilizers, and PPCs etc. in the production of the horticultural crops whereas lack of access to transportation, market informations, social problems, grading and packaging in the marketing of their horticultural crops.

Policy implications from the study

1. The present study clearly brings out that impact of different selected horticultural crops is highly recognized with respect to increase in the gross cropped area, cropping intensity; improve in the soil fertility thereby productivity of agricultural crops.
2. The outcomes of the study clearly reveal that in terms of income and employment, productivity, holding and income from selected crops are significantly higher in the study areas. This acknowledges the positive impact of livelihood on the farming community and is expected to change the standard of living at the household level in the days to come.
3. Due to increase in the crop yield, the cropping intensity among the fruit crops growers have changed irrespective of land holding size and it is mainly due to well-developed irrigation facilities around the villages thereby farmer income and employment. However, the increased income

and employment both for the selected crops is not uniformly distributed to all the farmers in the area. It necessities proper government attention.

4. The selected horticultural crops is confined to area jurisdiction and therefore the farmers who are confined to this are getting benefits out of it with respect to income as well as employment from various management activities, those farmers who are far away from adoption are least benefitted with regard to income and employment from activities and soil and water conservations activities too.
5. The different selected horticultural activities and the adoption rate of mentioned activities is lower among the farmers across the different farm sizes. It necessities farm level education, awareness and capacity building among farmers to take the advantage and adoption of different development programmes of government in time.
6. Establishing financial framework for sustainable functioning of the selected horticultural crops and participatory planning has been found significant for upliftment of the farm households economy.

Plate 1. Households survey for horticultural crops of Manipur

Plate 2. Socio-economic survey of sample respondents

Plate 3. Market related survey of horticultural crops

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ANNEXURE - I

DEPATMENT OF AGRICULTURAL ECONOMICS

NU: SASRD MEDZIPHEMA NAGALAND

SCHEDULE FOR FARM HOUSEHOLD SURVEY for- "Economic study on various levels of recommended practices in selected horticultural crops of Nagaland and Manipur"

Mr. Th. Motilal Singh

Research Scholar

09402689049

DATE OF SURVEY: …….. CODE No: …….

I. IDENTIFICATION

1	Farmer's name	9	Distance of Households from(Km)
2	Father's name	I	Kacha/ Pucca road
3	Caste	Ii	Local market name
4	Village	Iii	Regulated market name
5	Tehsil	Iv	Bank branch
6	Block	v	Post office
7	District	Vi	Co-operative Store
8	Post Office	vii	Block office

II. DEMOGRAPHIC FEATURE OF THE FAMILY

SL. NO.	Name & Relationship to the head of the Family		Sex M/F	Age (Yr)	Edu.	Occupations & Income(Rs)				Total income (rs)
	Name	relations				Main	Income	Subsidiary	Income	

2										
3										
4										
5										
6										
7										
8										
9										
10										

III. LAND INVENTORY AND IRRIGATION

SL. NO.	Particulars	Area(Ha)			SL. NO.	Particulars	Area(Ha)			Total holding
		Irrigated	Unirrigated	Total (I)			Irrigated	Unirrigated	Total(II)	
	Operational holdind				2	Other area				
	a)Owned					a) orchard				
	a) Leased-in					b) Fallow land				
	b) Leased-out					c) Pasture				
	d)Total cultivated area					e)Waste land				

IV. LIVESTOCK INVENTORY AND INCOME

					production		Home consumption		Marketed surplus		Income	
					MP(lt)	BP(Qt)	MP(lt)	BP(Qt)	MP(lt)	BP(Qt)	MP(lt)	BP(Qt)

V. FARM BUILDING INVENTORY

SL. NO.	Particulars	No.	Area/kuccha/pucca		Const ruction	Annual repair(rs)	Present value (rs)
			Year	Cost(rs)			
1	Residential						
2	Cattle-shed						
3	Farm house						
4	Store house						
5	others						

VI. FARM MACHINERY AND IMPLEMENTS INVENTORY

SL. NO.	Particulars	No.	purchased		SL. NO.	Particulars	No.	purchased	
			Year	Value (rs)				Year	Value (rs)
1	Tractor				15	Rope			
2	Power tiller				16	Fan			
3	Iron plough				17	Gunny bag			
4	Wooden plough				18	Bullock cart			
5	Plank				19	Khurpi			
6	Sickles				20	others			
7	Spade								
8	Thresher								
9	Rake								
10	Basket								
11	Mat								
12	Sprayer								
13	Duster								
14	pimpset								

VII. OTHER SOURCES OF INCOME (FARM & OFF-FARM INCOME)

SL. NO.	Particulars	Monthly income (rs)	remarks	SL. NO.	Particulars	Monthly income (rs)	remarks
1	**services**						
2	**business**			**5**	**Rural artisans**		
3	**Hired labour**				Black smithy		
	labour				carpentary		
	machinery				khadi & handloom		
	rental			**6**	**pensions**		
4	**Sales of**			**7**	**Others (specify)**		
	animals						
	machinery						
	others						

VIII. CROPPING PATTERN, PRODUCTION AND FARM INCOME FROM CROPS

SL. NO.	Particulars	Area		Variety	Sowing time	Harvesting time	Total production(kg)		Price(rs)		Total value (rs)	
		Irr.	Unirri.				MP	BP	MP	BP	MP	BP
1	Zaid crops											
	a)											
	b)											
	c)											
2	Kharif crops											
	a)											
	b)											
	c)											
3	Rabi crops											
	a)											
	b)											
	c)											

Irri. = irrigated; Unirri. = unirrigated; MP = marginal product ; BP = by product

IX. COST OF PRODUCTION (Rs) **Name of Crops** **Area (ha) :**

A. Cost of labours

Sl. No	Particulars	Land preparation			Sowing/ Trans-plantation	Inter-cultural operation			Irri ./ Dewat	Manuring	Fertile-zation	Plant Prote-ction	Staking	harvesting
		Ploug	Harr	plank		Hoe	Weed	earth						
1	**Human labour**													
	A.family labour													
	i)men													
	ii)women													
	iii)child													
	B.hired labour													
	i)men													
	ii)women													
	iii)child													
	C.permanent													
	i)men													

	ii)women													
	iii)child													
2	**Bullock labour**													
	a)owned													
	b)hired													
3	**Tractor**													
	a)owned													
	b)hired													
4	**Power tiller**													
	a)owned													
	b)hired													

B. Cost of inputs

Sl. No	Particulars	Quantity Kg/bag	Price/kg/bag (Rs)	Total value (Rs)	Sl. No	Particulars	Quantity Kg/bag	Price/kg/bag (Rs)	Total value (Rs)
1	Seed/compost				4	Plant protection			
2	Manures/compost				5	Irrigation/ dewatering			
3	fertilizers				6	Staking materials			
	a)urea				7	Land revenue			
	b)CAN				8	Rental value of land			
	c)SSP				9	Rent paid for leased-in land			
	d)DAP								
	e)MOP								

X. MARKETABLE AND MARKETED SURPLUS:

SL. NO	Crops	Total prodn. (tons)	Home con-sumption (tons)	Kept for seed(tons)	Gift (tons)	Others(tons)	Marketable Surplus	Losses (tons)	Marketed surplus

XI. MARKETING CHANNELS

SL. NO	Method of sale	Market	Distance of market from Farm (km)	Means of transport	Qty (tons)	Price/tons (Rs)	Total price (Rs)
1	Sale of assembling point						
	a)village traders/contractor						
	b)primary wholeseller/ reatailers/consumers						
2	Sale at road head						
	a)village traders/contractor						
	b)commission Agent/retailer/consumer						
3	Sale within the state						
	a)contractor / commission agent						
	b)Retailer/consumer						
4	Sale outside the state						
	a)contractor / commission agent						
	b)Retailer/consumer						

XII. MARKETING COSTS; SALE PRICE AND PROFITS OF PRODUCER SELLER (Rs)

SL. NO	Particulars	Marketing costs(Rs)	Sale price(Rs)	Net profit (Rs)	SL. NO	Particulars	Marketing costs(Rs)	Sale price(Rs)	Net profit (Rs)
1	**Charge for**				**2**	**Material costs**			
	a)cleaning/sorting					a)packing			
	b)packaging					b)others			
	c)loading/unloading								
	d)weighing								
	e)losses								
	f)commission paid								
	g)taxes/licence fee								
	h)market fees								
	i)storage/postal								
	j)others								

XIII. PRODUCTION PROBLEMS

Sl. No.	Problems	Response YES/NO	Sl. No.	Problems	Response (YES/NO)
1	seed		4	Fertilizers	
	a)price are very high			a)high prices	
	b)quality of seed not good			b)high transportation costs	
	c)not available in time			c)desired brand not available	
	d)low reliability			d)not available at proper time	
2	Labour		5	PP Chemicals	
	a)skilled labour not available in time			a)high price	
	b)high wage rates			b)don’t know proper dose, time of application	
	c)unskilled labour not available in time			c)don’t know proper method of spraying	
3	irrigation			d)desired brand not available	
	a)perennial sources are not available			e)lack of knowledge about chemicals	
	b)irrigation facility not available			f)distant market	
	c)irrigation facility not reliable			g)high transportation cost	

XIII. MARKETING PROBLEMS

Sl. No.	Problems	Response YES/NO	Sl. No.	Problems	Response YES/NO
1	GRADING		4	weighing	
	a)mechanical grading facilities not available			a)weighing not done accurately	
	b)grading standards not specific			b)use of improper scales	
	c)grading by hand is costly		5	prices	
	d)hand grading leads to quality deterioration			a)no support prices	
2	packing			b)glut in peak marketing season	
	a)costly packing materials			c)low prices	
	b)lack of quality packing materials		6	Market information	
	c)packing materials not available in time			a)lack of timely availability of market news	
3	Transportation			b)no reliable sources of market informations	
	a)high transportation charges		7	Malpractices	
	b)lack of all weathe/ metallic roads			a)in bidding / auctioning	
	c)quick and timely transportation facilities not available			b)arbitrary commission deductions	
	d)lack of linking roads			c)high and undue market charges	

Annexure - II
Dimapur (Medziphema)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.651260
R Square	0.719751
Adjusted R Square	0.590456
Standard Error	1015.02
Observation	50

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	4413.091	471.56	26.04113	2.54E-234
Residual	44	6129.132	88.0257		
Tota	49	12767.78			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-20674.1	11988.85	-1.72444	0.089455	-44624.5	3276.423	-44624.5	3276.423
X Variable 1	165.5265	78.23067	2.101948	0.039499	81.93693	322.194	81.93693	515.4572
X Variable 2	15.98298	7.786096	2.052759	0.044064	0.437535	31.52842	0.437535	31.52842
X Variable 3	-949.7155	1252.334	-0.75839	0.451003	-3451.58	1552.071	-3451.548	1552.071
X Variable 4	1104.882	311.8293	3.542079	0.000747	4815.116	17272.53	4815.116	17272.53
X Variable 5	2356.919	797.0196	2.955474	0.004366	763.1067	3949.192	763.0986	3949.192
X Variable 6	-1209.988	6775.177	-1.78534	0.078945	-25631	1438.982	-25631	14138.42

Kohima (Zakhama)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.631671
R Square	0.675664
Adjusted R Square	0.619810
Standard Error	678.11
Observations	100

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	74573.41	4971.56	26.04113	4.76E-11
Residual	94	52993.65	828.0257		
Total	99	127567.1			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	271.5305	342.0205	0.793901	0.430098	-411.335	954.3965	-411.335	954.3965
X Variable 1	3407.899	1249.595	2.727204	0.008174	913.003	5902.795	913.003	5902.795
X Variable 2	9.033107	8.803486	1.026083	0.308599	-8.54362	26.60983	-8.54362	26.60983
X Variable 3	-24975.2	25528.01	-0.97834	0.331477	-75943.5	25993.14	-75943.5	25993.14
X Variable 4	1765.138	510.3273	3.457675	0.000958	745.537	2782.538	745.637	7845.838
X Variable 5	2143.889	2211.607	0.969381	0.335894	-2271.73	6559.505	-2271.73	6559.505
X Variable 6	-2590.75	5740.717	-0.45129	0.653257	-14052.5	8870.958	-14052.5	8870.958

Nagaland State

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.951821
R Square	0.905964
Adjusted R Square	0.857139
Standard Error	2229.94
Observations	150

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	5	7473.451	491.5346	23.3453	3.54E-9
Residual	144	5293.652	82.02527		
Total	149	12767.198			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept								
X Variable 1	15973.64	4515.274	3.537691	0.000744	6958.606	24988.67	6958.606	24988.67
X Variable 2	3.104073	2.15479	1.440546	0.15444	-1.1981	7.406249	-1.1981	7.406249
X Variable 3	-1435.97	341.2385	-1.04845	0.298377	-512.283	1034.63	-5234.23	1231.63
X Variable 4	21.23459	5.104865	4.416463	3.81E-05	1247.286	3305.053	12475.296	3305.093
X Variable 5	20.12355	7.846511	3.084988	0.002973	8.723229	9.56912	8.272249	9.12856
X Variable 6	-21.1853	7.348013	-2.88313	0.005356	-35.8646	-6.50595	-35.8646	-6.50595

Thoubal (Thoubal)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.696123
R Square	0.750943
Adjusted R Square	0.696123
Standard Error	897.67
Observations	50

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	5	1.42E+11	1.11E+10	25.11238	5.24E-4
Residual	44	1.1E+10	1.52E+08		
Total	49	1.83E+11			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	2.424413	9.89924	0.244909	0.807287	-17.3401	22.18888	-17.3401	22.18888
X Variable 1	29.06074	12.84859	2.261784	0.027115	3.392729	54.72875	3.392729	54.72875
X Variable 2	16.42539	29.39024	0.558872	0.57814	-42.2541	75.10489	-42.2541	75.10489
X Variable 3	-0.18509	2.748335	-0.06735	0.946515	-5.67552	5.305335	-5.67552	5.305335
X Variable 4	0.464434	0.589777	0.787474	0.433823	-0.71309	1.641962	-0.71309	1.641962
X Variable 5	9.270854	7.415798	1.250149	0.215797	-5.5439	24.08561	-5.54393	24.08561
X Variable 6	-2.33182	16.44299	-0.14181	0.887674	-35.1805	30.51682	-35.1805	30.51682

Senapati (Mao-Maram)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.76458
R Square	0.584582
Adjusted R Square	0.487218
Standard Error	28.77544
Observations	100

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	74573.41	4971.56	36.0113	1.45E-06
Residual	94	52993.65	828.0257		
Total	99	127567.1			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.446569	3.498029	0.985289	0.328081	-3.53747	10.43061	-3.53747	10.43061
X Variable 1	41.11715	17.49953	2.349614	0.02189	6.157817	76.07648	6.157817	76.07648
X Variable 2	-0.60233	0.483415	-1.24598	0.217313	-1.56806	0.363406	-1.56806	0.363406
X Variable 3	-4.20408	14.01867	-0.29989	0.765232	-32.2096	23.80143	-32.2096	23.80143
X Variable 4	1.338244	6.568457	0.312449	0.072867	-1.34006	2.188883	-7.34006	5.188883
X Variable 5	5.059036	2.811115	3.487241	3.07E-05	1.444586	4.965485	1.344586	5.165485
X Variable 6	-1.25766	4.832059	-0.26027	0.795487	-10.9108	8.395485	-10.9108	8.395485

Manipur State

Regression Statistics	
Multiple R	0.802295
R Square	0.643677
Adjusted R Square	0.543189
Standard Error	38.4383
Observations	150

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	5	176155.6	11743.7	19.1711	6.91E-5
Residual	144	97515.19	1477.503		
Total	149	273670.8			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	344.0395	162.2087	2.120968	0.037685	20.17929	667.8997	20.17929	667.8997
X Variable 1	42.87763	13.45346	3.187108	0.002197	16.01693	69.73832	16.01693	69.73832
X Variable 2	17.43092	15.95143	1.09275	0.278476	-14.4171	49.27897	-14.4171	49.27897
X Variable 3	-2.81599	3.813675	-0.73839	0.462893	-10.4302	4.798257	-10.4302	4.798257
X Variable 4	6.103554	8.887587	0.68675	0.494646	-11.6411	23.84819	-11.6411	23.84819
X Variable 5	3.104073	2.154792	1.440546	0.154444	-1.19812	2.406249	-1.19813	2.406249
X Variable 6	1.424413	4.899241	0.90905	0.072867	-1.34006	2.188883	-1.34006	3.188883