PRODUCTION EFFICIENCY OF RICE CULTIVATION IN NAGALAND UNDER DIFFERENT FARMING SYSTEMS: A COMPARATIVE STUDY

A THESIS SUBMITTED IN FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN ECONOMICS

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CERTIFICATE

The thesis entitled ***"PRODUCTION EFFICIENCY OF RICE CULTIVATION IN NAGALAND UNDER DIFFERENT FARMING SYSTEMS: A COMPARATIVE STUDY''*** submitted by ***Mr. B. Imnawapang Longkumer***, bearing Registration No. 749/2017 (Dated: 18th August, 2015) embodies the result of investigations carried out by him under my supervision and guidance.

Further, certified that this work has not been submitted for any degree elsewhere and that the candidate has fulfilled all the conditions laid down by the University.

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DECLARATION

I, ***Mr. B. Imnawapang Longkumer***, hereby declare that the subject matter of this thesis is record of work done by me, that the content of this thesis did not form basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any other University/Institute.

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(B.IMNAWAPANG LONGKUMER)

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LIST OF ABBREVIATIONS

AGDP	:	Agriculture Gross Domestic Product
ATMA	:	Agricultural Technology Management Agency
B C	:	Before Christ
CAGR	:	Compound Annual Growth Rate
CRS	:	Constant Returns to Scale
DEA	:	Data Envelopment Analysis
FAO	:	Food and Agriculture Organization
FFS	:	Farmer Field School
FY	:	Fiscal Year
GDP	:	Gross Domestic Product
GM	:	Gross Margin
GR	:	Green Revolution
GR	:	Gross Return
HA	:	Hectare
HVP	:	High Yielding Variety Seed Programme
HYV	:	High Yielding Variety
IADP	:	Intensive Agricultural District Programme
IRRI	:	International Rice Research Institute
KVK	:	Krishi Vigyan Kendra
KM	:	Kilometer
KG	:	Kilogram
LF	:	Large Farmers
MDF	:	Medium Farmers
MF	:	Marginal Farmers
MFI	:	Micro Finance Institution
MT	:	Metric Tonnes
MV	:	Modern Varieties
NEH	:	North Eastern Hills
NER	:	North Eastern Region

NGOs	: Non-Governmental Organization
NPK	: Nitrogen Phosphorous Potassium
PAM	: Policy Analysis Matrix
R&D	: Research and Development
SFA	: Stochastic Frontier Analysis
SARS	: State Agriculture Research Station
SMF	: Small Farmers
SRI	: System of Rice Intensification
SS	: Secondary School
TE	: Technical Efficiency
TFP	: Total Factor Productivity
TRC	: Terrace Rice Cultivation
TR	: Total Revenue
TVC	: Total Variable Cost
UNEP	: United Nations Environment Programme
VHLSS	: Vietnam Household Living Standard Survey
VRS	: Variable Returns to Scale
WRC	: Wet Rice Cultivation
WTO	: World Trade Organization

CHAPTER 1

INTRODUCTION

INTRODUCTION

Agricultural production has a paramount significance towards uplifting India's economy, as the sector plays a very important role in meeting food security and eradication of poverty. In spite of the significance of this sector, the production pattern in agriculture in many parts of the country is mostly unrealized due to many unseen distribution of capital formation in rural infrastructure resource and development, education, health extensions and other price related bottlenecks. Consequently the level of productivity of the agricultural sector in many states specially North-Eastern Region (NER), are far below the potential than the other regions achieved during the time of Green Revolution. Higher agricultural productivity contributes to higher income level of the family, which in turn leads to increase in labour productivity. On the other hand, poor conditions of soil, severe weed infestations as well as unfavorable working condition of labourers reduce production levels in upland rice growing states (Mukhopadhyay et.al, 1972).[1]

Though agriculture is a predominant sector of the Indian economy, it is characterized by low productivity and low supply elasticity. India witnessed four phases of agricultural policy after independence: first from 1947-1965, which witnessed tremendous reform in agriculture, institutional changes, major development of irrigation projects, strengthening of cooperative credit institutions, abolition of intermediaries and giving land to the actual tellers etc. Community Development Programmes, decentralized planning and Intensive Area Development Programmes were also initiated for regenerating Indian agriculture and for fixation of minimum support price, Agricultural Price Commission was formed in 1965. The second phase started in 1967-78, with adoption of new agricultural strategy, relying on High Yielding varieties of crops, multi cropping and spread of irrigation facilities etc. Attainment of self-sufficiency in food grains production was the biggest achievement of this strategy. While, Green Revolution came as a blessing in disguise at the right

[1]Severe weed infestation has resulted in reduction of yield to the extent of 50 to 60 per cent and sometimes even complete failure has been reported by different farmers (See Mukhopadhyay et al., 1972).

time to support the increase in demand for wage goods, which followed the increased employment opportunities contemplated in the new strategy for development (S.V. Sethuraman) [2] . The third phase began from 1980-1991 and it started with diversification process, resulting into fast growth of non-food grains like, fishery, poultry, milk, vegetables, fruits etc., accelerating growth in agricultural GDP at 3.52 percent. The fourth phase started from 1991, after the initiation of economic reform. The reform involved policies, such as, globalization, deregulation, and liberalization. Opening up of domestic market by initiating of new international trade accord and WTO was another milestone that affected agriculture during this period. Despite concentrated industrialization in the last seven decades, Indian agriculture still forms the backbone of Indian economy and occupies a place of pride and is the most important sector, accounting 17 percent of India's Gross Domestic Product and also provides employment to about 53 percent of the population as per 2017-18.

1. Rice Cultivation and its Significance

Rice is the world's most important food crop, being the staple food of over 50% of the world population, particularly India and China, and other Asian and African countries. Rice is a major source of energy in human diet and more than three billion people are dependent on rice as their major source of calorie (Chandrasekaran et al., 2007)[3]. Since we do not know when rice was first discovered and domesticated, it is buried in obscurity and the depths of time. One of the most important developments in the long and turbulent history of the human race, which led to the development of civilization, was the domestication of rice. The domestication of rice was believed to have began somewhere in Asia, and was lost in the mists of time forever, and grain slowly spread all over the world. It is also believed that, in India, the rice plant was originated in southern India and it spread to the north and slowly to other parts of the country. The plant was found to have spread to China and then onwards to Korea, the Philippines (about 2000 B.C), Japan and Indonesia (about 1000 B.C).

Rice is one of the most important food crop and for almost two-third of India's population, and it is considered as a life for our country, as it plays a very vital role in

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[2] S. V. Sethuraman (1974), "Employment and Labor Productivity in India since 1950". Economic Development and Cultural Change, Vol. 22(4), Pp. 673-690. Published by: The University of Chicago Press.

[3] Chandrasekaran, B., Annadurai, K., Kavimani, R. (2007). A textbook of Rice Science. Scientific Publishers (India), Jodhpur, India.

food security of our nation and it is a means of livelihood for millions of rural population. India has the largest area under rice farming, covering an area of about 41.92 million hectares and with an annual production of 89.09 MT (Anonymous, 2009). It is also the major food crop of the North Eastern Hills region, occupying more than two third of the total cropped area (Borthakur, 1997)[4]. The North-Eastern Region accounts for 10.48% of country's total area and 6.46% of the total rice production (Bujarbaruah et al., 2004)[5]. The immense diversity of rice germplasm is a rich source for many rice based products and it is also used for treating many health related diseases like, indigestion, epilepsy, arthritis, paralysis, diabetes and it also give strength to women who are pregnant and lactating.

This chapter is divided into three sections. Section I gives an introduction, Concepts and Definition, significance of study, statement of the problem, objectives, hypotheses, methodology and limitations of the study; Section II is related review of literature and Section III is on study profile.

SECTION I

1.1 Concepts and Definitions:

Production function and Productive Efficiency

Production function is referred to the expression of the technological relation between physical inputs and outputs of the goods. Productive efficiency is a situation in which the economy could not produce any more of one good without sacrificing production of another good. On the other hand, productive efficiency occurs when a good or a service is being produced at the lowest possible cost.

Land: Land comprises of all the naturally occurring resources as well as geographic land. It includes, geographical locations, forests, mineral deposits, fish stocks and atmospheric quality.

Human Labour: Human labour is defined as the physical and mental effort used by human beings for creation of goods and services. Labor force of a Nation is

[4]Borthakur, D.N, (1992). Shifting cultivation known as Jhumming is one of the most ancient system of farming believed to have originated in the Neolithic period during 7000 B.C

[5]Bujarbaruah, K.M. (2004). Organic Farming; Opportunities and challenges in NE region of India. International conference on Organic food held from Feb.15-17 at ICAR Research Complex for NEH region, Umiam, Meghalaya

determined by the size of its adult population and also the extent to which the adults are either working or willing to work for wages.

Bullock Labour: Bullock labour is defined as the number of hours a pair of bullock spends on the farm per day, and it includes both owned and hired labour.

Machine Labour: It includes equipments, such as hand tools and power tools to tractors and many different kinds of farm implements that they tow or operate. Since the advent of mechanized agriculture, agricultural machinery has become an indispensable part of how the world is fed.

Seeds: Seed can be defined as material that is used for the purpose of planting and regeneration. It is a fertilized matured ovule covered with seed coat i.e., part of agriculture, sericulture and horticultural etc., which is used for sowing or planting purpose. Thus seed is the most important and crucial input for crop production, and the ways to increase productivity without adding to the extent of land now under cultivation by planting quality seed.

Farm yard manures: Manure is defined as an organic matter, which is derived mostly from feces of animals except in the case of green manure, and is used as an organic fertilizer in agriculture. Manures contributes in increasing the fertility of the soil by adding organic matter and nutrients, like nitrogen, which are utilized by fungi, bacteria, and other organisms in the soil.

Fertilizers: Fertilizers are materials of natural or synthetic origin which is applied in soils or plant tissues to supply plant nutrients, which are essential for the growth of plants. There exist many sources of fertilizer, which includes, both naturally and industrially produced.

Pesticides/ Plant protection chemicals: Pesticides are those chemical compounds which are used to kill pests, including rodents, insects, fungi and all the unwanted weeds. They are mainly used in public health to kill many diseases and to kill pests that damage crops in agriculture. Pesticides are toxic in nature, as it harms organisms, including human beings, so it needs to be used very safely and should be disposed off properly.

Cost of Cultivation and cost of production: Cost of cultivation refers to the cost which includes factor costs, till the stage of gathering the harvest and that cost of production up to the stage of marketing the produce.

Allocation Efficiency: Allocative efficiency is referred to the adjustment of inputs and outputs to select relative prices, having chosen in production technology.

Technical Efficiency: Technical efficiency is referred to the maximum attainable level of output from a give level of production inputs, given the available range of alternative technologies to the farmer.

Production Efficiency: The way of how effectively an available resource is used for the purpose of profit maximization, given the best available production technology.

Economic Efficiency: Economic efficiency is defined as a state in which every resource is optimally allocated to serve each and every individual or an entity in the best by minimizing waste and inefficiency. Any changes made to assist one entity would automatically harm another when an economy is economically efficient.

Measuring Production Function and Efficiency

Production function is defined as the expression of technological relation between physical inputs and outputs of the goods. The main purpose of production function is to address the allocative efficiency in the use of factor inputs in production and also the resulting distribution of income to those factors, while abstracting away from the technological problems of achieving technical efficiency.

Measuring productive efficiency is important for both the economic theorist and policy makers. It is very essential to make some actual measurements of efficiency if the theoretical arguments to relative efficiency of different economic systems are to be subjected to the empirical testing. Many attempts have been made to solve this problem, but, although they usually produced careful measurements of some or all of the inputs and outputs of the industry, they have failed to combine these measurements into any satisfactory measure of efficiency (Farrel, M. J 1957)[6]. Farrell was the first to measure productive efficiency empirically. He defined cost efficiency and decomposed

[6]Farrel, M. J (1957),"The measurement of productive efficiency". *Journal of Royal Statistical Society*, Vol. 19 (1-2), Pp.253-281.

it into its technical and allocative parts using data on US agriculture. The development of Data Envelopment Analysis method was due to the work of Farrell using linear programming and this method is widely used in the literature as a non-parametric non-stochastic technique.

Many efficiency calculations have been developed for frontier estimation and efficiency starting from the first empirical application of Farrell (1957). Essentially two main methodologies are used for measuring TE: the econometric (parametric) approach, and the mathematical (non-parametric) approach. The Cobb–Douglas production function given by Charles W. Cobb and Paul H. Douglas (1927) is a linear homogeneous production function, which implies, that the factors of production can be substituted for one another up to a certain extent only.It was developed and tested against statistical evidence from 1927–1947.

1.2 Rice in India and North Eastern Region

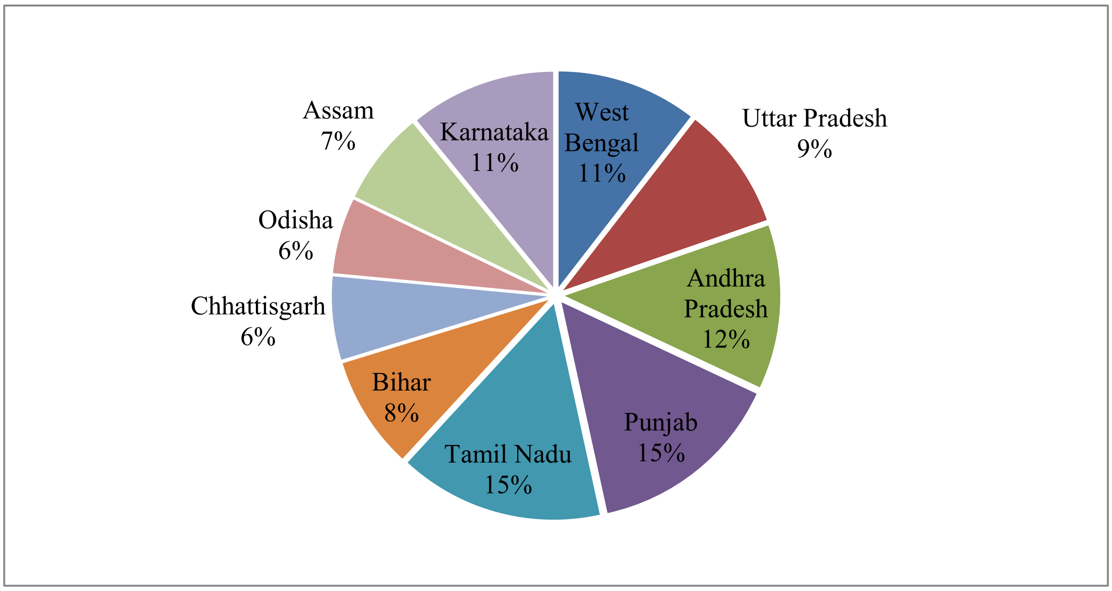
India is the world's second largest producers of rice and brown rice, accounting for almost 20% of world production and it is the staple food for the people of the eastern and southern parts of the country. Majority of the farmers in these regions derive their livelihood from rice cultivation. In addition to the rich genetic diversity, each region in India adopted diverse cultivation practices to adapt to the local conditions. Whereas, rice grown in North Eastern Region (NER), as well as other the hilly areas is known as dry or upland rice cultivation. Interestingly, the yield per hectare of upland rice is comparatively less than that of the wet rice. India, being a land of eternal growing season, and the deltas of Godavari, Kaveri, Krishna, Indravati and Mahanadi with a thick set-up of canal irrigation for the farmers to cultivate two or even three crops a year. Even three crops a year has been made possible due to irrigation. The age-old hill irrigational conveniences have made even the hilly terraced fields from Kashmir to Assam idyllically suited for rice farming. Two crops of rice a year are raised in states like Bihar, West Bengal and Orissa. Rice is cultivated in winter, autumn and summer season in India. Winter rice (Kharif) is a long duration crop than summer rice (Rabi), while winter rice crop is raised preferably in low-lying areas which remain flooded mainly during the rainy season. On the other hand, autumn rice is mostly raised in states like, Uttar Pradesh, Madhya Pradesh, Punjab and Himachal Pradesh. Summer, autumn and winter rice are mostly raised in states of Andhra Pradesh, West Bengal, Assam and Orissa. Summer rice on the other hand is raised on a small scale and on a very small area. However, the leading rice crop accounting for a major portion of the total hectare under rice in all seasons in the country is winter rice.

Table 1.1: Distribution of Area, Production and Yield of Rice among the major Producing States in India (2016-17)

Sl. No	State	Area (Lakh Hectares)	Production (Lakh Tonnes)	Yield (Kg/Hectares)
1	West Bengal	54.33	146.05	2,688
2	Uttar Pradesh	59.47	140.22	2,358
3	Andhra Pradesh	40.96	128.95	3,146
4	Punjab	28.18	105.42	3,741
5	Tamil Nadu	19.03	74.58	3,918
6	Bihar	33.24	71.62	2,155
7	Chhattisgarh	37.73	60.28	1,597
8	Odisha	40.04	58.07	1,450
9	Assam	25.37	45.16	1,780
10	Karnataka	14.16	39.55	2,793

Source: Ministry of Agriculture and Rural Development, Govt. of India

Figure 1.1: Major Rice producing States in India



Though the rice is grown in majority of the states in India, the above mentioned 10 states accounts for 80% of the total rice production in India. Table 1.1 indicates that, West Bengal is the leading producer among the all the states in terms of production, followed by UP and AP, while Tamil Nadu stands top in terms of yield per hectare with more than 3,918 Kgs, followed by Punjab and Andhra Pradesh with 3,741 kgs and 3,146 kgs per hectare respectively. On the contrary, the states of Odisha and

Chattisgarh registered the lowest yield, with an average of 1,450 kgs and 1,597 kgs per hectare. Uttar Pradesh has the largest area under rice, with a total of 59.47 lakh hectares, followed by West Bengal and Andhra Pradesh with 54.33 lakh hectares and 40.96 lakh hectares respectively, while Tamil Nadu and Karnataka are the states with the lowest area under rice with 19.03 and 14.16 lakh hectares during the year 2016-17.

Similarly, North East India is blessed with luscious greenery and unspoilt beauty. All the NER states are highly dependent on agriculture and rice is the major food crop. This region receives very heavy rainfall and rice is grown under rain fed condition. The state of Assam grows more than one crop in a year and ranks 9th largest producer of rice in India, with 25.37 Lakh Hectares producing 45.16 lakh tones and a yield of 1780 Kg/hectares. The total production of rice from this region is 5.25 million tonnes, which is almost 6 percent of national average. The average productivity of rice in this region is about 1780 kg/ha and which is much below than the national average of 2240 kg/ha during the year 2016-17.

Nagaland attainted statehood on 1st December 1963 and it is one of the states in the North Eastern Region of India. Primary sector in the state economy contributing about 31.4%, of which crop production constitutes to be the most dominant activity in the state. Rice is the staple food crop of the state with about 86% of the cultivable area in the state under jhum and terrace cultivation systems. Moreover, for more than 100 years, rice has been the most important food crop of the state, and it is also a part of the tradition and cultural heritage. However, rice production in the state is constrained by bio-physical, economic and technological bottlenecks. Despite of all these obstacles, the farmers have significantly moved on to adopt integrated approaches like, organic, dry land farming and double cropping system in recent years. Rice farming systems in Nagaland is divided into three forms, i,e, Jhum cultivation, Wet Rice cultivation and Wet Terrace Cultivation. Jhum cultivation is practiced in almost all the parts of Nagaland, while Wet rice cultivation is confined mainly to the plain areas of Dimapur district and Wet terrace cultivation is confined to Kohima and Phek districts. The yield rate of TRC/WRC has been experiencing a faster rise since 2010-11 and though it remained stagnant in 2011-12.

The state has initiated steps to revive traditional rice over the years for many reasons. Though, the farmers are not growing traditional varieties for sustenance, but they are still the custodian of knowledge about them. In the wake of climate change, these varieties of rice will be promoted among farmers, since they are the best bet for adapting to changing climate. State Agriculture Research Station (SARS) at Mokokchung has identified around 867 traditional 'land races' of rice and most of them are found to be grown under the jhum cultivation system, which is being practiced by different Naga tribes in the state. For promoting livelihood and food security, the state government has recently initiated a project under traditional integrated rotational farming system called "gene pool conservation of indigenous rice varieties".

1.3 Significance of the Study

Developing economies can benefit much from the studies related to inefficiencies through finding the possibilities of increasing production by increasing efficiencies and without increasing the resource base or technology. Rice farming in the state provides a source of livelihood. However, rice cultivation has been marked by many constraints with low productivity. One of the main reasons for lower productivity of agriculture in Nagaland is the inability of the farmers to fully exploit the available resources. The productivity is relatively low in the state compared to the national average and even other states in the North East Region by non-adoption of HYV seeds, chemical fertilizers, pests, diseases and other soil nutrient management technologies. The study will help us to find out the differences in cost of production and productivity among different farming systems, its technical and economic efficiency and factors that promotes as well as hinders production efficiency among different rice farming systems. The findings of this study will be helpful and useful for the farmers to give appropriate policy recommendations, designed to increase productivity by identifying key characteristics of different farming systems in the state.

1.4 Statement of the Problem

Rice farming is a dominant rural economic as well as culturally important activity in Nagaland. Rice farming utilizes 70 percent of the agricultural land (1.89 lakh hectares) of the State and it produces 4.29 lakh tons of rice. The yield from jhum, terrace and wet cultivation varies considerably depending upon the socio-ecological context and the efficiency of productivity also varies significantly in the state. Scope of rice production to a commercial level is of high potentiality but hilly terrain and topography of the state gives limitations. Due to highly fragmented land holdings under community land distribution system, rice farmers can earn very little just to sustain their immediate needs. This means, farmers do not have the means to invest in their land, which can keep them from upgrading and adopting new farming techniques, which would have resulted in increasing the efficiency. It is also not feasible or practical for large mechanized operations to take place in hilly terrains and even if farmers did happen to own land in the plains, due to small land holdings it prevent the farmers from making that kind of investment required for mechanization. The State government has adopted little in terms of mechanization, irrigation, training, price regulation and infrastructure development and it is not an uncommon sight for farmers to manually plough, sow and harvest their crops. Even transportation is time consuming and the produce is loaded in hand woven bamboo baskets and is manually transported, as there are no proper roads for vehicles to pass. Losses due to unavailability of proper storage devices also facilities in wastage of the produce after the harvest. Lack of proper initiative taken by the Government to support the farmers and the tools, seeds, fertilizers, and pesticides etc provided by the State government at subsidized rate are not sufficient and also not feasible to all the farmers.

All this has resulted a gap between the potential and the actual yield, resulting in lowering down the efficiency. The average actual yield of the major rice crop was 1547 ton per hectare (ha) in 2013-14, while the average potential yield was 2200 kgs per hectare. In other words, Nagaland has a substantial yield gap between the potential and the actual yield, which requires production improvement to reduce this gap. From this background, the present study attempts to understand the existing rice farming systems in Nagaland, through measuring the productive efficiency and inefficiencies and to formulate recommendations for improving farm performances and sustaining rice production systems in the study area.

1.5 Objectives:

In the light of the above background, the focus of the present study is to understand the rice production system and how available resources are being used by the cultivators to improve the efficiency in production and productivity among the growers in different farming systems. With these broad issues in mind, the following objectives are set for the study.

1. To investigate the existing rice production systems in Nagaland

2. To evaluate cost of production and causes for cost variations under different rice farming systems in Nagaland

3. To assess the farm efficiency and factors influencing the productivity.

4. To analyze the farmer's perceptions on problems and prospects of rice cultivation

1.6 Hypotheses

1. Wet terrace cultivation (WTC) and Wet Rice Cultivation (WRC) have higher return compared to Jhum Paddy

2. Irrigated rice farms are more capital intensive than Jhum cultivation

3. Farmer characteristics, farm size, household assets are significant factors affecting the efficiency of rice production in the study area.

1.7 Methodology

1.7 (a) Source of Data:

The data comprises of both primary and secondary data. The Primary data was collected through interview and questionnaire methods. A pre-tested comprehensive schedule was designed especially for the purpose and canvass in the study area. The secondary data have been obtained from different sources, such as administrative reports, Handbook of Statistics, Directorate of Agriculture, crop reports, record and reports from Ministry of Agriculture, supplemented by published and unpublished articles, journals, books, newspaper etc. Nagaland, a dominant agrarian economy with 87% of population and 70% of workforce engaged in the agriculture. At the macro level the entire11 districts of the state is covered and at the micro level analysis, three districts i.e. Mokokchung, Dimapur and Phek are selected on the basis of persistence of major rice farming systems.

1.7 (b) Sample Design:

At the micro level analysis, stratified random sampling method has been applied. The state was stratified according to well-defined 11 districts. Out of which, three districts (i.e. Mokokchung, Dimapur and Phek districts) were selected purposively for the study on the basis of rice farming systems. From each District, three Blocks have been selected and from each Block one village with 50 households were selected randomly. For Mokokchung District the villages of Mongsenyimti under Chuchuyimlang Block, Longmisa village under Ongpangkong North Block and Longkhum village under Ongpangkong South Block was selected, while for Phek District Pfutseromi village under Pfutsero Block, Chizami village under Chizami Block and Kikruma village under Kikruma Block was selected. On the other hand the village of Singrijan under Dhansiripar Block, Nihoto under Kuhuboto Block and Nihokhu under Nihokhu Block was selected respectively in Dimapur District. From the selected villages; households were stratified into four different farm groups namely[7], Marginal Farmers (MF), Small Farmers (SF), Medium Farmers (MDF) and Large Farmers (LF). The households are selected randomly and the total sample size is 450, i.e. 150 household from each Districts and 50 households from each villages.

1.7 (c) Data Analysis:

The data was analyzed using appropriate statistical tools and technique, such as ratios, percentages, proportions. In addition to the above usual statistical measures, Multiple Regression, Cobb Douglas production function and stochastic production frontier models are applied.

i) Gross Return

GR= Total production x per unit price

ii) Gross Margin

GM=TR-TVC

Where, TR=Total Revenue

TVC=Total Variable Cost

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[7]Marginal farmers: Operating upto 2.5 acres of land; small farmers: Having an operated areas between 2.51 to 5.0 acres of land; Medium farmers: operating an area between 5.0 to 10 acres of land, Large farmers: whose operated area was more than 10.01 acres. See Kailas Sarap, 1991, Reddy, 1992.

iii) Compounded Annual Growth Rate

$$\text{CAGR} = \left(\frac{EndingValue}{BeginningValue}\right)\left(\frac{1}{No.ofYears}\right) - 1$$

iv) Multiple Regression Analysis

$$Y_t = \sum_{i=0}^{k} \beta_i \, X_{it} + \mu_t$$

Where, Y_t is the dependent variable, the X's are the independent variables, and μ_t is the error term. β_1 is the constant term, or intercept of the equation

v) Cobb-Douglas production Function is

$$\ln Y_i = \beta 0 + \sum_{k=1}^{n} \beta_k \ln x_k + v_i - u_i$$

Where, Y_i is the output, β is constant, k is the quantity of capital, v_i and u_i are the error terms

1.7 (d) Period of Study

For primary data, the study relates to the agriculture crop year of 2016-17 and for secondary data regarding area, production and yield for district wise in the state was covered for a period of 19 years i,e.1998-99 to 2016-17 and for state wise analysis the data was covered from 1997-98 to 2015-16.

1.8 Limitations of the Study

The primary data collected from the respondent has been well taken care of to the best possible ways to avoid biasness and misinterpretation but it cannot be ruled out that the data collected may not be free from errors. All the information from the respondents are based on mire approximation and calculations of the farmers through their lifelong experiences since Naga farmers has no proper written records beginning from size of land area to the units of fertilizers/manures used till the point of harvest and the number of units sold in the market etc, and it is very difficult to get appropriate information from the respondent. Another limitation in getting the data was the ignorance of the farmers, their unwillingness and also the negative attitude and approach they have towards the people who come to get information from them thinking that it is from a concerned Government Department who has always come and made false promises every time. In spite of all this drawbacks and problems, care has been taken to ensure that the data collected from the respondent is in conformity with the actual facts and figures with the concerned Department under the Government of Nagaland. Despite of all the limitations this research has been taken up to study the condition of paddy cultivators, the problems and the challenges the farmers face in cultivation and also with an aim to educate the farmers in minimizing the errors and also to educate them about the available resources at their disposal and to train them to achieve higher growth and production.

1.9 Organization of the Study:

The organization of the study will be as follows:

Chapter 1: Introduction
This chapter discusses the introductory background, significance, statement of the problem, objectives, hypothesis, methodology, and limitations of the study along with detail review of literature and profile of the study.

Chapter 2: **Extent of Rice Farming and Socio-Economic Profile**
This chapter presents the extent of rice cultivation in terms of area, production and productivity at macro and micro perspectives and Socio-Economic Profile.

Chapter 3: **Production Efficiency and Determinants**
This Chapter asses Production Efficiency and determining factors of rice farming under different farming systems in the selected study villages.

Chapter 4: Farmer's Perceptions and Problems of Rice Farming Systems
This chapter describes the Farmer's opinions on rice cultivation, problems and prospects under different farming systems.

Chapter 5*:* Summary and Conclusion
This chapter presents summary and conclusions of the thesis followed by policy recommendations along with scope for further research.

SECTION II

1.2 REVIEW OF LITERATURE

Review of literature would help us to understand the current research problem and also facilitate to modify and improve the present study. The review in this study is restricted mainly to literature on productivity in agriculture. Studies at international level, developed as well as developing countries, national and northeast level are being compared. The conclusion of the studies varies widely with respect to the time frame, the nature of data used, methodology employed, the number of variables examined and the estimation procedure adopted. The studies reviewed are arranged in a chronological order, so that it will help enable us to trace the historical evolution of the methodology used, improvement in data coverage and estimation procedure and also the contribution of each piece of research to the stock of knowledge. This section presents some of the earlier works to review in the relevant context broadly in three sections. In section one, studies related to production and productivity trend, in section two studies related to production function and its determinants and in section three studies related to production efficiency and inefficiency.

1.2.1 STUDIES RELATING TO PRODUCTION AND PRODUCTIVITY TRENDS

Albert Howard (1920), the study was based on improvement of crop production in India, as the investigator realized about a new world where the problems of agricultural conditions are entirely different from the West. Study observed that, average yield per acre was low and remarkably constant, while the average production showed no change, and there was a considerable seasonal variation in yield. It also indicated that, Indian producers lack uniformity and evenness, which modern industries demand and cultivator are conservative, and it becomes difficult to make him understand the difference between a good crop and of a variety which can give yield above the average. In India, yield is of paramount importance and the period for growing the crop is much more strictly limited than other countries. Early sowing becomes impossible as the soil is too hot for the seedlings, while sowing late leads to great slowing down in growth as the temperature falls. It was also found that, in exceptional seasons, late, high-yielding give a crop considerably higher than that yielded by the more rapidly maturing kinds. However, it is reversed in average years, while in very short seasons, the rapidly maturing kind gives a fair crop and the high yielding type practically nothing beyond straw. Study also found that, combining both the highest yielding and the highest quality in one variety may not be possible but high yield can be united with quality far above the average as payment for yield is easy and immediate but payment for quality is often a slow process.

Jyoti P. Bhattacharjee (1955) in his paper, "Resource Use and Productivity in World Agriculture" an attempt was made to fit in a production function, linear in logarithms, to agriculture in selected countries of the world. The production computed the average growth rate of world agricultural output of the year from 1948 to 1950. The study was done through fitting of a single equation production to the data of agricultural inputs and output for selected countries and this selection was entirely determined by the availability of the needed statistics. The study showed that, fertilizer consumption, arable land and the number of people active in agriculture were the terms of inputs contributing to the agricultural output of the countries. While the productivities of these items of input showed that, marginal productivity of chemical fertilizer was highest, followed by one-man labor and the lowest among the three was that of an acre of arable land. However, items like productive livestock, tractors used, work stock, did show any significant regression. Study also found that, the rate of growth per year was 2.26 percent, as against the estimated increase in rate of population of 1.22 percent per year in the world.

P. C. Goswami and P. D. Saikia (1968) the study was based on Assam's experience trading in paddy between 1959 and 1966. The study emphasized that, no scheme of procurement of foodgrains from the surplus farmers can succeed unless, the procurement price is remunerative to the farmers, yielding them a reasonable return after covering their costs of production and the retail prices of foodgrains in the major consuming centers are effectively controlled. The study revealed that, unrealistic procurement prices can start a vicious circle, leading to collapse of any scheme of public distribution of foodgrains and the procurement prices were fixed too low, forcing the large farmers selling their produce to private agencies and the consequent failure of procurement resulted in the fair price shops in the state being starved of rice and consumers being thrown on the free market for most of their requirements leading to soaring prices. The study finally concluded that, high price in the open market was the result of inadequate supply of rice from fair price shops which led to brisk trade in rice in the open market, especially in the urban areas and for the success of procurement, Government needs to control smuggling and unauthorized trade in paddy and provision of minimum quantity is necessary for consumption through fair price shops in urban areas and Government need to implement its policies without too frequent modifications and relaxations.

Jiro Iinuma (1969) in his paper, "The Meiji System: 'The Revolution of Rice Cultivation Technology in Japan'', made an attempt to examine the role of technology in Rice cultivation in North China. The study indicated that, the system of rice cultivation must have been the constant deep irrigation system because, the system in Yang-tsu-chiang Valley in those times were found to be the constant deep irrigation system with no plows and there were no plows until the fifth century in Japan. It is found that, occasional draining system established in North China may have diffused to North Korea where it had a similar climatic condition to North China and later introduced to Japan through South Korea. Study also indicated that, during the Meiji era, Japan started to study European and American agricultural technology, the government established agricultural schools and experimental stations and employed European and American agricultural scholars and engineers, who introduced the use of a no-sole plow, which later spread all over Japan. Study also found that, it encouraged the breeding of new varieties of rice and as a result more productive system of rice cultivation was established at the end of the nineteenth century and this system was came to be known as the "Meiji system" of rice cultivation. The study concluded that, the Japanese method of rice cultivation is being introduced to Southeast Asia at present and it exhibits a higher productivity than that of native rice cultivation.

A. K. Chakravarti (1973), the study examined the diffusion of the High Yielding Variety Seed Program which has contributed to serious interregional disparities. Along with raising the total food grain production, the problem for farmers in India is to make India self-sufficient in food production, which can be achieved by raising the acreages and the yields but in India the cultivable land is limited. Study indicated that, judicious combination and use of chemical fertilizers, irrigation, pesticides, and capital investment is needed for successful adoption of the H.V.P but despite the recent increase in fertilizer consumption, it consumes only one-fifth of world's average, as farmers cannot afford to purchase. Study also found that, timely and adequate water availability are important for the new seeds to respond to fertilizer better but in India seventy percent of the cropped area receives less rainfall even during the main cropping season. Study also indicates that, unequal success of the cereals under the H.V.P has increased regional disparity, while the wheat-growing areas have been found to be benefitted more than the rice growing areas under the new program.

S. V. Sethuraman (1974), "Employment and Labor Productivity in India since 1950", the paper analyzed the trends in employment and labor productivity and an attempt was done to link the overall development strategy. The study found that, there was respectable rate of growth of employment in the Indian economy in sectors like, mining and plantations during 1950-66, but it slackened considerably since then. It also indicated that, modern sector are organized better and its installed capacity is better utilized and this sector showed a better performance in employment and productivity, resulting in greater investable surplus capacity of the economy in generating employment. Study also found that, since majority of the total working force is engaged in traditional sector as labor productivity declining, the concern for poverty is now greater than ever. The decreasing labor productivity has lead to fall in labor income and ultimately swelled the population below the poverty line. However, with the availability of fertilizer, other modern inputs, new varieties of wheat and other crops have opened up the possibility for a widespread technological change. Study also indicated that, if new strategy shifts more resources to the traditional sector with a more efficient use of industrial capacity in the future than the rate of economic growth can be raised without worsening the distribution of income.

N. Krishnaji (1975), the paper made an attempt to analyze the inter-state variations in per-capita production of foodgrains. Study indicated that, even though a staple per capita production was recorded during the fifties but it widened during the next decade. However, productivity differentials narrowed down during the earlier period and changes in the regional pattern of the land man ratio neutralized the dampening effect of productivity differentials. It also found that, changes depended on the spatial pattern of the growth of acreage under foodgrains in relation to the growth in population. Study also showed that, changes in land-man ratio have not favoured a reduction in inequalities and they worked rather in the opposite direction and, there was no tendency for the growth in population to be higher either through a higher natural rate or through greater immigration in the high productivity regions. It suggests for a compensatory change in the land-man ratio that can neutralize the wide inter regional variations in productivity per hectare in the long run.

'The Rice Cultures and Discussion', **Te-Tzu Chang and A. H. Bunting** (1976), study indicated that, cultivation of rice started when the inhabitants like, hunters, fishers and food gatherer near the river dropped seeds into low-lying fields and it was found that, land preparation, transplanting and irrigations were largely developed in yellow Han river basin, later spreading to Southeast Asia. Rice culture was expanded from the flooded areas into fringe areas, where the soil was well balanced. It also found that, development of rice was greatly accelerated by human and natural selection, which was the result of man's extension of its culture and persistent selection within a geographic region but due to extensive contacts among the people there was rapid changes in predominant varieties within an area. The study further showed that, there was an increase in population, changes in diet and predominance of specific draft animals due to such exchanges and it slowly resulted in loss of cultivator's primitive characteristics and acquired wider adaptation, sterility barriers developed and a drifty and productivity plant type evolved.

Performance and Prospects of Crop Production in India **A Vaidyanathan** (1977), the paper made an assessment on the prospects for accelerating agricultural growth and examined the causes of the non-fulfillment of targets and to assess the possibilities, and constraints on increasing agricultural production. Study showed that, the main reason for the fall in actual growth persistently short of targets, are due to loose manner in which the plans deal with the relation between targets and programmes. The study made a comparison between India and China and found out that, India has an advantage in accumulation of scientific knowledge for increasing productivity of land manifold, since the gap between present and potential productivity in India is much greater than China, which had already achieved a very high level of intensity of land use and cultivation practices. Study also found that, given the existence of technical know-how, it will be possible to achieve higher rates of agricultural growth than those recorded by other countries, but it has consistently fallen short of target due to slowing down of agricultural growth during the last decade, which has resulted in a near stagnation of agricultural output per capita and constraining growth of the rest of the economy due to the acceleration in population growth.

Growth of Productivity in Indian Agriculture, **C. G. Ranade** (1986) made an attempt to examine the contribution to growth by changes in cropping pattern, locational shift and pure crop yields in the pre and post Green Revolution periods, from 1952-53 through 1972-73. It tried to do an extension work of Dharm Narain and explain the anomalies, correct the data for those anomalies and redo the decomposition analysis for the periods 1952-53 to 1961-62 and 1961-62 to 1972-73, and also extended the analysis for the period 1972-73 to 1982-83. The study found that, it was due to technological change in rice production that helped states like Punjab and Haryana in tapping the comparative advantage and the locational shift effect was possible only after technological change took place and as a result, the contribution of the pure yield effect was more in the pre as opposed to the post-Green Revolution, which shows that, technological change reduces the per unit cost of production of output and hence increases the returns of production. It also found that, India has not only made a pioneering progress in the area of the Green Revolution but has also been successful in some states like Gujarat and Maharashtra in the area of expanding the processing of the agricultural produce, such as for sugarcane, and thereby increasing the incomes of farmers.

Jerry A. Sharples (1990), "Cost of Production and Productivity in Analyzing Trade and Competitiveness", the paper emphasized to provide a better understanding of international competitiveness by improving on measures of agricultural costs and productivity. The analysis illustrated basic links between measures of costs and competitiveness and the focus was on costs, even though some of the implications have been extended to measures of productivity. The study found that, estimates of agricultural costs need to be consistent with trade theory and it should tell little about comparative advantage, and also should show how differing competitive market forces influence input use and payments to fixed factors within countries, and useful to an extent for estimating future incremental changes in input prices, technical efficiency, and policy might shift agricultural supply curves. The study concluded that, useful information about how domestic competitiveness forces affect resource use and costs by incorporating the basic concepts of trade theory through the analysis of inter-country comparisons of costs and productivity.

World Agriculture: Production and Productivity in the Late 1980s, **David Grigg** (1992). The study highlighted the international differences in production and productivity and an attempt was made to measure the total agricultural output of the world. Study indicated that, Tropical Africa is characterized largely by extensive farming systems and very low crop yields, use of fertilizer inputs are lower than elsewhere, and low percentage of the arable. Farming was found to be still reliant upon labour and there was very little progress in mechanization, while livestock production was rarely integrated with crop growth. Study also showed that, Europe is the only region where both land and labour productivity exceeds the world mean and have a comparatively high labour inputs but since 1950 it has experienced a dramatic decline, rapid mechanization and high output per man, although still falling short of North America. North America was found to have a high crop yields and intensive farming system occupying a comparatively small proportion of the total agricultural area and so AGDP per hectare of agricultural land was below the world mean, while AGDP per capita was above. On the other hand, study found that, Asia and the whole of South-east Asia have AGDP per hectare above the world mean but labour productivity was below. The study also found that, since the 1960s the use of new high-yielding varieties of rice and wheat, combined with the greater use of fertilizer has increased crop yields but still in most of the Asian countries human labour is paramount and so labour productivities are still below the world average.

Santha A.M. (1993), the paper made an attempt to examine the cost and returns of paddy cultivations for different seasons in Trichur, Kerala. The study used a primary data from three cultivated seasons and found that, for viruppa season, the cost of cultivation was found to be minimum at about Rs.3726.16 per hectare, while cost of cultivation during Mundakan and Punja had not much difference, with a cost of Rs.4641.51 and Rs.4625.50 respectively. The input-wise split up revealed that, the cost on hired human labour was the major share of the total, with Virappa and Mundakan accounting 22.62 and 25.57 per cent and for Punja 27.22 per cent. While, imputed value of rent on land was the next important input. The paid out cost for Viruppa accounted only for 62.54 per cent, 65.04 per cent in Mundakan and for Punja it was 67.74 per cent. The return per rupee invested was the highest for Viruppa, followed by Mandaka and Punjab.

Loren Tauer (1995) made an attempt to estimate farmer's productivity by age. The study found that, agricultural technology was found to be consistent across age groups within that region, but different efficiencies in utilizing that technology were displayed by farmers of various ages and also used different levels of inputs in a technology that may not exhibit constant returns to scale. The results showed that, the productivity of the farmers generally increases and then decreases with age. It also found that, farmers between the ages of 35 and 44 being the most productive. The study further showed that, there was an increase in farmer's efficiency on average by about 5 to 10 percent every year and then it decreases at the same rate. However, there was no change in efficiency with change in age among the farmers in Appalachia, Southeast, and Delta States. It is also found that, farmers in the Corn Belt lose efficiency past mid life, indicating no efficiency gain while they age, but the efficiency fall was found to be less than its increases as they age among the farmers in the Mountain and Pacific regions. Study also found that, farmers of middle age were 30 percent more productive than the youngest and oldest age groups.

S. D. Sawant and C. V. Achuthan (1995) in their paper "Agricultural Growth across Crops and Regions: Emerging Trends and Patterns", an attempt was made to analyze agricultural growth of India across crops and regions in the post-green revolution period that unfolds new trends and patterns emerged until 1980s. Study found that, the role played by yield improvement in including higher output growth has been far more important than that of expansion in area, indicating that the process of growth has been technologically more dynamic. While acceleration in yield growth has been significant for crops like rice, maize, other pulses, rubber and cotton etc., but for other crops yields continued to expand at pre 1981 levels. Enhancement in yield growth was found to be more impressive for non-food grains, as compared to food grains, indicating a much wider diffusion of technology across the crops. It also found that, performance of western region was most unsatisfactory among all the regions of India, which might be an indication of increasing preference to non-agricultural sectors. The study suggested that, in view of the likely deterioration of the foodgrain economy in the western and southern parts of India and the declining prospects of high growth in foodgrains output in the north-western states, it is inevitable that the central and the eastern regions have to share the burden of India's food security. Study further suggest for a greater thrust on policies and a commitment of adequate resources implementation and to strengthen the policies and programmes for broadening further the base of agricultural growth and making it more sustainable.

Vishwa Ballabh and Sushil Pandey (1999), study tried to highlight on the nature of economic and institutional changes occurring in rice production systems of two villages from eastern UP, Ecauna in Deoria district (Flood Prone) and Tewari-ka-Tarkulawa in Maharajganj district (flood-free) over the last 15 year. Study found that, slow growth of agricultural production in eastern India is due to various reasons like, feudal production, characterized by large landowners exploiting small farmers and landless labourers. It was also found that, Indian rural labour market, particularly in eastern India, has been that of an oligopolistic market with large and rich farmers fixing wages and using interlinked credit and land market to their advantage. It further indicated that, new opportunities for increasing farm productivity and incomes have led not only to changes in crop choice and input usage but have induced changes in land and labour markets and real wages have increased. The study suggested for an innovative technological policy and institutional interventions to exploit and encourage rural dynamism needed to guide the process of economic growth.

Profitability of Hybrid Rice Cultivation: Evidence from Karnataka''. **P. G. Chengappa et al.** (2003). The study highlighted on the profitability of Hybrid rice cultivation based on farmer's experiences during 2000-01 crop years and the reasons for lower profitability and the constraints. Study found out that, hybrid rice was giving more yield but less profitable than the existing high yielding varieties seeds. The study further showed that, higher seed cost resulted in higher cost of production and higher level of fertilizer and labour consumption and lower market prices have completely offset the yield gain recorded for hybrid rice. It suggested for refining of hybrid rice technology, which will reduce cost of cultivation and improve the quality of rice to create a demand pull suiting the taste and preferences of consumers.

A. Amarender Reddy (2004) in his paper, "Consumption Pattern, Trade and Production Potential of Pulses", an attempt was made to solve the problem of shortage and surge in import of pulses and to identify the niches where productivity and area can be increased with cost effective technology and management methods. Study revealed that, shortage in supply and the surge in import of pulses have led to an increase in price and costing heavily in terms of valuable foreign exchange. Study also showed that, to increase pulses production and consumption, we need to have a region specific approach, because consumer preference for different pulse crops also varies widely across regions. It stated that, growing international market for pulse crops is an opportunity as well as a threat for pulse farmers, as the increase in productivity and competitiveness will leads to a growing world demand for pulses. However, it further indicated that the existing high yielding varieties have the potential to increase productivity but it need to increase location specific efforts for wider acceptability of improved varieties among farmers through development of high-yielding, pest resistant varieties, which will ultimately increase yield. Study also indicated that, increasing our competitiveness by producing at low cost will be affordable to the mass population and can help accomplish eliminate malnutrition and for this it needs efficient use of genetic resources, besides natural resources such as land and water, on a long term sustainable basis.

Phanindra Goyari (2005), the paper examined the sustainability of the agriculture sector in the face of damages brought by natural calamities in Assam. Study found that, more than 70 per cent of rice, 70 per cent of foodgrains, 83 to 89 per cent of sugarcane, 55 to 65 per cent of potato and almost entire tea output etc., comes from Assam. All this showed the position of Assam in NER in terms of production of various crops and indicates that Assam can be made the foodgrain basket for the whole NER if all potentialities of agricultural development can be explored but it has been threatened by flood problems, sand casting, water logging etc. Study suggested the need for controlling the flood menace as it is very critical for ecological security, livelihood and food security of the state and its neighboring states. Most of the flood and erosion control measures undertaken are of short term and it is ineffective, insufficient and unsatisfactory and it suggest for effective management of flood and erosion, long term measures in the form of multipurpose reservoirs, dams and water shed management. It also suggested for a concerted policy by both the state and central governments to solve flood problems permanently along with the cooperation from neighbouring countries which may be useful and helpful in controlling the perennial flood problem permanently and will go a long way in sustaining the agricultural development in particular and economic development of the state as whole.

Comparative Analysis of Rice Marketing System in Sri Lanka: Pre and Post Liberalization Period, **Rupasena and Vijayakumar** (2006). The paper examined the structural changes in marketing of rice after economic liberalization to compare the performance between pre and post liberalization period. Study showed that, , the major policy changes on marketing during post liberalization period were, closing down of Paddy Marketing Board along with guaranteed price scheme, food stamp scheme replacing the rice rationing scheme, liberalization of imports, stabilization of price and establishment of food supply monitoring system. It further indicated that, there was a no growth of are under rice after liberalization, while there was a positive growth of before liberalization. However, there was a positive growth in yield in both the periods but the growth lowered in the post liberalization period. Study also showed that, during pre-liberalization, the producer and retail price of rice increased in real terms but due to deregulation of rice trade it reduced during post liberalization. The study stressed that, instead of increasing production to sustain rice farming in the open economy, it need a shift towards increasing farm income and suggested policies governing rice economy to focus on developing forward and backward linkages with private sector.

Aldas Janaiah et al. (2006), study analyzed the long-term yield growth of rice by ecosystem and state, and the TFP growth for two periods early GR (until 1985) and late GR (after 1985). The data was from the databank of the International Rice Research Institute (IRRI), and was compiled from various sources. The study found that, the yield of rice of the country as a whole increased at 2.3 per cent during 1971-2003 as pe the compounded rate and there was a substantial increase in per unit area use of chemical fertilizer in the irrigated states during the early GR period as the MV area rapidly expanded, registering appreciable yield. The TFP during GR period in the irrigated states like, Andhra Pradesh and Punjab grew at 1.2-1.3 per cent per annum but there was a rapid decline in TFP growth between the early and late GR periods in Punjab and Karnataka. On the contrary, in the rainfed areas the TFP growth picked up as MV adoption increased after 1980s. Results indicates that, there was a considerable impact on rice productivity due to various modern technologies developed and adopted by the farmers over the period but there was an apparent fall in the level of productivity impact of the successive generations of modern technologies. However, study found that, deceleration in TFP growth in the progressive areas was not unusual to see because TFP levels could not be increased at the same rate like during the late GR period as it was during the early GR period.

Status of Agriculture in India: Trends and Prospects, **Archana S. Mathur et al.** (2006), examined the trends in growth of agricultural production in India over the last one and a half decades and identified the factors affecting agricultural growth and analyzed the constraints that have affected growth. The study showed that, there is a vast inter-state differences in growth rate of agriculture and even more so for foodgrains. Study at all-India level suggested that, government expenditure in agriculture including public investment, subsidy for fertilizer and electricity consumption are the main factors affecting agricultural production. Again the state-wise analysis showed that, agricultural output at current prices was significantly and positively dependent on government expenditure and the projections for growth in agriculture sector at the all-India level suggested that there is need for an increase in average growth of 10 to 15 per cent per annum in government expenditure. The study indicated that, the average CAGR in total government expenditure on agriculture by selected major 15 states taken together is 20 per cent for the period of 2002-03 to 2004-05 and this trend not only needs to be sustained but has to be stepped up to achieve desired growth. It further emphasized on enhancing government expenditure particularly in rural infrastructure, comprising irrigation, storage and marketing, apart from timely supplies of improved inputs, credit, research and extension services and to address the declining provision of inputs and other subsidies.

Atanu Sengupta and Subrata Kundu (2008) in their paper, "Factor Contribution and Productivity Growth in Underdeveloped Agriculture: A Study from Liberalised India", analyzed the impact of liberalization policies on agriculture in the context of the Indian state of West Bengal. Study found that, West Bengal has emerged as a new power in the agricultural sector since the 1980s and over the period grains production has increased at 3.01 per cent per annum. However, agricultural production in this region was behind the national average until the early 1980s, and this change occurred due to expansion in the Boro (summer) crop, and also due to expansion in the area under cultivation. Study indicated that, there has been a significant upsurge in agricultural productivity due to the establishment of the democratic Panchayati institution and the conduct of Operation Barga lead. Establishment of democratic institution resulted in recording the names of the sharecroppers, granting them heritable rights of cultivation and minimizing the risk of eviction. The second factor was, adoption of new technology and better utilization of fertilizers, credit etc. The study found that, the technical change and input elasticity measures for all the inputs seemed to have improved in the eighties but since the late eighties there was turnabout as the above measures began to decline and the analysis of the components of technical change clearly revealed a huge pool of surplus labour that is generated by the labour augmented changes with over reliance on agriculture and some inputs it even became negative after the nineties.

K. Sita Devi and T. Ponnarasi (2009), tried to estimate the cost and returns of paddy under the System of Rice Intensification (SRI) and compared with those in conventional method and also identified various factors influencing in adoption of SRI and the problems associated. The study showed that, there has been a higher net return for SRI compared to the conventional method and even the cost of production per tone of paddy was lower in SRI, than the conventional method. The cost of production under the conventional method was also found to be almost double because of low productivity of rice in this method. Again, SRI was found to have comparatively higher returns over different cost than conventional method of rice cultivation, like, farm business income, family labour income, net income etc. Further, study also showed that, farmers reported the inability to infuse a shift from conventional method to SRI was due to lack of training, experience and extension services. The study suggested that, to increase productivity and net profit, without increasing the area adoption of SRI technique as an alternative method.

Alejandro Nin-Pratt, Bingxin Yu and Shenggen Fan (2010), the study showed that, China's agricultural sector showed a better performance at an average rate of 3.40% after the reforms of the late 1970s and early 1980s, while the growth after the reforms was only 0.54%. The study pointed that, the differences in TFP growth between China and India is due to two main factors. First, fundamental institutional reforms transformed the growth of agricultural sector growth in China but there was no such change in India. The study showed that, the transformation of the manufacturing sector in China accelerated TFP, with reallocation of labor to manufacturing from agriculture and increase in supply of agricultural inputs and acceleration of technical change in agriculture was the difference in TFP growth between China and India. In contrast, in India, employment in agricultural sector continued to grow during the 1993-2006, but there was insufficient rate of expansion of employment opportunities in industry and services sectors relative to India's population growth. In India, the main policy was investment in R&D, extension of the technologies and Green Revolution also took place during a time in which agriculture was not the main priority of country's development strategy and policies, which resulted in negative rates of in agriculture. For India, TFP growth in agricultural had little or negative contributions of efficiency growth and the policies implemented resulted in inefficient allocation of inputs during the analyzed period.

Rukuosietuo Kuotsuo et al. (2014), study found that eradication of shifting cultivation and replacing with integrated farming system model may be the best for saving the environment but it is well known that it will never be easy for someone whose occupation will change overnight radically. So, it suggested the idea for scientific systems of organic cultivation which would be taught to the farmers that can give a better option to generate income in a land where fertilizers have never been used before. The study also found that even today traditional organic products are sold in market in Nagaland as per the rate of non organic products and thus faces low income and productivity to the farmers. The study suggested for crop insurance to protect the famers in case of crop failure and issuing certificate as 'organic like' agriculture to those who adopt improved shifting cultivation which may alter the environmentally harmful system to less harmful so that the farmers can fetch a premium price over the conventional products.

1.2.2 STUDIES RELATING TO PRODUCTION FUNCTION AND DETERMINANTS

Farrell (1957) on his seminal paper provided the concepts of efficiency and their computation. He states that, before discussing the significance of efficiency measures, it is important to consider the definition of efficient production function. He interpreted the concepts of the technical efficiency and price efficiency of a firm for single input as well as to the cases of many input and outputs. According to him, the overall efficiency is the product of technical and price efficiency of the unit. He suggested better statistical methods over old methods of measuring efficiencies like average productivity of labour, cost comparison etc. An illustration of the method was done by citing an example of agriculture in United States with the input output data for 48 productive units.

Abeysekara (1976) made an attempt to analyze the production function of rice in Sri Lanka using the Cobb-Douglas production function, where total output was regressed with land, labour, fertilizer, tractor services, buffalo services, agro-chemicals, and seed etc. All the variables except for land and labour were valued in monetary terms. The study was carried out from five selected districts of Sri Lanka from the records maintained by 107 paddy farmers during Maha season from the year 1972-73. The study found that, variables like, land, fertilizer, labour, and seed had a significant and positive impact on rice production and the analysis of allocative efficiency revealed that, achieving efficient uses of land and buffalo services were the main concern of the rice farmers, while labour and fertilizer allocation was inadequate. Shortages of cash and the high degree of risk associated with output were the main reasons for under use in fertilizer. Expansion of farm credit facilities, along with investment in farmer education were the major recommendations made in the study.

Chareneset al. (1978) introduced the concept of Data Envelopment Analysis (DEA) in their paper on measuring efficiency of decision making units (DMU‟s). In order to improve planning and control of their activities, a number of ways were provided for assessing the efficiency of DMU's. Study showed that, a new definition of efficiency for use in evaluating activities of nonprofit entities participating in public programmes was provided by a non linear programming model. A scalar measure of efficiency was provided for each participating unit, in addition to the methods for objectively determining weights by reference with observational data for multiple outputs and inputs that characterize such programmmes. For an effective computation, equivalences to ordinary linear programming models were established and the linear programming models provided a new way for estimating external relations from observational data. Study also concluded that, the connections between economic and engineering approaches to efficiency were declined along with new interpretations and the way of using them in evaluating and controlling managerial behavior in public programmes.

Factors affecting farmers attachment to production agriculture, **Roger J. Beck and Eric H** (1989), tried to determine whether the off-farm employment opportunities has an effect on an index reflecting attachment of farm operators to production. Study showed that, a greater index in measuring the absolute level of operator's attachment to production was shown by variables like occupation and number of days working on the farm. It suggests that, adjusting of farmers labour resources was more rapid than the indications of measures presumed to explain the farm's ability to generate income. Study also found that, there was higher correlation of per farm soil productivity with absolute attachment level of farm operators to production but the correlation with changes in attachment was negatively and it suggested that, when farm conditions are adverse, it does not keep operators on their farms even if the quality of the resource base of a farm can be high. Of the five states, comprising Illinois, Corn Belt, and Iowa, study found that, the average full-time attachment to productive agriculture was the most between 1978 and 1982. It also showed that, there was no data used in the study reflected the differences in the type of agriculture that could readily permit labor reallocations. All this results showed that, in changing their status from full to part-time operators, farm operators have responded at the margin to the availability of off-farm employment opportunities and farmers in Illinois were found to be more likely full-time farm operators.

Shanmugam and Palinisami (1993) studied the economic efficiency of rice in used a frontier production function to study the economic efficiency of rice in Srivilliputhur, Kamarajnagar district of Tamil Nadu. The study revealed that, the loss of output due to technical inefficiency was higher than that of loss of output due to allocative inefficiency. The study indicated that, even the average farmers can get higher yield by adopting the technology that is being used by the best practice farmers. It was also found that, production could be raised by 29.7 per cent, if the technology gaps between the average farme and best practice farmers were narrowed.

Parik (1994) used a translog frontier production with the objective of ascertaining the reasons for inefficiency function and the study tried to examine the characteristics of some of the most efficient and least efficient farmers in North West Frontier Province of Pakistan. Study found that, for efficient farmers, wealth, farm assets, contact with extension workers were the most important factors, while factors like, family size was small, fragmentation was high in case of inefficient farmers and contacts with extension personnel was found to be nil. The analysis of technical efficiency suggested that, younger farmers have an easier access to credit, while large assets and education and were likely to operate the farms efficiently.

Kalirajan and Shand (1994) made an attempt to study the efficiency of cotton growers in Madurai district of Tamil Nadu using frontier production function. Due to the risk, a method was developed for estimating farm specific economic efficiency, since the economic efficiency of the cotton growers with technical and allocative risk was 68.3per cent. Study found that, owing to their perceived technical risk, farmers loose on an average of about 20 to 25 per cent of economic and the loss from allocative risk was 6 to 7 per cent. Thus, the study suggested that, for a potential raise in output and profit, majority of cotton growers needs to eliminate both the type of risks.

Najma R. Sharif and Atul A. Dar (1996) examined the technical efficiency in rice cultivation by estimating stochastic production frontiers, it also tried to assess the role of household and other characteristics in explaining farmer's differences in efficiency. The study found that, since the sixties, in view of its promise of higher yields, combined with its supposed scale neutrality, government has actively promoted HYV cultivation, so that small farmers can also share in its benefits. Study also found that, although the technical efficiency was high in HYV seeds like, Boro crop, it is even higher in the traditional seeds like, Aman crop and there was much greater variability in efficiency in the technically more demanding HYV crop. The latter finding is found to be consistent with the view that yields in HYV cultivation are relatively more uncertain and the variability in technical efficiency can be traced partly to differences in education and farm size. Study also indicates that, educated farmers are more efficient than smaller farmers and this reflects the limited access of small farmers to public services and to water and fertilizer both which are essential elements of HYV cultivation. The study concludes that, Government policies that promote farmer education, effective delivery of extension services, and more equal access to scarce inputs of water and fertilizer, could go a long way in promoting both higher yields (efficiency) and equity which are important aspects of rural development.

Prabodh and Yanagida (2004) used stochastic frontier production methodology to estimate the technical efficiency of small holding rice farms in Sri Lanka. Study found that, the mean technical efficiency of paddy farms was anging from 0.34 – 0.95 and factors like, method of planting, farm size and inorganic fertilizer showed significant effect on rice yield. The study found that, age of farmer, their level of education, experience and extension assistance were some of the major factors influencing technical inefficiency in the study area. Whereas, the mechanisms to improve the technical efficiency of farmers it indicated education and extension assistance as important and necessary factors.

M Niaz Asadullah and Sanzidur Rahman (2005), the study debated on the role of education in rice farm production in Bangladesh and by using stochastic production frontier functions it tried to estimate the effect of education on productivity and efficiency. Study found that, the impact on farm production and productivity is influenced by educated individual of the household. While the external effect of education on agricultural productivity was not found and also neighbour's education did not matter in reducing production inefficiency. The study also found that, productivity and potential output are augmented as long as an educated adult co-resides in the same household and since farm production is centralized. Study also found that, the empirical evidence are too weak to advocate the common beliefs of benefits of schooling educational investment in agrarian societies but again we cannot deny that, significant influence of education and on adoption of technological innovations in agriculture for increasing productivity.

Kumar et al. (2005) used Data Envelopment Analysis (DEA) approach for estimating the efficiency levels of irrigated rice farms of Uttaranchal. Study analysed that, the overall technical efficiency of rice farmers who wrere cultivating irrigated rice farms growing local variety was found to be 75 per cent. Whereas, there was improvement in the estimated technical efficiency of farms and almost 92 per cent of the farmers were founf to have adopted new technology. This study suggested that, by using new improved varieties of seeds, rice farmers can increase its technical efficiency.

Stefan Backman et al. (2011), study showed that, with the existing technology and resource endowments of rice farmers in the study area, there is a substantial possibility increasing output or decrease inputs. It stated that, farmers experience and extension has negative effect on technical efficiency, whereas, factors such as, access to microfinance, off-farm income, education, age and land fragmentation positively affected technical inefficiency. To improve the access of farmers to finance without collateral and at reasonable cost, it suggested for establishment of microfinance banks and also policies for improvement of farm education and land holding that will be favorable for improving the technical efficiency. A well designed adult literacy programs that to have a direct impact on household production, and also forming of cooperatives, motivating farmers to buy and enlarge contiguous plots, passing legislation to supports such consolidation and formulating national land use policy was also recommended.

Javedet al. (2011) used Data Envelopment Analysis (DEA) process to investigate the effect of farm size on productive efficiency of 200 farms belonging to small land holder of cotton-wheat system in Punjab. Their results suggested that, for all the farm size categories, there exist gains from improving productive efficiency. Similarly, small farms were found to be technically more efficient, when compared to large and medium farms as per the decomposition of total technical efficiency into pure technical and scale efficiency. On the other hand, scale efficiency was the main reason of high level of total technical efficiency of large farms. Though gains from improving allocative efficiency exist in 96 percent of the sample farms but small farms were found to have less allocative efficiency, when compared to medium and large farms.

Nair, B. G et al. (2012) made an attempt to study and estimate the economic and allocative efficiency at farm level, by selecting farmers growing soybean in Amravati district of Maharashtra, with respect to soyabean crop. The farmers were divided into three groups namely, Group I for small farmers, secondly, medium farmers Group II and Group III for large farmers. The survey method was used for collecting the primary data and the Data Envelopment Analysis was used in computing. The analysis from the study revealed that, the mean allocative efficiency for small farmers was 0.0, while for medium farmers and large farmers it was around 69.09 and 61.4 per cent, respectively. However, the mean for small farmers was 0, while economic efficiency of medium farmers and large farmers was found to be 66.0 and 35.5 per cent, respectively.

Musemwa, L. et al. (2013) tried to analyse the production of field crops of the resettled farmers in Zimbabwe and determined the technical, allocative and economic efficiency. They collected data was from 245 land reform beneficiaries, and Data Envelop Analysis (DEA) was adopted and the main reason for it, was due to its capability in handling multiple inputs and outputs. Commercial land reform beneficiaries were found to have a higher average technical efficiency, when compared to subsistence (small land size) land reform beneficiaries and the old resettled farmers, as per the result of DEA. Similarly, small land holders were also found to be less cost-efficient on an average when compared to large land holders. It was also found that, use of wrong inputs at the prevailing input prices was found to be the main reason for cost inefficiency of large farmers, rather than waste of inputs, while for small land holders, use of wrong inputs at the prevailing input prices and waste of inputs were the reason for cost inefficiency. Study concludes that, bringing improving in the ability of the resettled farmers and letting them choose optimum level of input for given factor prices and saving inputs through correct usage will improve their efficiency in field crop production.

Rahman, M. Saidur et al. (2013), the study established a relation between farm size and its productivity in 31 districts of Bangladesh. Based on the category of farm size, a multi-staged sampling technique was used to select a representative sample and ten irrigated rice growing households were selected randomly. Study found out that, the highest yield was received by medium farmers, followed by the small farmers, marginal farmers, and the least was large farmers. The result showed that, the net return from rice farming is minimal and the highest net earnings was received by medium farmers, the net earnings of large farmers was the lowest. It also showed that, the efficiency level of medium and small farmers were higher, while and the least among the farm types was from marginal farmers. Also, the options in choosing technologies and cash capital availability was higher for medium farmers, when compared to other categories of farm, while marginal farmers have higher technical inefficiency because they have poor resource and they have cash capital constraints. It was also found that, as perceived by most of the famers, cheaper price of rice during harvesting season was the main reasons for fewer net returns. So, the study suggested for a well ahead declaration of procurement price and lower input prices policy, which in the long run can help as a good incentive for farmers to be in rice farming.

1.2.3 STUDIES RELATING TO PRODUCTION EFFICIENCY AND INEFFICIENCY

Venkatareddy Chennareddy (1967), an attempt was made to examine the production efficiency in South Indian Agriculture and the study was taken from the fiscal year 1957-58 in the West Godavari district, Andhra Pradesh a dominant agricultural area in South India. Study found that, since in India, increasing all inputs in the traditional state of the art it is very much impossible to increase agriculture production, it suggested for breaking through the state of art and introduction of modern technology in a package to achieve a rapid and for a mass development. New inputs, agricultural education, special skills, technique and competent guidance in farm planning will be the package. However, Indian agriculture is unable to get expect spectacular short run progress due to the inability to supply suffieicent modern inputs at fair prices, unfavorable market prices and credit, and also the lack of trained people for massive agricultural work.

S. Mahendra Dev(1988), study found that, in all the states, the workforce in crop production is likely to fall in land-person ratio and the success of removing poverty depends on growth in general and agricultural development in particular. While, it will not be sufficient to lift the landless poor above the poverty, as per the estimates on the annual earnings of landless labour households. The prospect of irrigation coverage at the state level reveal that, even after using the full irrigation potential, over 60 per cent of the net sown area in four states, i.e., Karnataka. Maharashtra, Rajasthan and Himachal Pradesh and less than 60 per cent in Gujarat remain dependent on rainfall. The study further found that, during 1962-65 to 1975-78, 171 out of the 289 districts recorded less than 2 per cent rate of growth in overall yields and these districts accounted for around 66 per cent of the all India rural population and 70 per cent of the all India poverty population and out of the 171 low growth districts, 84 recorded either very low growth or negative growth rates. While in Assam, Bihar and Orissa it recorded low growth rate in yields while, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh and West Bengal, accounted for around 60 to 90 per cent of their respective rural population and poverty population. The study revealed that, focus has to be on the marginal farmers since the incidence of poverty was the highest in the size classes of land and their share in the total landholdings was also high in eastern states.

Chahal and Chahal (1989) made an attempt to examine the economics of irrigated crops in Punjab. The study observed that, paddy incurred the highest cost per acre, followed by maize, sugarcane, cotton, wheat, and groundnut, while sugarcane received that highest gross returns, followed by wheat, paddy, cotton, groundnut etc. Again, the annual returns to fixed farm source were the highest for sugarcane, which was followed by paddy-wheat, groundnut-wheat among the crop combination systems. Study also shows that, paddy-wheat combination received the lowest per unit of irrigation and the highest for groundnut-wheat, followed by cotton-wheat, sugarcane and maize-wheat. The study recommended that, growing cotton groundnut system should be encouraged more for the farmers.

K. N. Ninan (1992), study analysed the economics of shifting cultivation over settled cultivation in north-east India. The study showed that, settled cultivation is not as remunerative as shifting cultivation and it argues that the strategy for hill area development in India which has hitherto focused on the narrow issue of shifting versus settled cultivation should shift its emphasis to the larger and more relevant issue like, diversification of economic activities, which is the key to the future and economic prosperity of hill and tribal regions. The study also found that, when population density was low, there was unlimited land for cultivation and jhum cycles were long enough to permit regeneration of lands, and not only that but jhum cultivation was able to provide adequate income and subsistence to those dependent on this system of cultivation. But the study indicated that, jhum cultivation cannot be sustained further without adverse effect on ecology and economy of hill regions due to the growing population pressure on land, declining per capita availability of land and a shortening of jhum cycles. Even though a shift from jhum to scientific and ecologically less harmful forms of cultivation like settled cultivation sound to be more but it is doubtful whether settled cultivation can sustain jhum cultivators looking at the context of the uneconomic size of holdings and agricultural stagnation characteristic of eastern India.

Jayaram et al. (1992) tried to estimate of technical efficiency of rice cultivation. The analysis reveals that, large farmers were reported to have higher technical efficiency among the farm size groups, followed by small farmers. It was also found that, farmers growing rice achieved a relatively higher level of physical efficiency than others. However, it was found that, the input use among large and small farmer was inefficient, while non-judicious use of resources, such as fertilizer and irrigation were the reasons for the inefficiency of farmers, particularly in the case of small farmer.

Praduman Kumar and Mark W. Rosegrant (1994), study showed that, although TFP growth for wheat has been extensive but there is relatively little research done on total factor productivity measurement. Analysis found that, productivity growth for the rice crop accounted for nearly 41 per cent of the total area under cereals and 46 per cent in total cereals production in India and 22 per cent in total world rice production. Study found that, there has been only a slight increase in area under rice during 1980s and this increase have come essentially from improved utilization of the available infrastructure and also from the resulting increase in yield per unit of land. The eastern region of India followed the northern and the southern regions. Public policies such as, investment in irrigation, infrastructure, investment in research, and pricing policies lowered the unit cost of production and rice prices in real terms, benefiting both consumers and producers. Study further showed that, productivity of resources can be enhanced further by improving the management of infrastructure as well as by extending it to the less developed areas by introducing new technologies. found to be

The most important sources of growth in TFP was found to be related with development of market infrastructure, research, canal irrigation, and balanced use of fertilizers. It concluded that, eastern and the southern regions of India holds the future in rice productivity and there is a need to target public investments in research, irrigation, and infrastructure towards these potential areas.

Linh H. Vu (1994), using the package FEAR developed by Wilson in the R platform, the study tried to estimate the bias and the confidence interval of the input-based technical efficiency with VRS. The study found out that, under CRS system, the mean technical efficiency was 0.704, while it was 0.765 under VRS for output-oriented DEA and 0.785 under VRS for input-oriented DEA. The study stresses the need for a significant potential for farmers to reduce their costs by increasing efficiency as it reveals substantial production inefficiency for sample rice farmers. The study further indicated that, for efficiency improvement an increase in land holding and farm size has substantial benefits and regional factors were also found to be important in influencing technical efficiency. It also found that, as more than a half of the whole country rice production comes from it, Mekong River Delta has more potential for improving technical efficiency and it is among the best rice growing regions in the world. Study also showed that, technical efficiency is not significantly affected by non-farm ratio and policies such as, improvement of farm education, land holding and land quality will be beneficial in improving farmer's technical efficiency, and will be useful information for policy makers in raising efficiency for each region.

Mohandas and Thomas (1997) an attempt was made to study and analyse the economics of rice production for different farm size holders in Kuttanad areas of Kerala. The study showed that, marginal farmers obtained the highest percentage increase in gross income per hectare from rice cultivation, which was followed by large and small farmers. The study also showed that, rice cultivation becomes a relatively less remunerative enterprise, when there is a cost escalation. The study suggested that, farmers should use mechanization wherever possible, as it reduces the cost of human labour.

Singh and Nareshkumar (1998) attempted to study the technical efficiency of rice cultivation in Punjab. Study found out that, the efficiency across different regions and size categories of rice cultivators in Hoshirpur district and Sangrur district has a considerably wide variation, as per the technical efficiency. Study concluded that, higher technical efficiency was mainly found to be due to timely transplanting and application of irrigation, fertilizers and pesticides in appropriate dosages.

Munir Ahmad et el. (1999), estimated the farm level technical efficiency of rice farms using stochastic Cobb-Douglas production frontier. The data were collected using a stratified random sampling technique for the crop season 1996-97 from the district of Sheikhpura. Study found that, the average technical efficiency of sampled rice farmers was 84 percent, while 57 and 96 were the minimum and a maximum percent. Even though it was difficult to compare, it found a significant improvement in managerial skills over the last one and a half decade comparing the average technical efficiency with that of the mean economic and the main reasons for this trend could be that, the rice region faced almost the static technology setup. Again, a positive and significant role was played by availability of agricultural credit and agricultural extension services in achieving frontier output as per the measures of technical efficiencies on different farm and farmer specific characteristics. The study also indicated that, factors like, age and education played a positive effect on technical efficiency. Whereas, higher the ratio of own land to total farm size, the lower is the technical efficiency, which indicates that, farmers who plough more rented in area are more efficient than that of the farmers cultivating land.

Bhupat M. Desai et al. (1999), study highlighted that, Agricultural 'Strategy' for Raising Productivity must be technical change, that is both seed and complementary farm inputs and resources based rather than only seed or only resource-based. It suggested for Government expenditure on public sector seed industry to enhance its capacity and quality of services, adequate and quality seeds availability and both public and private sectors in this industry must be made more accountable to an independent regulatory agency, while certification and testing for quality to be mandatory for the private sector also and prescribe maximum retail price of seed. Study further states that, Public expenditures must be on modernization of the existing canal irrigation projects to alleviate problems of water logging, soil salinity, etc and institutions may also promote credit in areas where watersheds are completed to further develop land and other associated benefits and extension agencies should improve their co-ordination and interdependency to encourage farmers to adopt more efficient irrigation practices etc, necessary for reaping the full benefits. It also suggested for a better parity in pricing through prescribing location specific maximum retail price for well irrigation and rationalization of canal water charges and on planning the supplies the demand targets should be more realistic by considering district rather than state level data as a basis for estimation.

Badal and Singh (2001) made an attempt to study the resource productivity and allocative efficiency of maize production in Bihar. The data was collected from 180 farmers, 12 villages of 3 districts. The study concluded that, there found a wide variation of resource use efficiency for different inputs across the crops and in order to achieve optimal allocation of inputs there was scope to reallocate the resources. Compared to any other crop of the region, High Yielding Varieties (HYVs) and a greater scope for input use for an enhanced productivity was offered by rabi maize. It was also found that, since there was enough human labour available, it can be used to increase in HYV maize farms in both rabi and kharif as well as on wheat farms for increased profits.

Abdul Wadud (2003). Using a stochastic efficiency decomposition technique and Data Envelopment Analysis (DEA) the study made an attempt to estimate the technical, allocative and economic efficiency of farms, through farm-level survey data for rice farmers in Bangladesh. The data was collected from two villages in the High Barind region of Bangladesh. The study showed that, the overall cropping intensity of this region was 175 per cent and all farmers possess some land, so there were no pure tenants and it indicates that farm households are homogeneous. Study further showed that, the farm households to be slightly decreasing returns to scale as per the stochastic frontier approach, but shows an increasing and dominantly decreasing returns to scale under DEA. The estimates of technical, allocative efficiency in stochastic frontier function showed greater variability than those from the DEA frontier but the estimates of economic efficiency showed equal variability with DEA frontier. The study also found out that, irrigation infrastructure and land degradation are statistically significant factors associated with technical, allocative and economic efficiency and degradation as an environmental factor that decreases technical, allocative and economic efficiency. Further, the study also found out that, human capital variables like age of farmers and years of education more or less affect farmer's capability to utilize inputs in a cost minimizing way.

Kwinarajit Sachchamarga and Williams (2004), study highlighted that, area planted to rice was more responsive to changes in area planted in previous years, the amount of rainfall, availability of agricultural labour, than to changes in paddy prices. Area planted, the annual amount of rainfall, paddy prices, and the availability of agricultural labour were the variables included in the empirical model. Study found that, policies to reduce rural labour shortages could do more to enhance the production of rice, than annual adjustments in the level of the guaranteed price of rice received by producers. Study concluded that, the estimated price coefficients in four models were negative and inappropriateness of the price indices used as deflators was the main reason for the negative signs for the price variable. It also indicated that, indices of farm prices or the cost of purchased inputs would have been appropriate deflators but were simply unavailable.

A.A. Tijani (2006). The study estimated technical efficiencies of rice farms in the state of Osun, Nigeria, and identified some factors which influence productive efficiency. The study showed that, the levels of technical efficiency ranged from 29.4% to 98.2%, with a mean of 86.6%, which suggests that, the average rice output falls short by13.4% of the maximum possible level. The study also showed that, factors like, application of traditional preparation methods and off-farm income determine the efficiencies level and its significance but unexpectedly negative and significantly correlated with the contact of extension officers. The study further found that, if less efficient farms are encouraged to follow the resource utilization pattern of the most efficient farms, than rice production can be increased with the current levels of inputs and technology. The study suggested that, for effective use of traditional preparations and appropriate policy or regulation should be formulated by state authorities at various levels and rice cultivators should engage in off-farm jobs and the activities of the extension agents in the study area should be investigated further.

A. Suresh and T.R. Keshava Reddy (2006) attempted to analyze the resource productivity and allocative, as well as the technical efficiency of paddy production by using stratified random sampling from the data collected from 71 rice farmers of the command area, Kerala. Study found out that, in the command area, the cost of cultivation of paddy is Rs 21603/ha, resulting in a BC ratio of 1.34, while the elasticity coefficients for chemical fertilizers, human labour and farmyard manure were found to be significant and positive. The allocative efficiency also indicates that, marginal return per one rupee increase under these heads would be Rs 2.83, Rs 1.57 and Rs 1.17, respectively. On the other hand, the average technical efficiency of the paddy farmers was found to be 66.8 per cent. Education of the farmer and irrigation provided during the water-stress days were the main factors enhancing the technical efficiency. While, education level of the farmers and the irrigation depicted a statistically significant positive influence, but the presence of water-stress had negative influence on the technical efficiency. It suggested for an equitable distribution of canal water and to enhance extension services for resource management in the area.

Agricultural Credit in India: Status, Issues and Future Agenda, **Rakesh Mohan** (2006). The study showed that, several weaknesses have affected the viability and sustainability of the credit institutions even though the outreach and the amount of agricultural credit have increased over the years. Study found that, inadequate provision of credit to small and marginal farmers, limited deposit mobilization and heavy dependence on borrowed funds by major agricultural credit purveyors as the gaps in the system like. The study suggested for a strong and viable agricultural financial institutions to cater to the requirements of finance for building the necessary institutional and marketing infrastructure. Which will emphasizes on a package approach, like technology inputs, along with provision of infrastructure inputs like power at subsidized costs, supply of seeds, fertilizers and most importantly, credit provision through the nationalized banking system. However, the persistence of high fertilizer and power subsidies and minimum support prices has acted as a disincentive for crop diversification. So, the study suggests that, to meet the changing needs of both producers and consumers there is a need for major review of agriculture policy

Akhtar, Sharif and Akmal (2007), the study made an attempt to analyse the economic efficiency and competitiveness of rice production systems of Punjab and also assessed the effect of policy intervention on the production of Basmati and IRRI rice. The study showed that, increase in production of Basmati rice can lead to an increase in exports and the production of IRRI. The study also showed that, the main reason for for inefficient use of resources to produce the commodity for a particular region is due to the lack of economic efficiency. The study also indicated a lack of competitiveness at the farm level in the production of both Basmati and IRRI rice and the incentive structure affecting farmers negatively. While, the net effect of policy intervention is to reduce the farm level profitability of both rice production systems. Study further highlights the need for removing the existing policy distorting the structure of economic incentives to increase economic efficiency and to attain farm level competitiveness in rice production.

Abedullah et al.(2007), study used a Stochastic Frontier Production approach attempted to establish a relationship between resource endowments and technical efficiency in rice production and to determine the future investment strategies that can enhance the production of rice in Punjab. The study showed that, due to heavy pest infestation, the coefficient of pesticide is non-significant, while the use of fertilizer was found to have negative impact on production, mainly due to improper combination of N, P, and K nutrients. The study suggested that, in order to strengthen and enhance the productivity of rice the role of extension department Investment on mechanization can significantly contribute to improve farmer's technical efficiency as per the result of inefficiency model, implying that the role of agricultural credit institutes needs to be redefined. Study also showed that, the average fertilizer (NPK) used was around 94 kg which was lower than the recommended level of 114 kg and the average rice yield was found to be 35 mounds per acre and due to difference in number of plants, soil quality, planting time, different level of input use and random shocks etc., there is a high variation in yield. The study suggested that, private sector to invest on education in the rural areas and Government institutions like Banks to tie up credit supply policy to improve mechanization and to motivate young generation to participate in agricultural activities, since they has have better ability to adopt modern technology and to make timely decisions.

Onoja, Anthony O. Ibrahim, M. K. and Achike, A. I. (2010), the study used a stratified random sampling to select 174 cassava farmers from two agricultural zones, Kogi, Nigeria, and it tried to determine the effects of farm credit and basic farm inputs utilized by Cassava producers. The study found that, depending on agricultural zone, the magnitude of effect of these variables vary and apart from stem cuttings, almost all the variables showed a statistically significant effect on the output of cassava. The study also found that, investors get increasing returns through cassava farming and the technical efficiency of the farms was very high, while the inefficiency variables were found to be statistically insignificant. The study suggested the need for implementation of farm credit, especially to genuine cassava farmers at a single digit interest rate by government and private financial institutions, so that they can consolidate on the gains they make. It also recommended for an improved inputs, like appropriate inorganic fertilizers and hybrid stem cuttings available in the state based on soil testing.

Hongmei Li and Mingxian Li (2011), study tried to investigate the factors influencing collective water management and their impact on technical efficiency in rice production based on the data collected from Hubei, China. The study found out that, a collective water management by water user groups with high social capital and high homogeneity of crop varieties cultivated can be successfully operated, since they have the confidence to invest in collective activities and lower the transaction costs of working together. The study further states that, distribution of water more efficiently among farmers can be coordinated with high homogeneity. The stochastic frontier analyses showed that, provision of sufficient irrigation water at critical stages of cultivation and successful collective water management had a significant and positive effect on improving technical efficiency. The study concluded that, to improve the ability of collective water management and to improve the technical efficiency of rice production, Government need to play active roles in accumulation of social capital.

Khai and Yabe (2011) made an attempt to estimate technical efficiency of rice cultivation and identify its determinants. The study found out that, there was a big difference in technical efficiency among farmers in the sample, suggesting that there is a potential ability of output to increase by using inputs more efficiently. The study also found out that, the relationship of the various attributes with the technical efficiency of farmers and the model applied to analyze the equation of TE, demonstrated as functions of rice farmer's social characteristics and other specific variables leading to technical inefficiency. The study showed that, intensive labour and irrigation are the most important factor that helps the farmers in increasing the technical efficiency of rice production and the study also found out that, education levels of the farmers had positive association with technical efficiency. Therefore, the government should focus on encouraging rice farms to produce more efficiently in terms of utility of labour to gain TE. It further suggested that, policies of Government should concentrate on investing in irrigation, increase the level of farmers education, knowledge about new technology and expenditure management through short trainings and extension services.

Arindam LahaandPravat Kumar Kuri (2011), the study tried to examined the implications of access to credit on technical efficiency in production by comparing between two mutually exclusive groups, bank customers having an access to formal financial institutions, and non-bank customers who are financially excluded and served by informal financial institutions. Study showed that, the lowest level of technical inefficiency was found under fixed rent tenancy, followed by owner cultivation, cost sharecropping and pure sharecropping tenancy, as per the measurement of technical inefficiency across alternative modes of cultivation. So, it indicated that, fixed rent and owner cultivation are more technically efficient than pure sharecropping and cost sharecropping. Empirical evidence also suggested that, tenants are technically inefficient than owner farms, except for middle farmer category, bank customers in all other size classes showed a higher level of technical efficiency, when compared to non-bank customers, as per the estimated technical efficiency of bank and non-bank customers. The study further shows that, access to formal credit play a significant role in achieving technical efficiency in agriculture and the analysis confirmed that bank customers achieve a higher technical efficiency than non-bank customers.

Prasanna, Bulankulama and Kuruppuge (2012) have emphasized the study to analyze the factors affecting farmer’s higher gain from paddy marketing and identify the likelihood factors affecting on farmers in the North Central Province of Sri Lanka. The data was from the field survey carried out in three irrigation systems, from 257 households and empirical logit model was used to assess the factors. The study found that, due to concentrated market power among few oligopolistic buyers there are imperfections on existing paddy marketing system. It is also found that, factors such as, land size, land ownership, accessibility in credit market and farmer’s involvement in informal credit sector played a very important role to gain higher returns from paddy marketing. The study suggested that, with regard to the paddy marketing, reviewing the roles and functions of government extension services and farmer organizations were emphasized.

Abdus Samad (2013), the study estimated the technical efficiencies of the IRRI rice production using stochastic frontier production model in three villages of the northern part of Bangladesh, and determined the significant factors underlying their technical efficiency. The data of three villages were randomly collected from 112 farmers who cultivate IRRI paddy among twelve hundred farmers of the three villages. Study found that, since rice cultivation is entirely dependent on irrigation, the data for land consists of only irrigated land and family and hired labor were used as substitute for each other.

The analysis from the farm level technical efficiencies shows that, the average efficiency for the high yielding rice (IRRI) cultivation was 85.2 percent. Study also shows that, there were technical efficiencies above 70 percent for 25 percent of the farms, the study showed that, experience of farmers, education, and use of fertilizers were found to be positively and significantly related to technical efficiency.

Md Muzharul Islam Akond Sumanash Dutta (2013) used the stochastic frontier production function method to study the technical efficiency of rice producing farms and also to identified the determinants of agricultural productivity and technical efficiency of farms in selected Char Chaparies of Assam. The estimated production function revealed that, factors such as, farming experience of the farmers, Irrigation, chemical fertilizer, labour man days have significant and positive impact on rice productivity and the estimated farm level technical efficiency was found to be ranging from 37.1 percent to 96.11 percent. The study also showed that, the farm's efficiency can still be increased with available resources with the farmers, like, improving quality human resource, farmers experience and utilizing the benefits of alternative occupations of the members of agricultural households. The study found that, only one farm had technical efficiency less than 40 percent in the poverty-stricken Char Chapari and it further found that, farms can still increase their agricultural output through proper use of existing inputs and technology without additional resources.

Le Quang Long et al. (2013). The study was done on the economic efficiency in rice production in the Cuulong river delta using a sample of 200 rice farmers. The study showed that, the frontier output and observed output differences is primarily due to factors which are under farm control. Study found that, variables such as labor, fertilizer and chemical plant protection are the important in rice production. The study also found that, technical, allocative and economic efficiency of rice production are consistent with the current production situation and are different between seasons. Another finding from the study is that, the overall economic efficiency of rice farms can be improved substantially. However, it was found that, during the summer-autumn season, the allocative efficiency has a high rate than technical efficiency. Study suggest that, in the Winter-spring season farmers cultivating rice in this region should pay attention to technology and in Summer-autumn season thy should give importance in relative price of input to achieve the best in technical and allocative efficiency.

Altaf Hussain (2015), study indicated that, income of the farmers of the valley is very low due to poor agricultural productivity, also it is effected due to the frequent flood and sometimes due to scarcity of water during pre and post monsoon period. Also, high rate of productivity is difficult to expect in the valley due to poor irrigation facilities. The new agricultural strategy also failed to make its charisma fully in the valley. The study revealed that, factors like labour, fertilizer, pesticides, irrigation, tractor etc., have a positive influenced on the level of productivity of farms. Thus, farm level efficiency could be increased by increasing the use of such factors. However, it becomes difficult to say much on the optimum level of input quantities as allocative efficiency has not been found out in the study. Along with its determining factors, this study opens up windows for further research to analyze allocative efficiency of farms.

Vuong Quoc Duy (2015), study found out that, credit plays a very vital role improving the production and production efficiency of rice. The study shows that, both formal and informal credit appears to be important and it focused mainly on the effects of both credits institutions on production efficiency. The study suggested that, various possible policies, such as expansion of rural credit systems, establishing more branches of agricultural and community banks, savings mobilization programmes and provision of credit services to the banks customers etc., are needed in order to improve the rice production. It also highlighted for expansion of rural credit systems, that help to increase rice production and efficiency and also found that, establishing more branches banks in the rural areas and accessibility of credit by households could be improved, providing innovative credit schemes to overcome the problems of farmers who lack collateral and reducing the long processing times of loan applications. It also suggest that, access to credit should be made easier for the farmers without the specific commodity requirements and encourage saving and mobilization programmes to develop and promote which will inspire participation and provide encouragement to farmers to save and reinvest.

YuYu Tun (2015), "An Analysis on the Factors Affecting Rice Production Efficiency in Myanmar". The study used both the data envelopment analysis (DEA) and the stochastic frontier approach (SFA) to revealed the impact of farm mechanization on rice production efficiency and investigated the determining factors affecting the production efficiency. The study indicated that, there is a potential to improve the existing technical efficiency of the sample farmers based on the average technical inefficiency, without reducing both the levels of input used and the existing technology. From the study it indicated that, farmers are unwilling to discard their traditional practices and adopt modern technologies, and the study also found out that, due to the scarcity of employed seasonal labor especially during the peak period, the value of using family labor might be more efficient. Study suggested that, rice farming in Myanmar should focus on modern farm mechanization system, which can be achieved by the systematic land reclamation, since the structure of agriculture is fragmented, which has for a long time obstructed the use of efficient modern farm mechanization. It further suggests that, development in agriculture can be obtained only by farm consolidation and not through application of farm mechanization in order to improve productivity.

Baravkar, S. N (b) et al. (2015). The study tried to estimate the technical, allocative and economic efficiency of Kharif onion in western Maharashtra. Study revealed that, small farmers on an average can reduce the consumption of inputs the by 11.8 to 8.6 per cent, as per the TE under CRS of Kharif onion, while medium farmers can reduce the consumption of all inputs by 10.00 to 3.8 per cent, when compared to 7.1 to 4.2 per cent reduction of inputs by the large farmers group. Study also found that, large farms can redue the input cost by about Rs. 30 to Rs. 36 for land, while there is a reduction in the cost of see was Rs. 770 to Rs. 4088, Rs. 832 to Rs. 1077 for N, Rs.335 to Rs. 1207 for P, Rs. 151 to Rs. 219 for mechanical labour, Rs. 1917 to Rs.2844 for hired male labour, Rs.8916 to Rs. 11694 for hired female labour, Rs. 840 to Rs. 2085 for organic manure, respectively. The study suggested the need for reducing the gap in the levels of manure and fertilizer used and its optimum use.

SECTION III

1.3 STUDY PROFILE

Nagaland is one of the "Eight sisters" of the North-East India. The State has a distinct character both in terms of its social composition as well as in its developmental history. It borders Burma to the east, the state of Assam to the west, Arunachal Pradesh and part of Assam to the north, and Manipur to the south. The state of Nagaland emerged out of the Naga Hills district of Assam and NEFA province, in

1963. Though Nagaland has been confronted with special constraints and challenges in the areas of geographical terrain, politics, economics and infrastructural developments, the social capital and the resilience of the Naga village communities are not only giving hope but also beginning to help overcome all the other difficulties. In spite of its many constraints and challenges, Nagaland has continued to make new developmental paths for itself and has also shown a unique model for the country. The Village Councils, Village Development Boards, and the recently introduced Communitization of Public Institutions and Services Act, 2002, have already been acknowledged as successful in areas like, education, health, power, etc.

1.3.1 GEOGRAPHICAL FEATURES OF NAGALAND AND THE SELECTED DISTRICTS

The state has 11 Districts with Kohima as the capital, and the largest city is Dimapur. The state of Nagaland has an area of 16,579 square kilometers with a population of 1,980,602 as per 2011 Census, making it one of the smallest states of India. The state is inhabited by 17 major tribes namely, Ao, Angami, Lotha, Sumi, Chang, Konyak, Chakhesang, Khiamniungan, Sangtam, Yimchunger, Dimasa Kachari, Phom, Rengma, Kuki, Zeme-Liangmai (Zeliang) Pochury and Rongmei as well as many more sub-tribes. Each tribe has a unique character with its own distinct customs, language and dress. Agriculture is the most important sector and the principal crops include rice, corn, millets, pulses, oilseeds, sugarcane, tobacco, potatoes, and fibers and more than 70% of the population are employed within it. However, Nagaland still depends on the import of food supplies from other states. The practice of jhum is the most dominant cultivation practiced in Nagaland, followed by terracing and wet cultivation. Forestry is also an important source of income but due to large deforestation the area under forest cover has decreased tremendously and it has also resulted in drastic climate change of the state over the past few years.

Cottage industries such as weaving, woodwork and pottery are also an important source of revenue. Tourism is important, but due to geographic isolation of the state it is largely limited. The state is mostly mountainous except those areas bordering Assam valley. Mount Saramati is the highest peak at 3,840 meters and its range forms a natural barrier between Nagaland and Burma. The state is home to a rich variety of flora and fauna and it has been suggested as the falcon capital of the world.

Table 1.3.1 shows the geographical features of Nagaland and the selected districts, i.e. Mokokchung, Phek and Dimapur. The total geographical area of Nagaland is 16,579 Sq.km. Nagaland has a largely monsoon climate with high humidity levels. Annual rainfall averages around 1,800–2,500 mm, concentrated in the months of May to September. The state enjoys a salubrious climate. Summer is the shortest season in the state, which lasts for only a few months. Rainfall is the major source of irrigation and river Dhansari, Dikhu, Doyang, and Tizu are the major rivers of Nagaland. The types of soils found in Nagaland are Entisols, Inceptisols, Alfisols and Ultisols.

Table 1.3.1: Geographical Features of Nagaland and the three Selected Districts

Geographical features		**Nagaland**	**Districts**		
			Mokokchung	**Dimapur**	**Phek**
Area (sq.km)		16,579	1615	927	2026
Northern Latitude		$25^{0}67'$	$26^{0}\ 32'$	$25^{0}92'$	$25^{0}\ 40'$
Eastern Longitude		$94^{0}12'$	$94^{0}\ 50'$	$93^{0}73'$	$94^{0}28'$
Altitude Above Sea Level		194 m and 3048 m	1325.08 m	260 m	1524
Climate		Humid and moderate	Mild	Hot and humid	Cold and moderate
Temperature	Summer	16^{0}C to 31^{0}C	30^{0}C	36ºC	19^{0}C
	Winter	4^{0}C to 24^{0}C	17^{0}C	17^{0}C	04^{0}C
Annual Rainfall		2000 mm	2165.7 mm	1077.5 mm	1593 mm
Major Source Of Irrigation		Rainfall	Rainfall	Rainfall	Rainfall
Soil Type		Alfisols, Entisols, Inceptisols,Ultisols	Entisols, Utisols	Alluvial and Residual soil	Entisols, Ultisols, Inceptisols
Major River		Dhansiri, Doyang, Dikhu and Tizu	Milak, Dikhu,	Dhansiri,Diphu, Chathe, Zubza	Sedzu, Tizu and Lanye

Source: Statistical Handbook of Nagaland 2016, Directorate of Economics and Statistics, Nagaland.

The district of Mokokchung came into existence since Nagaland attained its statehood on 1st December, 1963. It has an area of 1,615 sq. km. representing 9.74 percent of the total area of the state and it occupies the sixth place among the districts. Mokokchung is situated at 26.33^{0} N 94.53^{0} E. It is at an altitude of 1325 meters above sea level. The district is predominantly inhabited by Ao tribe. The district of Mokokchung is surrounded by the state of Assam to its North, Wokha to its West, Tuensang to its

East, Zunheboto to its South. Mokokchung is at a distance of about 145 km from the state capital. The climate of Mokokchung is mild throughout the year; with temperature here averaging 18.0 °C and its annual rainfall is 2165.7 mm.

Similarly, Phek is the eighth district of Nagaland, it was declared as a full-fledged district on 19th December 1973. It is the home of the Chakhesang and Pochury tribes. It has an area of 2026 sq.km (12.22% of the state total area), which is the second largest area in the state. It lies in the South-East of Nagaland and is bounded by Myanmar in the east, the state of Manipur in the south, Kohima district on the west and Zunheboto district on the north. It is located between 25^0 40'N 94^0 28'E. Topographical features of Phek show that, the district is drained by the waters of the rivers Sedzu, Tizu and Lanye. About 70% of the district is covered with thick evergreen forest. The highest mountain is Zanibu, which is about 8000ft above sea-level. The district is rich in flora and fauna and it receives an average annual rainfall of 1593 mm.

On the other hand, the district of Dimapur is the largest city in Nagaland. In the middle Ages, it was the capital of the Dimasa Kachari Kingdom. It is located at 25°54′45″N93°44′30″E and is bounded by Kohima district on the south and east, Karbi Anglong district of Assam on the west, the Karbi Anglong and stretch of Golaghat District of Assam in the west and the north. It is also called the gateway to Nagaland and it is only district with a railhead. A large area of Dimapur District is in the plains, with an average elevation of 260 meters above the sea level and covers an area of 927 sq. Km. It is 74 Km away from the state capital Kohima. The District has a heterogeneous population, with the majority comprising of Naga tribes from all over state. During summer, the climate is hot and humid in the plains of Dimapur district (reaching a maximum of 36 degree Celsius, with humidity up to 93 percent), while the temperature in the winter ranging from 12 to 28 degree Celsius and winter months are cool and pleasant unlike other districts of the state. The district also receives an annual rainfall of around 1077.5 mm.

1.3.2 DEMOGRAPHIC PROFILE OF NAGALAND

Table 1.3.2: Demographic profile of Nagaland and the three selected Districts

Sl. No.	Demographic features	Nagaland	Districts		
			Mokokchung	Phek	Dimapur
1.	Population	1978502	194622	163418	378811
	i) Male	1024649 (51.79)	101092 (51.94)	83743 (51.24)	197394 (52.11)
	ii) Female	953853 (48.21)	93530 (48.06)	79675 (48.76)	181417 (47.89)
2.	Density of population	119	121	81	409
3.	Sex ratio	931	925	951	919
	i) Rural	940	946	969	937
	ii) Urban	908	875	860	903
4.	Literacy rate	79.55	91.62	78.05	84.79
	i) Male	82.75	92.18	83.66	87.54
	ii) Female	76.11	91.01	72.21	81.77
5.	No. of villages	1428	108	117	222
6.	No. of households	393165	42433	36556	77623
7.	No. of blocks	52	6	5	4
8.	Total workers	974122	100067	80277	151350
	a)Main workers	741179 (100)	81046 (100)	63645 (100)	122358 (100)
	i)Cultivators	420379 (56.72)	48925 (48.89)	55091 (68.63)	24517 (16.20)
	ii)Agricultural labourers	22571 (3.04)	9166 (9.16)	3159 (3.94)	8990 (5.94)
	iii)Working in household industry	9525 (1.28)	3798 (3.80)	1275 (1.59)	5073 (3.35)
	iv)Other workers	288704 (38.95)	38178 (38.15)	20752 (25.85)	112770 (74.51)
	b)marginal workers	232943	19021	16632	28992
9.	Total non-workers	1004380	94555	83141	227461

Source: Statistical handbook of Nagaland 2016

Table 1.3.2 shows the demographic profile of Nagaland as per census 2011. The total population of Nagaland was 1,978,502, of which comprised of 1,024,649 and 953,853 male and female respectively. Density of population of the state is 119 per sq. km, which is lower than national average 382 per sq. km. There are 1428 villages, 393,165 houses and 52 blocks as per the data of Directorate of Census Operations, Kohima, Nagaland. Sex Ratio in Nagaland is 931 and literacy rate of the state is 79.55 percent as per 2011 census. The male literacy stands at 82.75 percent while female literacy is at 76.11 percent. There are a total of 1004,380 (50.76%) non-working population and 974122 (49.24) working population, out of which 741,179 (37.46%) are main workers, 232,943 (11.7%) are marginal workers, with 537,702 (55.2%) as cultivators, 62,962 (6.46%) as agricultural labourers, 22,838 (2.34%) workers in household industry, 350,620 (35.99%) as other workers. The population living in urban areas is about 570,966 (28.86%) of which 299,177 are males and while remaining 271,789 are females. Whereas, the total population living in of rural areas is 1,407,536 (61.14%) of which male and female 7,25,472 and 6,82,064 respectively.

Similarly, the total population in Mokokchung is 194,622 of which males and females are 101,092 and 93,530 respectively, occupying 5th place in terms of population. There are 6 blocks and 108 villages with 42,433 households. The average household size of the district is 5 persons. The initial provisional data released by census India 2011, shows that density of population in the district is 121 people per sq. km. Literacy rate of Mokokchung is 91.62 comprising 92.18 and 91.01 percent of male and female respectively. The Sex Ratio in Mokokchung is 925 per 1000 male. The total working population is 100,067 (51.42%), with 81,046 (41.64%) main workers, 19021 (9.77%) as marginal workers and among the working population there are 48,925 (48.89%) cultivators, 9,166 (9.16%) as agriculture labourer, workers in household industry constitute 3,798 (3.80%) and 38,178 (38.15%) as other workers. On the other hand, the total non-working population is around 94,555 (48.58%).

While, Phek district has a population of 163418, comprising of 8374 male and 79675 female respectively. The district has about 36556 households, 117 villages and 5 blocks. The average household size of the district is 4 persons per household. The density of population is 81 per sq. km and the average sex ratio stands at 951 female per 1000 female which is higher than the state average of 931. The total literates of Phek district is 105,893 at an average of 78.05%, with male averaging 83.66% and female 72.21%. The total working population is 80,277 (49.12), with 63645 (38.95%) as main workers, 16632 (10.18%) marginal workers, 55,091 (68.63%) cultivators, 3159 (3.94%) agricultural labourers and 1275 (1.59%) workers in household industry and 20752 (25.85%) as other workers, while, the total number of non-workers are 83141.

On the other hand, Dimapur district has a population of 378811, which consist of 197394 male and 181417 female respectively. The district has 222 villages, 77623 households and 4 blocks. The average household size of the district is 5 persons per household. The density of population is 409 per sq. Km and the sex ratio stand at 919 for 1000 male. The total literates are 278037 (84.79%), higher than state average, with

150,142 (87.54%) males and 127895 (81.77%) females respectively. The total working population is 151350 (39.95%), with 122358 (32.30%) main workers, 28992 (7.65%) marginal workers, 24517 (16.20%) cultivators, 8990 (5.94%) agriculture labourers, 5073 (3.35%) as workers is household industry and 112770 (74.51%) of population in other works. The total non-workers are 227461.

1.3.3 LAND DISTRIBUTION AND LAND USE PATTERNS

Table 1.3.3 depicts the land distribution system in Nagaland and the selected districts. The total geographical area of Nagaland is 1657900 ha, with a forest cover of 862930 (52.04%) ha. The state has 95491 ha of land not available for cultivation and about 156131 (9.41%) ha of uncultivated land excluding fallow land. It has an area of 106293 ha of fallow land and 46785 ha of current follow. The total cropped area in the state is 521316 ha, whereas, Net sown area is around 384641 (73.78%) ha, while area sown more than once, net irrigated area and gross irrigated areas are 136675 (26.21%) ha, 90970 (%) ha, 99790 (19.14%) ha respectively.

Similarly, Dimapur district covers a total area of 92700 ha, with a forest cover of 16530 (17.83%) ha. The land not available for cultivation is 10709 (11.55%) ha, while uncultivated land excluding fallow is about 3047 (3.28%) ha. The district has about 2730 ha fallow land and the net sown area is about 59274 (70.97%) ha as on March 31, 2016. The total cropped area is about 83519 ha., while, area sown more than once, net irrigated area and gross irrigated area are about 24243 (29.02%) ha, 35890 (94.97%) ha and 37790 (45.24%) ha in total cropped area respectively.

Mokokchung district has a total area of 161500 ha, with a forest cover of 81657 (50.56%) ha. It has an area of 10446 (6.46%) ha non available for cultivation, while 17488 (10.82%) ha comes under uncultivated land excluding fallow land and 6954 (39.76%) ha comes under cultivable waste land. The total cropped area of the district is about 45307 ha, out of which 12583 (27.77%) ha of area sown more than once during the year 2016.

Similarly, in Phek district, the total geographical area is about 202660 ha of which forest covers about 124774 (61.56%), 9861 (4.86%) ha comes under land non available for cultivation and 16255 (8.02%) ha under cultivated land excluding fallow land while 5412 (33.29%) ha of area comes under cultivable waste. The total cropped area of the district is 50016 ha, of which about 13269 (26.52%) ha comes under area sown more than once.

Table 1.3.3: Land use Pattern of Nagaland and the three Selected Districts

(in Hectares)

Sl. No.	Land Particulars		Nagaland	Districts		
				Mokokchung	Phek	Dimapur
1.	Geographical area		1657900	161500	202600	92700
2.	Land utilization statistics		1652271	160988	202338	92290
i	Forest		862930	81657	124774	16530
ii	Non available for cultivation (a+b)		95491	10446	9861	10709
	a. Land under non agriculture		92995	10279	9611	10458
	b. Barren and uncultivable Land		2496	167	250	251
iii	Uncultivated Land Excluding Fallow Land (a+b)		156131	17488	16255	3047
	a. Land under Miscellaneous tree crops and groves not included in net area sown		89672	10534	10843	1494
	b. Cultivable Waste Land		66459	6954	5412	1553
iv	Fallow Land (a+b)		153078	17673	14701	2730
	a. Fallow Land other than current fallow		106293	11432	9576	1572
	b. Current fallow		46785	6241	5125	1158
v	Net area sown		384641	33724	36747	59274
3.	Rainfed area	i. Cultivated	176948.62	12597.94	17396.73	18470
		ii. Cultivable waste	201872.69	31558.84	28418.49	13910
4.	Total cropped area		521316	45307	50016	83519
5.	Area sown more than once		136675	12583	13269	24243
6.	Net irrigated area		90970	2820	4610	35890
7.	Gross irrigated area		99790	7320	5300	37790

Source: Statistical Hand Book of Nagaland 2016

1.3.4 CROPPING PATTERN

Cropping pattern usually refers to a combination of crops in time and space. When crops occupy different growing period, the combination in time occurs and combinations in space occur when crops are inter planted. A cropping system usually means the combination of crops within a given year and the cropping pattern follows two distinct seasons, namely, Kharif season from the month of July to October and Rabi season from October to March. The crops grown between March to June is known as Zaid crop. The crops are grown solo or mixed-cropping or in a definite sequence or rotational cropping. The land may be occupied by one crop during one session, called mono-cropping or by two crops during one season, known as double-cropping, which may be grown in a year in a sequence.

Farmers in Nagaland are mostly organic farmers who follow the traditional system of cultivation and are very new to use of technology, new equipments, fertilizers and manures etc. Farmers follow different cropping pattern based on different climatic condition and soil fertility prevailing in different district of the state. There are many crops which are cultivated in Nagaland and some of them are given below. Table 1.3.4 shows the area and production of major crops produced in Nagaland from the year 2007-08 to 2015-16. The data indicates that, area under major crops in the state has increased from 388530 hectares to 465356 hectares from 2007-08 to 2015-16 with an increase by 16.50%. For the district of Mokokchung, the data shows a decreasing trend in area by 16.72% during this period from 45030 hectares to 35465 hectares. The reason is due to the decline in the area under cereals, pulses and oilseeds during these periods. Similarly, in Phek district also the data shows a decline in trend in area under cultivation from 46680 hectares to 4454 hectares declined by 4.79% over the period of the study. While in Dimapur district, experienced a large increase in area under by an average of 38.56% and the reason is that almost all the area cultivated under these major crops increased by big margin except.

As per data, the production of all the major crops has increased in the state from 1060990 MT to 1689546 from the year 2007-08 to 2015-16. The average increased in production during this period is 37.20%. Data shows that, productivity under horticulture is the highest among all the major crops in the table. For the district of Mokokchung, the production has increased from 117680 MT to 143836 MT which is by a margin of 18.18%. The reason is due to the increase in production of horticulture and commercial crops but there has been a decline in production of cereals, pulses and oil seeds. Phek district also experienced an increase in production during this period from 131340 MT to 143538 MT which is by a margin of 8.49%. Dimapur district experienced the highest production with an average increase of 27.01%, and this is due to the increase in production of cereals and horticulture.

Table 1.3.4: Area and Production under Principle Crops in Nagaland and the three selected Districts

(Area in Hectares)

Major crops	**Nagaland**			**Mokokchung**			**Phek**			**Dimapur**		
	2007-08	2011-12	2015-16	2007-08	2011-12	2015-16	2007-08	2011-12	2015-16	2007-08	2011-12	2015-16
Cereals	250440	264750	285340	29380	19920	21150	30990	25270	27350	32500	52750	55890
Pulses	30060	34940	37490	4020	2970	3080	3560	3320	3250	1900	2050	2600
Oilseeds	75980	66280	67870	8290	6050	6220	8570	6570	6690	9830	8680	9070
Horticulture	14250	24410	37206	1450	2955	3828	1550	2305	3454	1400	2830	4465
Commercial crops/others	17800	31240	37450	1890	3570	4300	2010	3140	3800	3160	6230	7390
Total	388530	421620	465356	45030	35465	38578	46680	40605	44544	48790	72540	79415

(Production in MT)

Major Crops	Nagaland			Mokokchung			Phek			Dimapur		
	2007-08	2011-12	2015-16	2007-08	2011-12	2015-16	2007-08	2011-12	2015-16	2007-08	2011-12	2015-16
Cereals	446260	533270	633790	49980	38920	45630	54620	52660	62530	72470	119130	139830
Pulses	35460	37170	43110	4510	3030	3460	4050	3290	3640	2950	1860	2680
Oilseeds	67000	68120	70020	6680	5700	5950	6970	6660	6800	10940	8480	8900
Horticulture	186000	180235	494226	18500	22050	39796	17500	18530	29568	23000	9675	49320
Commercial crops/others	326270	385800	448400	38010	44010	49000	48200	33890	41000	97870	74630	83210
Total	1060990	1204595	1689546	117680	113710	143836	131340	115030	143538	207230	213775	283940

Source: Statistical Handbook of Nagaland 2016 & Directorate of Economics and Statistics

i. Cereals

Majority of the area under cultivation and agriculture production in Nagaland falls under cereals cultivation which includes rice, wheat, maize and barley etc. The state has been witnessing an increase in area and cultivation of cereals over the last10 years (2007-08 to 2015-16). The table shows clearly that, there has been an increase in area from 25440 Hectares in 2007-08 to 28534 hectares in 2015-16. But in the case of Mokokchung and Phek district, the table shows a decreasing trend over this period with Mokokchung district with an area of 29380 hectares in 2007-08 to 21150 hectares in 2015-16 and Phek district declining from 30990 hectares in 2007-08 to 27350 in 2015-16. Whereas, Dimapur district witnessed an increasing trend from 32500 hectares in 2007-08 to 55890 hectares in 2015-16. In case of production, the state has witnessed an increase trend in production of cereals over the last10 years (2007-08 to 2015-16). The table shows clearly that, production increased from 44626 MT in 2007-08 to 633790 MT in 2015-16. But in the case of Mokokchung, the table shows of 49980 MT in 2007-08 to 45630 MT in 2015-16, which indicated a decreasing trend over these years. On the other hand, Phek and Dimapur witnessed an increasing trend with Phek district producing 54620 MT in 2007-08 to 62530 MT in 2015-16, while Dimapur district saw an increase from 72470 MT in 2007-08 to 139830 MT in 2015-16.

ii. Pulses.

Pulses are the edible seeds of plants in the legume family. Pulses include Naga dal (rice bean), pea, gram, etc. Nagaland has been showing an increase trend in area of pulses from 30060 hectares in the year 2007-08 to 37490 hectares in 2015-16. Dimapur district also shows an increasing trend from 1900 hectares in 2007-08 to 2600 hectares in 2015-16. But in the case of Mokokchung and Phek district, the table shows a decreasing trend over these 10 years with Mokokchung district experiencing from 4020 hectares in 2007-08 to 3080 hectares in 2015-16 and Phek district from 3560 hectares in 2007-08 to 3250 in 2015-16. Production of pulses on the other hand has been showing an increasing trend over these 10 years but there has been a decrease in production in all the three selected districts during this course of time. As per table production of pulses in Nagaland is shown as 35460 MT in 2007-08 to 43110 MT in 2015-16. Mokokchung district witnessed a decrease from 4510 MT in 2007-08 to 3460 MT in 2015-16, Phek district with a production of 4050 MT in 2007-

08 to 3640 MT in 2015-16 and Dimapur district with 2950 MT in 2007-08 to 2680 MT in 2015-16 shows a decreasing trend.

iii. Oil seeds.

Oil seeds include sunflower, groundnut, rapeseeds/mustard, perilla etc. Nagaland has been experiencing a decrease in oil seed cultivation over these 10 years (2007-08 to 2015-16). Table shows that in the year 2007-08 the area under oilseeds cultivation was 75980 hectares but it decreased to 67870 hectares in 2015-16. The three districts of Mokokchung, Phek and Dimapur have been experiencing decreasing trend, with Mokokchung district showing 8290 hectares in 2007-08 to 6220 hectares in 2015-16, Phek district from 8570 hectares in 2007-08 to 6690 hectares in 2015-16 and Dimapur district from 9830 hectares in 2007-08 to 9070 hectares in 2015-16. As per the table, the overall oil seed production has increased over these 10 years (2007-08 to 2015-16), with data showing 67000 MT in the year 2007-08 to 70020 in 2015-16. However, the districts of Mokokchung, Phek and Dimapur have been experienced a decreasing trend, with Mokokchung district from 6680 MT in 2007-08 to 5950 MT in 2015-16, Phek district from 6970 MT in 2007-08 to 6800 MT in 2015-16 and Dimapur district from 10940 MT in 2007-08 to 8900 MT in 2015-16 all showing a decreasing trend.

iv. Commercial Crops.

Crops such as sugarcane, tea, ginger, yam, jute, potato, cotton etc., come under commercial crops. Cultivation of commercial crops has been increasing in Nagaland during this 10 (2007-08 to 2015-16) years as per the table and also all the three selected districts. Nagaland has seen an increasing trend in area cultivated from 17800 hectares in 2007-08 to 37450 hectares in 2015-16. The district of Mokokchung with an area of 1890 hectares in 2007-08 has seen an increase to 4300 hectares in the year 2015-16. Even the districts of Phek and Dimapur has also witnessed an increasing trend over this period, with Phek district from 2010 hectares in 2007-08 to 3800 hectares in 2015-16 and Dimapur district from 3160 hectares in 2007-08 to 7390 hectares in 2015-16. In case of production of commercial crops, the state has witnessed an increasing trend over this period, with a yield of 326270 MT in 2007-08 to 448400 MT in 2015-16. The district of Mokokchung with a production of 380100 MT in 2007-08 has seen an increase to 49000 MT in the year 2015-16. But for the distrcts of Phek and Dimapur there has been a decreasing trend during this period, with Phek district from 33890 MT in 2007-08 to 41000 MT in 2015-16 and Dimapur district from 97870 MT in 2007-08 to 83210 MT in 2015-16

v. Horticulture.

The state witnessed an increasing trend in area under horticulture by an average of 61.69% from the period of 2007-08 to 2015-16. All the three selected districts also experienced an increasing trend during the same period, with Mokokchung district from 1450 hectares to 3828 hectares from 2007-08 to 2015-16, which is by a margin of 62.12%. In case of Phek district, it increased by 55.12%, whereas in Dimapur district, the increase has been from 1400 hectares to 4465 hectares from 2007-08 to 2015-16 which is the highest increase among all the three districts, with an average of 68.64%. Horticulture is the science and art of growing plants (fruits, vegetables, flowers, and any other cultivar). It also includes plant conservation, landscape restoration, soil management, landscape and garden design, construction, and maintenance, and arboriculture. Horticulture in Nagaland has seen an increasing trend by 62.36% during the period from 2007-08 to 2015-16. The reason is due to increase in production of all the districts during this period. As per the data in the table, Mokokchung district witnessed an increasing trend by 53.51%, while, in Phek district increased by an average of 40.81%. Dimapur district achieved the highest in production, with an average of 53.36 among the three districts during this same period.

1.3.5 INFRASTRUCTURE FACILITIES

Socio-economic development is very important for development of every society, and it can be possible only when we have a proper infrastructure and infrastructural development, such as proper road connectivity, schools and colleges, health care facilities, power etc. The sector is highly responsible for propelling overall development and enjoys intense focus from Government for initiating policies that would ensure time-bound creation of world class infrastructure in the country.

Table 1.3.5: Infrastructure facilities in Nagaland and the selected Districts (2015-16)

Sl. No.	Particulars		Nagaland	Districts		
				Mokokchung	Phek	Dimapur
1	No. of Schools		2828	286	256	518
	i.Central		28	3	01	7
	ii.State		2070	227	188	296
	iii.Private		727	56	67	215
2.	No. of Degree Educational Institute		63	5	2	24
	i.Government		15	2	2	1
	ii.Private		48	3	0	23
3.	District Hospital		11	1	1	1
4.	Primary Health Centre		126	14	23	8
5.	Community Health Centre		21	3	3	2
6.	No. of Banks		161	23	8	54
7.	Postal Service		330	52	36	55
8.	Police station		69	9	6	8
9.	District Industries Centre		11	1	1	1
10.	Airways		1	0	0	1
11.	Railways		1	0	0	1
12	Fire stations		13	1	1	1
13.	Newspapers Daily	i. English	4	0	0	4
		ii. Others	4	1	0	1
		Total	8	1	0	5
14.	Sub-District Industries Centre		6	0	1	1
15.	Road		12033	980	1069.80	1287.64
	i. Surface		4215.385	573.095	148.5	412.64
	ii.Unsurface		7817.6	406.9	921.3	875

Source: Statistical handbook of Nagaland 2016

The Indian government's 'Act East' policy, focuses on strengthening relations with neighbouring countries and Prime Minister Narendra Modi is spearheading initiatives to enhance connectivity through various projects pertaining to road, rail, air, telecom, power and waterways. The steps taken by the state government for infrastructural development can be seen in the table below. Table 1.3.5 indicates that there are about 2828 schools in Nagaland in the year 2015-16, which slightly increased from 2533 in the year 2007-08. While the number of degree colleges has increased from 58 in 2012-13 to 63 in 2015-16. The number of hospitals, primary health centre and community health care stands at 11, 126 and 21 respectively. The number of banks in Nagaland as on 31st March 2016 is 161. The number of postal services, police station and fire stations is 330, 69 and 13 respectively. The state has 12033 km of road connectivity, with 4215.385 km of surfaced and 7817.6 km of unsurfaced road as on 2016.

Similarly, in Mokokchung district about 286 schools are running and of which 3 schools are central schools, 227 Government schools and 26 private schools and 5 degree colleges in Mokokchung district as of 2015-16. The district has 1 District hospital, 14 primary health care centers and 3 community health care centers. The number of postal services as well as police stations was 52, and 9 respectively as on 2015-16. The district has a total of 980 km of road with 573.095 km surface and 406.9 km of unsurfaced road.

On the other hand Phek district has 2 degree colleges, 256 schools of which 1 school is central school, 188 Government schools and 67 private schools. It has 1 district hospital, 23 primary health care centers, 3 community health care centers. The district has 8 banks, 36 postal services and 6 police stations, 1 district industries centre and 1 sub-district industries centre. The district is covered by 1069.80 km of roads with 148.5 km of surfaced and 921.3 km of unsurfaced roads.

In contrast to that the district of Dimapur has a better infrastructural condition than the counterpart districts of Mokokchung and Phek. The districts has a total of 518 schools out of which 7 are central schools, 296 Government schools and 215 private schools and 24 degree colleges. The district has 1 district hospital, 8 primary health care centers and 2 community health care centers. The district has 54 banks, 55 postal services and 7 police stations. Dimapur is the only district in Nagaland to have airport and railway link and it has 1 district industries centre and 1 sub-district industries centre. Five (5) daily newspapers are published in the district with 4 in English language and 1 in local language. The district is covered with 1287.64 km of roads, with 412.64 km surfaced and 875 km of unsurfaced roads.

RECAPULATION

This chapter discusses on the origin of rice, the types of rice growing regions in India, objectives, methodology used etc., review on past literature of rice cultivation,specially on production and yield efficiency. Profile of the study area for the state and districts have been discussed with respect to geographical, demographical, land utilization and land use pattern and availability of infrastructure situations in the state and respective districts.

CHAPTER 2

EXTENT OF RICE FARMING AND SOCIO-ECONOMIC PROFILE

INTRODUCTION

This chapter discusses on extend of rice farming in India, Northeast Region and Nagaland state. It presents the extent of rice cultivation in terms of area, production and productivity at macro and micro perspectives and cost of cultivation under different rice farming system in Nagaland. Being the staple food crop of Nagaland demand for rice has been on an increase over the years and Government of Nagaland has been trying to encourage paddy cultivators to produce more by giving them training, equipments, pesticides, credit facilities as well as undertaking number of irrigation projects, supplying pumping set to farmers, initiating community Development projects, setting up of agriculture research and extension centers etc.

This chapter is divided into two sections. Section I discusses on the extent of rice cultivation in India, Northeast Region and Nagaland State in terms of area, production and productivity; Section II discusses on socio-economic profile of respondents in selected districts of this study.

SECTION I

2.1 AREA, PRODUCTION AND PRODUCTIVITY OF RICE IN INDIA-MAJOR RICE GROWING STATES

Rice is the most important food crop of India. The country has the largest area under rice crop among the rice growing countries in the world and it ranks second in production next to China. It occupies about 23.3% of gross cropped area and contributes 43% of total food grain production and 46% of the total cereal production of the country.

There has been a considerable increase in productivity of rice in India during the recent past. The productivity of rice has increased from 668 kgs per hectare in 1950-51 to 2,066 kgs per hectare during 2001-02 and further increased to 2400 kgs per hectare in 2015-16.The increase in productivity of rice is due to introduction of high yielding rice varieties responsive to high dose of fertilizers coupled with improved package of practices evolved by agricultural scientists for various regions. The total production of rice was around 20 million tons in 1950, which has seen an increased to around 106 million tons in 2013–14. In fact, there is a considerable increase in productivity of rice in the country but there are still certain areas, where productivity fluctuates significantly by various reasons like the nature of soil type, soil fertility, rainfall pattern, climatic conditions etc. Rice is cultivated in about 534 districts of the country and of which, 218 districts are producing higher yield than the national average. Whereas about 316 districts the yield rate was below the national average (Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New-Delhi).

Table 2.1.a: Area under Major Rice growing States in India (in Lakh Hectares)

Sl. No.	States	1997-98	2000-01	2010-11	2015-16	CGR (1997-98 to 2015-16)
1	Andhra Pradesh	35.00	42.43	47.51	32.10	-0.45%
2	Bihar	51.12	36.56	28.32	32.32	-2.38%
3	Karnataka	13.53	14.83	15.40	11.10	-1.04%
4	Madhya Pradesh	54.27	17.08	16.03	20.20	-5.07%
5	Odisha	44.97	44.34	42.25	39.41	-0.69%
6	Punjab	22.81	26.11	28.31	29.75	1.41%
7	Tamil Nadu	22.61	20.80	19.05	20.00	-0.64%
8	Uttar Pradesh	56.64	59.07	56.57	58.62	0.18%
9	West Bengal	59.00	54.35	49.44	55.24	-0.35%
10	All India	434.46	447.12	428.62	434.99	0.99%

Source: Handbook of statistics, Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New-Delhi.

Table 2.1.a shows the trend in area under rice producing states in India from the year 1997-98 to 2015-16. As per the compound growth rate, area under rice in all India level has increased by 0.99% over the period of time. Madhya Pradesh registered a rate of -5.07%, witnessing the highest fall in area under rice from 54.27 Lakh Hectare in 1997-98 to 20.20 Lakh Hectare in 2015-16. Similarly, in Bihar, the data shows that there is a decreasing trend and it registered a negative growth rate of -2.38% over the study period. On the contrary to that, the states of Punjab and Uttar Pradesh have registered an increasing trend in area under rice over the period of time, accounting at 1.41% and 0.18% respectively. The average size of land holding in rice cultivation has come down over the decades. The reason is due to shift of farmers from rice cultivation to other commercial crops, use of land for non-agriculture purpose, urbanization, decrease in soil fertility etc. Failure of monsoon is also another major

obstacle for decelerating of area under cultivation and more than half of the gross cropped area being rain fed.

Table 2.1.b: Distribution of Production under major Rice growing States in India

(in Lakh Tonnes)

Sl. No	States	1997-98	2000-01	2010-11	2015-16	CGR (1997-98 to 2015-16)
1	Andhra Pradesh	85.1	124.58	144.18	112.33	1.47%
2	Bihar	71.33	54.43	31.02	68.02	-0.25%
3	Karnataka	32.13	38.47	41.88	30.32	-0.32%
4	Madhya Pradesh	45.28	39.82	17.72	46.6	0.15%
5	Odisha	62.05	46.14	68.27	58.75	-0.29%
6	Punjab	79.04	91.54	108.37	118.23	2.14%
7	Tamil Nadu	68.94	73.66	57.92	75.17	0.46%
8	Uttar Pradesh	121.65	116.79	119.92	125.01	0.14%
9	West Bengal	132.37	124.28	130.45	159.54	0.99%
10	All India	825.35	849.80	959.79	1044.07	1.24%

Source: Handbook of statistics, Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New-Delhi.

Table 2.1.b indicates that, production of rice has increased from 825.35 lakh tonnes in 1997-98 to 1044.07 lakh tonnes in 2015-16, an increase by 1.24% over the period of time. Most of the states have witnessed an increasing trend and among the states, Punjab witnessed the highest increase of 79.04 lakh tonnes in 1997-98 to 118.23 lakh tones in 2015-16, with an average compound annual growth rate of 2.14%. On contrary to that, the state of Karnataka has witnessed the largest decline in production over the period of time.

Interesting observation in all the rice growing states reveals that, the average increase in production is much higher and is mainly attributed to the adoption of modern technique of production like use of fertilizers, HYV seeds, irrigation etc. However, the production is very less in some states mainly due to the deteriorating in yield rates, diminishing returns to modern varieties, lack of irrigation and misapplication of fertilizer and pesticides, high price fluctuation, high cost of cultivation etc. There is also concern that pest and disease resistance to modern pesticides now reduce yield rates, and that breeders have largely exploited the yield potential of major Green Revolution crops.

Table 2.1.c: Productivity of some of the major Rice growing States in India

(in Kgs/Hectares)

Sl. No.	States	1997-98	2000-01	2010-11	2015-16	CGR (1997-98 to 2015-16)
1	Andhra Pradesh	2431	2936	3034	3148	1.37%
2	Bihar	1395	1489	1095	4567	6.44%
3	Karnataka	2374	2593	2719	5554	4.57%
4	Madhya Pradesh	834	575	1106	1768	4.03%
5	Odisha	1380	1041	1616	4729	6.07%
6	Punjab	3465	3506	3828	3974	0.72%
7	Tamil Nadu	3050	3541	3040	8411	5.48%
8	Uttar Pradesh	2148	1977	2120	4850	4.38%
9	West Bengal	2243	2287	2639	6155	5.42%
10	All India	1900	1901	2239	5686.91	5.94%

Source: Handbook of statistics, Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India, New-Delhi.

Similarly, in Table 2.1.c, the data indicates that productivity of rice has witnessed an increase from 1900 Kgs per hectares to 5686.91 Kgs per hectares (1997-98 to 2015-16) registered an average of 5.94% growth over the study period. All the major rice growing states are showing a positive trend in yield rate over the period and Bihar has witnessed the highest from 1395 Kgs per hectares to 4567 Kgs per hectares (1997-98 to 2015-16), followed by Odisha and Tamil Nadu respectively. The increase in yield over the decades is mainly due to the introduction of high yielding variety seeds, coupled with better irrigation and increase in use of chemical fertilizers and pesticides. Introduction of new cultivated species and improved varieties of crop access to suitable technology are some of the reasons enabling the farmers to enhance higher productivity in the state and other.

Figure 2.1: Compounded Growth Rate of Area, Production and Productivity of major Rice growing States in India (1997-98 to 2015-16)

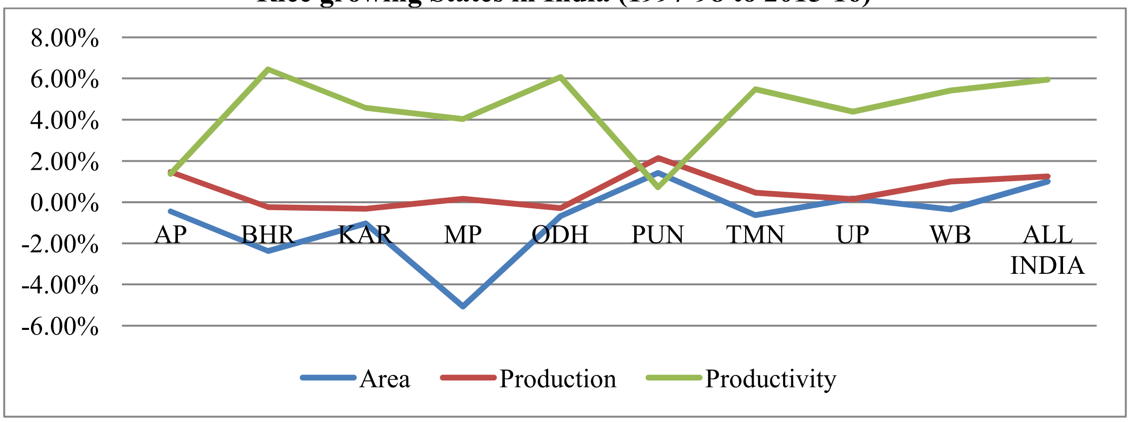

Table 2.1.d: Regression Analysis of the major Rice producing States in India

Sl. No	States	Constant	Coefficient				
			Area	Yield	R^2	F-Change	N
1	West Bengal	35.293	1.647 (2.62)*	0.004 (3.95)*	0.502	8.07	19
2	Uttar Pradesh	-72.519	3.111 (4.72)*	0.005 (3.71)*	0.771	27.03	19
3	Andhra Pradesh	-43.601	3.242 (7.53)*	0.011 (2.20)**	0.781	28.68	19
4	Punjab	-97.709	3.761 (6.45)*	0.026 (9.05)*	0.999	68.45	19
5	Tamil Nadu	-49.176	5.156 (10.61)*	0.002 (4.51)*	0.874	63.68	19
6	Bihar	-24.911	1.686 (8.91)*	0.008 (9.49)*	0.892	66.54	19
7	Odisha	-202.250	5.651 (2.81)*	0.009 (3.69)*	0.463	6.92	19
8	Madhya Pradesh	-21.505	0.949 (12.67)*	0.022 (7.64)*	0.931	109.28	19
9	Karnataka	-24.607	4.039 (4.91)*	0.001 (2.00)**	0.609	12.46	19
10	All India	-395.179	2.723 (2.86)*	0.047 (6.77)*	0.777	27.95	19

Note: Figures in the parenthesis indicates ‘t’ values
*, ** and *** indicates 1 percent, 5 percent and 10 percent significance level
Dependent variable: Production

The regression result of the major rice growing states in India is depicted in Table 2.1.d and the result shows that, the coefficient of area and yield in case of India is positively associated with the dependent variable and it is statistically significant at 1 percent level, which means a 1 percent increase in area leads to an increase in production by 2.73 times. R^2 value is 0.77 which signifies that 77 percent of the variation in production is explained by area as an explanatory variable. It is eminent from the table that, all the major rice growing states has registered positive association with dependent variables and statistical significance at 1 percent level with respect to area and productivity. The R^2 value of .502, .771, .781, .998, .874, 892, .463, .931, .609 clearly indicates the effect of area and yield on production is significant and it implies that, about 50, 77, 78, 99, 87, 89, 46, 93, 61 percent variation in production is case of West Bengal, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Bihar, Orissa, Madhya Pradesh and Karnataka respectively as explained by area and yield as explanatory variables.

2.2 Area, Production and Productivity of Rice in North East Region

Rice is a major stable food crop for entire Northeast region. North East Region (NER) comprises of eight states Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Area under rice in this region is around 3.45 million hectares, which accounted for 10.48% of total area under rice in the country. NER receives very heavy rainfall and rice is grown under rain fed condition. The state of Assam grows more than one crop in a year. The average total production of rice is about 5.25 million tonnes, which is about 6.0% of national average. The Productivity of rice in this region is about 1780 kg per ha only, which is much below the national average i.e., of 2240 kg per ha.

Table 2.2.a: Area under Rice cultivation of North-Eastern States (in Lakh Hectares)

Sl. No.	States	1997-98	2000-01	2010-11	2015-16	CGR (1997-98 to 2015-16)
1	Arunachal Pradesh	1.2	1.2	1.21	1.28	0.34
2	Assam	24.9	25.37	25.7	24.85	-0.01
3	Manipur	1.58	1.63	2.13	2.37	2.16
4	Meghalaya	1.05	1.08	1.08	1.1	0.25
5	Mizoram	0.68	0.56	0.41	0.37	-3.15
6	Nagaland	1.45	1.57	1.81	2.01	1.73
7	Sikkim	0.16	0.16	1.2	0.11	-1.95
8	Tripura	2.58	2.47	2.65	2.7	0.24
9	NER	33.65	34.04	36.19	34.79	0.18

Source: The North Eastern Development Finance Corporation Ltd (*NEDFi*)

Table 2.2.a shows that, area under rice in the North-Eastern Region has witnessed an increase by 0.18% over the period of time. The trend on area under rice has been increased slightly and it has registered from 33.65 Lakh Hectares to 34.79 Lakh Hectares only over the period. Among the states, Manipur has registered the highest increase in terms of percentage growth (2.16%), followed by Nagaland (1.73%). The area under rice for Manipur in the year 1997-98 was 1.58 Lakh Hectares which gradually increased by 2.37 Lakh Hectares during the year 2015-16. On the other hand, the states of Mizoram, Sikkim and Assam registered a declining trend of area under rice in which, Mizoram witnessed a fall in area by 3.15 percent followed by Sikkim 1.95 and Assam 0.01 percent respectively. For the state of Mizoram, the area under rice has been falling continuously in absolute terms from 0.68 Lakh Hectares in 1997-98 to 0.37 Lakh Hectares in are plotted for rice and other crop through terrace and shifting cultivation. The region has enough arable land to bring under cultivation

and this is one major reason for the increase in area under rice over the period of time and along with that the farmers as well as the government have realized the importance of self-sufficiency which has prompted to take various measure to encourage rice farming by providing subsidies on, HYV seed, fertilizers etc.

Table 2.2.b: Production of Rice in North-Eastern States (in Lakh Tonnes)

Sl. No	States	1997-98	2000-01	2010-11	2015-16	CGR (1997-98 to 2015-16)
1	Arunachal Pradesh	1.3	1.33	2.34	2.04	2.40 %
2	Assam	33.83	39.99	47.37	51.25	2.21 %
3	Manipur	3.52	3.82	5.22	3.39	-0.20 %
4	Meghalaya	1.5	1.79	2.07	3.01	3.73 %
5	Mizoram	1.1	1.04	0.47	0.62	-2.97 %
6	Nagaland	1.87	2.3	3.81	3.18	2.83 %
7	Sikkim	0.21	0.21	0.21	0.13	-2.49 %
8	Tripura	5.36	5.13	7.02	7.95	2.1 %
9	NER	48.69	55.65	68.51	71.57	2.05 %

Source: The North Eastern Development Finance Corporation Ltd (*NEDFi*)

Similarly, the production of rice in North-Eastern Region is shown in Table 2.2.b and it has witnessed an increasing trend from 48.69 lakh tonnes in 1997-98 to 71.57 lakh tonnes in 2015-16, registered at an average growth of 2.05%. Among the states, Meghalaya, Nagaland and Arunachal Pradesh witnessed an increasing trend with an average growth rate of 3.73%, 2.83% and 2.40 % respectively, which is higher than the regional average. On the other hand, Mizoram, Sikkim and Manipur registered declining trend over the period with a negative growth of 2.97%, 2.49% and 0.20% respectively by declining the area under rice over the study period and by adopting cropping pattern and crop diversification practices in these states at major levels.

The productivity of rice in North-East Region shown in Table 2.2.c depicts that, there is a positive growth in this region over the period of time. The yield of the region in 1997-98 was 12443 Kgs per hectare and it increased by 15720.8 Kgs per hectare in 2015-16, registering an increase in yield by 1.07. Among the states, Meghalaya, Assam and Arunachal Pradesh are the states that witnessed the highest yield with an average of 3.47%, 2.22% and 2.04% respectively while Manipur and Sikkim witnessed a negative yield at 2.31% and 0.54% respectively during the study period. The data reveals that, in major states, improvement in yield rate over the period is due to the introduction of HYV seeds, new technology, irrigation facilities, fertilizers, training, subsidies etc., which has helped the cultivators to accelerate the productivity. Though the rice production in this region has made significant strides, there have been wide fluctuations in the production over the years in all the States. Thus, it is of vital necessity to analyze the production and productivity trend of rice in North-East India where rice occupies 89.46% of the total area under foodgrains and contributes 92.32% total foodgrains.

Table 2.2.c: Productivity of Rice in North-Eastern States (in Kgs/Hectares)

Sl. No	States	1997-98	2000-01	2010-11	2015-16	CGR (1997-98 to 2015-16)
1	Arunachal Pradesh	1079	1119	1924.8	1584	2.04
2	Assam	1359	1511	1843	2062	2.22
3	Manipur	2227	2431	2400	1429	-2.31
4	Meghalaya	1427	1679	1911	2726	3.47
5	Mizoram	1620	1998	1160	1671	0.16
6	Nagaland	1290	1533	2100	1586	1.09
7	Sikkim	1363	1408	1727	1230	-0.54
8	Tripura	2078	2129	2655	2947	1.86
9	NER	12443	13808	15720.8	15235	1.07

Source: The North Eastern Development Finance Corporation Ltd (*NEDFi*)

Figure 2.2: Compounded Growth Rate of Area, Production and Productivity of Rice of North-Eastern States (1997-98 to 2015-16)

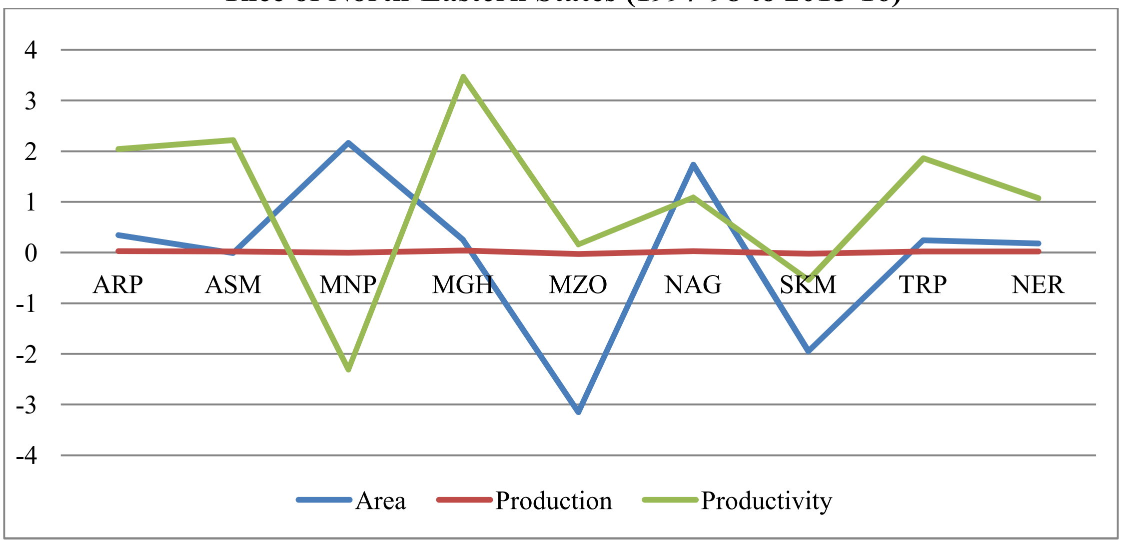

Table 2.2.d: Regression Analysis of the Rice Production of all the North-Eastern States

Sl. No	States	Constant	Coefficient				
			Area	Yield	R^2	F-Change	N
1	Arunachal	150.33	-104.35 (0.40)	-0.009 (0.46)	0.049	0.42	19
2	Assam	-35.51	1.435 (48.59)*	0.024 (206.81)*	0.999	26512.90	19
3	Manipur	-202.23	36.30 (0.41)	0.0744 (0.90)	0.047	0.40	19
4	Meghalaya	-1.80	1.645 (11.76)*	0.001 (120.07)*	0.999	13773.87	19
5	Mizoram	-0.924	1.82 (23.27)*	0.0005 (26.20)*	0.986	563.70	19
6	Nagaland	-2.63	1.550 (8.34)*	0.001 (19.72)*	0.989	757.17	19
7	Sikkim	0.14	-0.0006 (0.35)	0.00004 (1.48)	0.119	1.09	19
8	Tripura	-6.20	2.439 (32.83)*	0.002 (98.20)*	0.999	8730	19
9	NER	-32.010	0.431 (1.85)	0.041 (10.75)*	0.901	72.91	19

Note: Figures in the parenthesis indicates 't' values
*, ** and *** indicates 1 percent, 5 percent and 10 percent significance level
Dependent variable: Production

The regression result of rice production among the major North Eastern states is shown in Table 2.2.d. The data indicates that, the coefficient of area and yield of North-Eastern states as a whole from the year 1997-98 to 2015-16 shows a positive association and statistically significant in case of yield. It indicates that, for many states area under rice is positively associated with production and it is statistically significant at 1 percent level, which means that for every 1 percent increase in farm size, production increases by 0.041 times. Similarly, yield also registered positive and statistical significance at 1 percent level. The R^2 value is 0.901 clearly indicates that, the effect of area and yield on production is significant and it implies that about 90 percent variations in production. Among the states, Assam, Meghalaya, Mizoram, Nagaland and Tripura registered positive association with dependent variables and statistical significance at 1 percent level, while Arunachal Pradesh, Manipur and Sikkim registered expected signs but statistically insignificant with dependent variable. The R^2 value in case of Assam, Meghalaya, Mizoram, Nagaland and Tripura are .999, .999, .986, .989, and .999, which reveals that almost 99 and 98 percent variation in production respectively are explained by area and yield as explanatory variables.

2.3 Area, Production and Productivity of Rice in Nagaland-District wise Analysis

Rice is the staple food crop of Nagaland and it occupies about 70% of the total cultivated area and constitutes about 75% of the total food grain production. It is a source of income and employment for the people and it is part of the tradition and cultural heritage. Jhum and Terrace cultivations are the predominant forms of cultivation in the state and Jhum cultivation is the oldest one and it is practiced in all the parts of Nagaland, while Wet rice cultivation is confined to the plain areas of Dimapur district, while Wet terrace cultivation is confined to the districts of Kohima and Phek. Despite of many obstacles, the farmers have significantly moved on to adopt integrated approaches, organic, dry land farming and double cropping system. The yield rate of TRC/WRC rice has been registering faster growth in recent years.

Table 2.3.a: Area under Jhum cultivation among the Districts in Nagaland

(in hectare)

Sl. No	Districts	1998-99	2005-06	2010-11	2016-17	CGR (1998-99 to 2016-17)
1	Kohima	10500	10450	9880	5180	-3.65%
2	Tuensang	10000	19200	11490	10080	0.04%
3	Wokha	14000	13850	11670	10120	-1.69%
4	Mokokchung	14500	12670	11670	9350	-2.28%
5	Mon	13200	10300	9800	15990	1.01%
6	Zuenehboto	10400	7500	9720	9260	-0.61%
7	Phek	9600	6380	1960	1670	-8.79%
8	Dimapur	--	7800	9620	9150	1.07%
9	Kiphire	--	--	9080	8480	-0.76%
10	Longleng	--	--	7210	5830	-2.33%
11	Peren	--	--	4470	6380	4.03%
12	Nagaland	82200	88150	84900	91490	0.57%

Source: Statistical Handbook of Nagaland
Note: -- indicates Dimapur district was formed in 1997, Kiphire, Longleng and Peren districts were formed in 2003 only

Table 2.3.a shows that, the area under Jhum cultivation in Nagaland has witnessed an increase by 0.57% over the period of time. The trend in area under rice has registered at slower rate and has increased from 8220 hectares in 1998-99 to 91490 hectares in 2015-16. However, most of the districts in the state have registered a declining trend, in which Phek, Kohima, and Longleng witnessed a negative growth of 8.79%, 3.65% and 2.33% respectively. In Phek district, the main reason for decreasing trend in jhum

cultivation is due to the initiative taken up by the whole community to adopt WTC. While in case of Kohima, it is due to urbanization and also adoption of Wet Terrace Cultivation. Whereas, Peren and Mon district registered an increasing trend under jhum and registered a growth of 4.03% and 1.01% respectively over the period of time.

Table 2.3.b: Production under Jhum cultivation among the Districts in Nagaland

(in Metric Tonnes)

Sl. No	Districts	1998-99	2005-06	2010-11	2016-17	CGR (1998-99 to 2016-17)
1	Kohima	12120	18720	17802	10340	-0.83%
2	Tuensang	12000	28400	20810	20140	2.76%
3	Wokha	17500	20500	21200	20220	0.76%
4	Mokokchung	18420	19100	21000	18670	0.07%
5	Mon	16500	15640	17680	31910	3.53%
6	Zuenehboto	13000	10050	17450	18480	1.87%
7	Phek	11900	10190	3400	3330	-6.48%
8	Dimapur	--	11500	17170	18290	3.14%
9	Kiphire	--	--	16400	16940	0.36%
10	Longleng	--	--	12920	11620	-1.17%
11	Peren	--	--	7980	12750	5.34%
12	Nagaland	101440	134100	173812	182690	3.14%

Source: Statistical Handbook of Nagaland
Note: -- indicates Dimapur district was formed in 1997, Kiphire, Longleng and Peren districts were formed in 2003 only

Though the area under rice has registered a decreasing trend in most of the districts but production of rice in the state as a whole has increased by 3.14% during the period of time. Table 2.3.b shows that production of jhum rice in Nagaland has witnessed an increasing trend at an average growth of 3.14 % during the study period. The production of rice among the districts of Peren, Mon and Dimapur registered positive growth rate with an average growth of 5.34%, 3.53% and 3.14% respectively, which is higher than the state average. The main reason for increase in these districts is mainly due to increase in area under rice crop during this period. On the other hand, the districts of Phek and Longleng registered a negative growth over the period with an average of 6.48% and 1.17% respectively. The reason for this decline is due to decline in area under jhum during the period of time.

Table 2.3.c: Yield under Jhum cultivation among the Districts in Nagaland

(in Kg/hectare)

Sl. No	Districts	1998-99	2005-06	2010-11	2016-17	CGR (1998-99 to 2016-17)
1	Kohima	1154.29	1791.39	1801.82	1996.14	2.92%
2	Tuensang	1200.00	1479.17	1811.14	1998.02	2.72%
3	Wokha	1250.00	1480.14	1816.62	1998.02	2.50%
4	Mokokchung	1270.34	1507.50	1799.49	1996.79	2.41%
5	Mon	1250.00	1518.45	1804.08	1995.62	2.49%
6	Zuenehboto	1250.00	1340.00	1795.27	1995.68	2.49%
7	Phek	1239.58	1597.18	1734.69	1994.01	2.53%
8	Dimapur	--	1474.36	1784.82	1998.91	2.05%
9	Kiphire	--	--	1806.17	1997.64	1.13%
10	Longleng	--	--	1791.96	1993.14	1.19%
11	Peren	--	--	1785.23	1998.43	1.26%
12	Nagaland	1234.06	1521.27	2047.26	1996.83	2.57%

Source: Statistical Handbook of Nagaland
Note: -- indicates Dimapur district was formed in 1997, Kiphire, Longleng and Peren districts were formed in 2003 only

The distribution of productivity among the districts is shown in Table 2.3.c and the data depicts that, the state had witnessed positive growth over the period of time. The yield of the state in 1998-99 was 1234.06 kgs per hectare and it increased by 1996.83 kgs per hectare in 2016-17, registering an increase by 2.57 percent. It is interesting to note that, all the eleven districts have registered a positive growth in yield, while many districts registering a fall in area and production of rice during the same period. The main reason is that, the area under Jhum cultivation keeps changing every year and as a result the new fields are fertile since it is mostly a virgin land which was covered by forest. Similarly, the use of improved seeds and initiatives from concerned departments, giving training to farmers are also some of the reasons for enhancing the yield rate. Majority of the district have witnessed an equal increase in yield except Kiphire and Longleng districts registering the lowest growth with an average of 1.13% and 1.19% respectively due to the backwardness of farmers using traditional methods of farm practices.

Figure 2.3: Compounded Growth Rate of Area, Production and Productivity under Jhum in Nagaland (1998-99 to 2016-17)

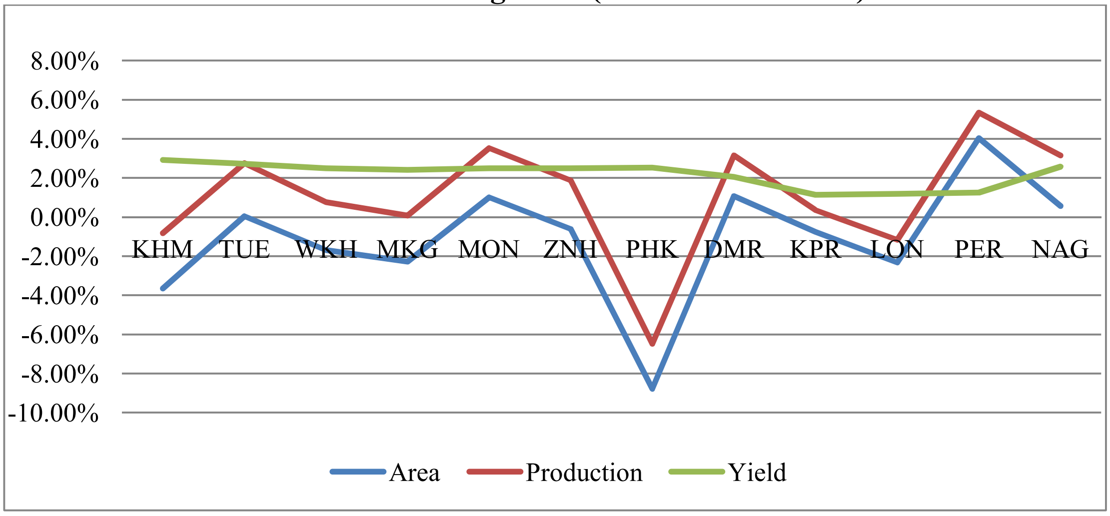

Table 2.3.d: Distribution of Rice Farming among the Districts in Nagaland: Regression Analysis

Sl. No	Districts	Constant	Coefficient				
			Area	Yield	R^2	F-Change	N
1	Kohima	-1.987	1.002 (134.21)*	0.993 (62.66)*	0.999	9217.19	19
2	Tuensang	-1.999	0.999 (95.91)*	1.000 (70.45)*	0.998	5708.77	19
3	Wokha	-2.003	0.991 (39.11)*	1.012 (51.48)*	0.994	1385.08	19
4	Mokokchun g	-1.997	1.007 (36.19)*	0.990 (37.55)*	0.990	792.54	19
5	Mon	-2.021	1.008 (80.18)*	0.996 (74.08)*	0.998	7389.05	19
6	Zunheoboto	-2.108	1.009 (73.27)*	1.021 (91.87)*	0.998	6196.58	19
7	Phek	-2.067	1.006 (214.32)*	1.014 (48.93)*	0.999	31278.82	19
8	Dimapur	-1.994	0.990 (65.19)*	0.994 (78.17)*	0.999	8854.17	15
9	Kiphire	-1.494	0.820 (10.07)*	1.062 (30.28)*	0.997	1240.65	9
10	Longleng	-1.700	0.943 (21.42)*	0.973 (32.33)*	0.992	529.30	9
11	Peren	-2.275	1.010 (40.97)*	1.073 (35.60)*	0.99	3771.39	9
12	Nagaland	-1.984	1.002 (24.73)*	0.991 (58.28)*	0.996	2142.72	19

Note: Figures in the parenthesis indicates ‘t’ values
*, ** and *** indicates 1 percent, 5 percent and 10 percent significance level
Dependent variable: Production

As per Table 2.3.d, the regression result shows that, the coefficients of area and yield under Jhum cultivation in Nagaland from the year 1998-99 to 2016-17 and the data indicates that both the factors have expected signs and statistically significant at 1percent level for all the districts. The results shows that, in all the districts the area under rice is positively associated with production and it is statistically significant at 1 percent level, which means that for every 1 percent increase in farm size, production increase by 24.73 times. Similarly, yield registered positive and statistically significant at 1 percent level, showing that for every 1 percent increase in every production, productivity will increase by 58.28 times. The R^2 is 0.996, which indicates that, the effect of area and yield on production is significant and it implies that about 99 percent variations with explanatory variables. The value of R^2 is .99 for all the districts and it reveals that almost 99 percent variation in production is explained by area and yield as explanatory variables with dependent variables.

Table 2.3.e: Area under WTC/WRC among the Districts in Nagaland (in hectare)

Sl. No	Districts	1998-99	2005-06	2010-11	2016-17	CGR (1998-99 to 2016-17)
1	Kohima	16850	11500	8050	10580	-2.42%
2	Tuensang	6500	6100	3550	6640	0.11%
3	Wokha	9850	1920	6400	9210	-0.35%
4	Mokokchung	6750	3100	6000	6880	0.1%
5	Mon	4720	1450	6000	6180	1.43%
6	Zuenheboto	3100	3450	2680	4980	2.53%
7	Phek	15750	13520	11920	14560	-0.41%
8	Dimapur	--	26950	35310	39740	2.62%
9	Kiphire	--	--	840	3080	15.53%
10	Longleng	--	--	210	2280	30.34%
11	Peren	--	--	6780	11040	5.57%
12	Nagaland	63520	68250	84820	115170	3.18%

Source: Statistical Handbook of Nagaland

Note: -- indicates Dimapur district was formed in 1997, Kiphire, Longleng and Peren districts were formed in 2003 only

Similarly, Table 2.3.e shows that area under WTC/WRC in the State has registered a positive growth rate and the area under rice increased from 63520 hectares in 1998-99 to 115170 hectares in 2016-17, registered at 3.18% growth rate over the period of time. While across the districts, Longleng registered the highest growth rate of 30.34%, followed by Kiphire 15.53% and Peren 5.57% respectively. It is interesting to note that, all the three districts registering highest growth rate are newly formed districts formed in the year 2003 and the data was taken from 2010-11 to 2016-17. On the contrary, the districts of Kohima, Phek and Wokha registered a negative growth rate with an average of 2.42%, 0.41% and 0.35% respectively. The main reason behind this decline is due to increase in human settlement and a shift from agriculture to other sectors over the period of time.

Table 2.3.f: Production under WTC/WRC among the Districts in Nagaland

(in Metric Tonnes)

Sl. No.	Districts	1998-99	2005-06	2010-11	2016-17	CGR (1998-99 to 2016-17)
1	Kohima	236800	220400	196200	295800	1.18%
2	Tuensang	111000	114500	88400	185700	2.75%
3	Wokha	167700	29300	157300	257900	2.29%
4	Mokokchung	115000	53200	146700	192500	2.75%
5	Mon	30500	22200	147200	172600	9.55%
6	Zunheboto	63000	61700	67100	139200	4.26%
7	Phek	259500	261800	296100	407200	14.18%
8	Dimapur	--	521400	856100	1113000	7.14%
9	Kiphire	--	--	22500	86000	16.07%
10	Longleng	--	--	7000	63800	27.83%
11	Peren	--	--	169500	310000	6.94%
12	Nagaland	983500	1290000	2075300	3223700	6.45%

Source: Statistical Handbook of Nagaland
Note: -- indicates Dimapur district was formed in 1997, Kiphire, Longleng and Peren districts were formed in 2003 only

The production of WTC/WRC of the state has registered an increase from 983500 metric tons in 1998-99 to 3223700 in 2016-17, at an average of 6.45% growth rate. Though the production in all the districts shows a positive growth, the newly formed districts of Longleng and Kiphire registered the highest growth with an average of 27.83% and 16.07% respectively, which was higher than the state average. On the other hand, the districts of Kohima, Wokha and Mokokchung are the districts that registered the lowest growth of 1.18%, 2.29% and 2.75% respectively over the study period due to the change in cropping pattern and crop diversity at higher level in these districts.

The distribution of productivity among the districts of Nagaland is shown in Table 2.3.g. The data indicates that, the productivity in WTC/WRC registered a positive growth in all the districts over the study period. The compound annual growth of the state witnessed about 3.17%. Similarly, the distribution of yield growth among the districts, Mon registered highest growth at 8.01%, followed by Longleng, Kiphire and

Kohima accounted with 4.37%, 3.92% and 3.69% respectively, which is higher than the state average. While the district of Peren and Zunheboto registered the lowest growth at 1.66% and 1.69% over the period due to less area under WTC/WRC in these districts during the study period.

Table 2.3.g: Yield under Wet Terrace Cultivation/Wet Rice Cultivation among the Districts in Nagaland

(in Kg/hectare)

Sl. No.	Districts	1998-99	2005-06	2010-11	2016-17	CGR (1998-99 to 2016-17)
1	Kohima	1405.34	1938.16	2437.27	2795.84	3.69%
2	Tuensang	1707.69	1886.67	2490.14	2796.69	2.63%
3	Wokha	1702.54	1661.90	2457.81	2800.22	2.65%
4	Mokokchung	1703.70	1790.38	2445.00	2797.97	2.65%
5	Mon	646.19	1000.00	2445.00	2792.88	8.01%
6	Zunheboto	2032.26	1794.12	2503.73	2795.18	1.69%
7	Phek	1647.62	1947.76	2484.06	2796.70	2.82%
8	Dimapur	--	1970.8	2424.53	2800.70	3.02%
9	Kiphire	--	--	2678.57	2792.21	3.92%
10	Longleng	--	--	3333.33	2798.25	4.37%
11	Peren	--	--	2500.00	2807.97	1.66%
12	Nagaland	1548.33	1917.04	2446.71	2799.08	3.17%

Source: Statistical Handbook of Nagaland

Note: -- indicates Dimapur district was formed in 1997, Kiphire, Longleng and Peren districts were formed in 2003 only

Figure 2.4: Compounded Growth Rate of Area, Production and Productivity under WTC/WRC in Nagaland (1998-99 to 2016-17)

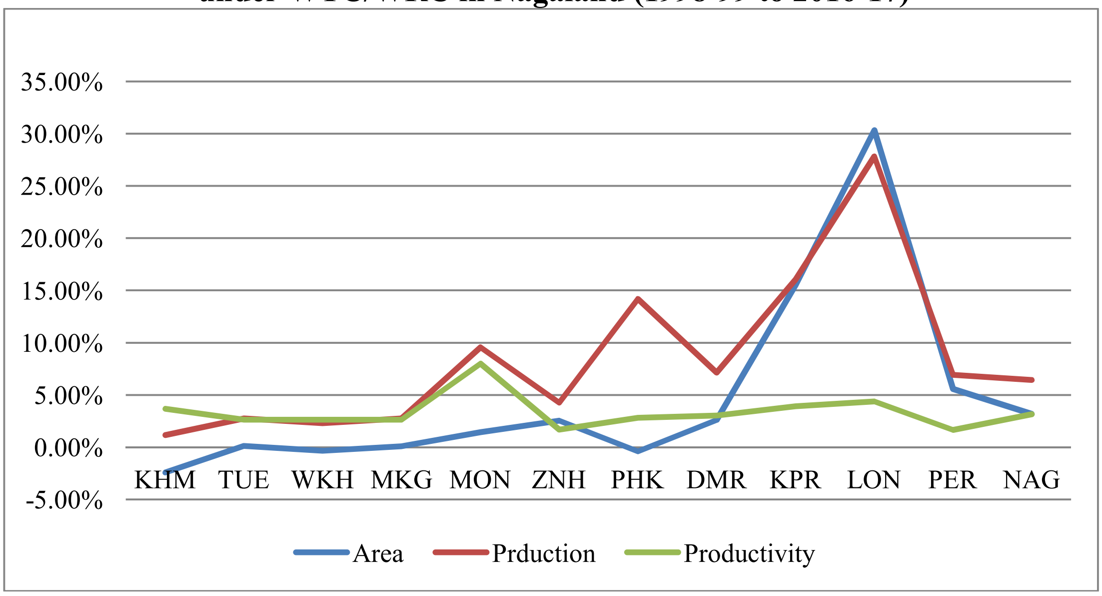

Table 2.3.h: Distribution of Rice farming among the Districts of Nagaland - Regression Analysis

Sl. No.	Districts	Constant	Coefficient				N
			Area	Yield	R^2	F-Change	
1	Kohima	-1.980	0.989 (106.15)*	1.006 (77.64)*	0.998	6056.51	19
2	Tuensang	-1.950	0.994 (113.34)*	0.991 (79.56)*	0.999	8572.36	19
3	Wokha	-1.989	0.995 (286.00)*	1.002 (113.98)*	0.999	70421.85	19
4	Mokokchung	-1.844	0.986 (108.42)*	0.974 (78.40)*	0.999	13133.21	19
5	Mon	-1.953	0.986 (156.93)*	1.000 (140.92)*	0.999	35166.43	19
6	Zunheboto	-1.886	0.979 (84.92)*	0.987 (213.65)*	0.999	29132.96	19
7	Phek	-1.944	0.995 (42.66)*	0.988 (77.82)*	0.997	3189.69	19
8	Dimapur	-1.956	0.989 (62.79)*	1.001 (45.14)*	0.999	7285.58	15
9	Kiphire	-1.942	0.994 (111.83)*	0.987 (31.67)*	0.999	15144.14	9
10	Longleng	-2.048	0.987 (281.69)*	1.024 (63.20)*	0.999	55270.52	9
11	Peren	-1.973	0.996 (48.02)*	0.995 (38.85)*	0.999	5397.99	9
12	Nagaland	-1.934	1.001 (55.82)*	0.977 (55.58)*	0.999	17407.47	19

Note: Figures in the parenthesis indicates 't' values
*, ** and *** indicates 1 percent, 5 percent and 10 percent significance level
Dependent variable: Production

The regression result of rice farming in Nagaland depicts in Table 2.3.h and the data indicates that, the coefficient of area and yield of WRC/WTC for all the districts of Nagaland shows a positive association and statistically significant at 1 percent, which indicates that for every 1 percent increase in farm size, production increases by 1.001 times in case of entire state. Similarly, yield also registered positive and statistical significance at 1 percent level for entire state as well as all the districts respectively. The R^2 value is 0.99 which clearly indicates that, the effect of area and yield on production is significant and it implies that about 99 percent variations in production is explained by the explanatory variables.

SECTION III

2.4 SOCIO-ECONOMIC PROFILE OF PADDY CULTIVATORS IN MOKOKCHUNG, PHEK AND DIMAPUR DISTRICTS

Rice cultivation is an agricultural activity in Nagaland in which most of the farm activities are carried out together by both male and female. However, some activities use only male labours while some activities use only female labours. Socio-economic profile of the farmers is very important to know the condition of rice cultivators as it helps us to know how many male and female are involved in a particular activity and which age group are the most or the least that is taking up rice farming and to know the information regarding the organization, management and production of the farmers. Information on the socio-economic profile of the respondents like age, family size, work force, educational qualification, type of occupation and size of land holding has been discussed below.

2.4.1 FAMILY SIZE AND WORKING FORCE

The size of family and working force is very important in determining the socio-economic condition of the respondent. Table 2.4.1 shows average family size and working population of rice growers in the three selected villages under Mokokchung district. The average family size is further divided into male and female and working population is divided into agriculture and non-agriculture workers.

Table 2.4.1: Average Family Size and Working force of selected Villages under Mokokchung District

Sl. No	Particulars	Mokokchung			
		Longkhum	Mongsenyimti	Longmisa	Total
1.	Family Size	4.86	4.46	4.3	4.54
	i.Male (49.69)	50.21	49.33	49.55	49.69
	ii.Female (50.31)	49.79	50.67	50.45	50.31
2	Working Population	79.42	65.47	65.17	70.02
	i.Agriculture (83.77)	70.47	90.42	90.41	83.77
	ii.Non-agriculture (16.23)	29.53	09.58	09.59	16.23

Source: Field survey 2016-17
Note: Figures in parenthesis are percentage to the total

The data is based on the selected 50 household from each village. Longkhum village has an average family size of 4.86, where male consist of 50.21% and female consist of 49.79%. The village has working population of 79.42, with an agricultural population of 70.47% and non-agriculture population of 29.53%. Mongsenyimti village on the other hand has a family size of 4.46, out of which 49.33% are male and 50.67% are female. The village has about 65.47% working population and out which the agricultural workers are 90.42 and non-agricultural workers are 09.58%. Similarly, in Longmisa village the family size is 4.3 in which 49.55% are male and 50.45% are female and out of 65.17 % working population 90.41% are agricultural workers and only 09.59% are non-agriculture workers during the study period of 2016-17. The data reveals that, Longkhum village has a bigger family size than their counterpart villages, while Mongsenyimti and Longmisa village has a higher female population than Longkhum, in which males are predominant than that of females. Similarly, among the working population distribution, Longkhum village has a higher working population with an average of 79.42% than Mongsenyimti and Longmisa villages of 65.47% and 65.17% respectively. Whereas, Mongsenyimti village has a higher agricultural population with an average of 90.42 and Longkhum village has the highest non-agriculture population with an average of 29.53 among the three selected villages in Mokokchung district.

Table 2.4.2: Average Family Size and Working force of the selected Villages under Phek District

Sl. No	Particulars	Phek			
		Pfutseromi	Chizami	Kikruma	Total
1.	Family Size	4.58	4.38	4.44	4.46
	i.Male (52.33)	50.66	55.00	51.35	52.33
	ii.Female (47.67)	49.34	45.00	48.65	47.67
2	Working Population	65.06	70.91	62.62	66.20
	i.Agriculture (82.86)	85.24	76.29	87.05	82.86
	ii.Non-agriculture (17.14)	14.76	23.71	12.95	17.14

Source: Field survey 2016-17
Note: Figures in parenthesis are percentage to the total

Distribution of family size and working force of selected three villages under Phek district is shown in Table 2.4.2. The table indicates that, Pfutseromi village has slightly bigger family size of 4.58 and out of this 50.66 is male and 49.34 are female. The village has a working population of 65.06%, out of that 85.24% are agricultural workers and 14.76% are non-agricultural workers. On the other hand, Chizami village has a family size of 4.38 in which 55% are male and 45% are female. Working population of this village stands at 70.91 out of which 76.29 are agriculture workers and 23.71% are non-agriculture workers. The village of Kikruma has a family size of 4.44 in which 52.33% are male and 47.67% are female.

The data reveals that, at an average Pfutseromi village has a bigger family size than the counterpart villages, while Chizami village has more male than their female counterparts. Similarly, Chizami village has a higher working population as well as higher non-agriculture population compared Pfutseromi and Kikruma villages and Pfutseromi village than the other two villages during the study year.

Table 2.4.3: Average Family Size and Working force of the selected Villages under Dimapur District

Sl. No	Particulars	Dimapur			
		Singrijan	Nihoto	Nihokhu	Total
1	Family Size	4.78	4.66	4.74	4.72
	i.Male (57.26)	57.3	52.79	61.60	57.26
	ii.Female (42.74)	42.67	47.21	38.40	42.74
2	Working Population	73.22	60.09	81.85	71.72
	i.Agriculture (82.95)	76.57	85.71	86.59	82.95
	ii.Non-agriculture (17.05)	23.43	14.29	13.41	17.05

Source: Field survey 2016-17

Note: Figures in parenthesis are percentage to the total

Similarly, the distribution of family size and working population of selected villages in Dimapur is shown in Table 2.4.3. The data indicates that, the family size in all selected villages is almost the same, while male female proportion is very wide during the study year. Out of the total working population of 73.22 in Singrijan village, 76.57% are agriculture workers and 23.43% are non-agriculture workers. Whereas, Nihoto village on the other hand has a family size of 4.66 in which 52.79% are male and 47.21% are female. The village has about 85.71% agricultural working population and only14.29% non-agriculture workers out of total 60.09 working population. Similarly, Nihokhu village has a family size of 4.72 of which 61.60% are male and 38.40% are female. The village has the highest working population of 81.85 and out of which, 86.59% is agriculture worker and only 13.41% are non-agricultural workers. The data reveals that, Singrijan village has slightly bigger family size, while Nihokhu has more male population than female counterparts as well as higher working population than their counterparts during the study period.

Table 2.4.4: Average Family Size and Working force of Rice growers among the selected Districts of Nagaland

Sl. No	Particulars	Three districts			
		Mokokchung	Phek	Dimapur	Total
1	Family Size	4.54	4.46	4.72	4.57
	i.Male (53.09)	49.69	52.33	57.26	53.09
	ii.Female (46.90)	50.31	47.67	42.74	46.90
2	Working Population	70.02	66.20	71.72	69.31
	i.Agriculture (83.19)	83.77	82.86	82.95	83.19
	ii.Non-agriculture (16.80)	16.23	17.14	17.05	16.80

Source: Field survey 2016-17
Note: Figures in parenthesis are percentage to the total

Similarly, the distribution of family size among the three selected districts is shown in Table 2.4.4. The table depicts that, Mokokchung district has an average family size of 4.54, Phek district is 4.46 and Dimapur is 4.72. Whereas, the gender wise distribution Mokokchung district consist of 49.69% male and 50.31% female, while Phek district has 52.33% male and 47.67% female and Dimapur district has 57.26% male and 42.74% female population respectively.

Mokokchung district has an average working population of 70.02% and out of which, 83.77% are in agriculture and 16.23% under non-agriculture sector. While, Phek district has about 66.20% of working population, of which 82.86% constitutes agriculture workers and 17.14% non-agriculture workers. On the other hand, Dimapur district has an average working population of 69.31% and out of which 83.19% are agriculture workers and only 16.80% is employed in non-agriculture sector. The data reveals that, the average family size in all the three districts is 4.57, constituting 53.09% male and 46.90% female. While the average working population is 69.31, of which 83.19% are agriculture workers and 16.80% are non-agriculture respectively. The family size of Dimapur district is higher than their counterpart districts.

2.4.2 AGE-WISE DISTRIBUTION

There are two sides of determining the capability of work done or that can be done based of the age of a farmer. A younger the farmer is, he is considered physically more capable to carry out manual works and hard and heavy works. However, older the farmer is, he is considered more experienced and capable in carrying out the activities that will enhance production. Farmers productivity generally increases and then decreases with age, while efficiencies of younger and older farmers are lower than middle-age farmers, Loren Tauer (1995)[8].

Table 2.5.1: Average Age distribution of Farmers of the three Villages under Mokokchung District

(in years)

Sl. No.	Age of Farmers	Longkhum	Mongsenyimti	Longmisa	Total
1	21-40	3 (6.00%)	8 (16.00%)	9 (18.00%)	20 (13.33%)
2	41-60	29 (58.00%)	26 (52.00%)	30 (60.00%)	85 (56.66%)
3	61-above	18 (36.00%)	16 (32.00%)	11 (22.00%)	45 (30.00%)
4	ALL	50 (100)	50 (100)	50 (100)	150(100)

Source: Field survey 2016-17
Note: Figure in the parenthesis is percentages to the total

Table 2.5.1, shows that the age of farmers of the three selected villages, i.e. Longkhum, Mongsenyimti and Longmisa under Mokokchung district. As per the data, Longkhum village has around 3 (6%) farmers in the age group of 21-40 years, while 29 (58%) farmers belong to the age group of 41-60, which constitutes the largest group and 18 (36%) farmers belonging to age group of 61 and above. Similarly, in Mongsenyimti, out of the 50 selected respondents, 26 (52%) farmers belong to the age group of 41-60 years and followed by 16 (32%) farmers in the age group of 60 years and above. On the other hand, in Longmisa village 30 (60.00%) farmers are in the age group of 41-60 years, 11 (22%) farmers belong to above 61 and years and 9 (18%) farmers in the age group of 21-40 years.

Similarly, in Phek district, Table 2.5.2 shows that, Kikruma village has a farming population of 29 (58%) who are in the age group of 41-60, followed by 17 (34%) farmers in 21-40 age group and only 4 (8%) farmers in the age group of 61 and above. Similarly, the largest group of farmers in Chizami village in the group of 41-60, constitute about 29 (58%), followed by 12 (24%) farmers in the age group of above 61 years and about 9 (18%) farmers are in the age of 21-40 years. Similarly, in Pfutseromi village about 31 (62%) farmers are in the age group of 41-60 years, followed by 16

[8]Loren Tauer (1995), "Age and Farmer Productivity". Review of Agricultural Economics, Vol. 17(1), Pp. 63-69. Oxford University Press on behalf of Agricultural & Applied Economics Association

(32%) farmers in the age group of 21-41 years and only 3 (6%) farmers in the age group of above 61 years. The data reveals that, in Phek district, the age group of 41-60 is predominant, followed by the age group of 21-40 years. The age group of above 60 years is very low and about 12.67% of the total respondents in Phek district are into wet terrace rice farming which is predominantly existing in the district.

Table 2.5.2: Average Age distribution of Farmers of three Villages under Phek District

(in years)

Sl. No.	Age of Farmers	Kikruma	Chizami	Pfutseromi	Total
1	21-40	17 (34%)	09 (18%)	16 (32%)	42 (28%)
2	41-60	29 (58%)	29 (58%)	31 (62%)	89 (59.33%)
3	61-above	04 (8%)	12 (24%)	03 (6%)	19 (12.69%)
5	ALL	50 (100%)	50 (100%)	50 (100%)	150(100%)

Source: Field survey 2016-17
Note: Figure in the parenthesis is percentages to the total

Age distribution of respondents in selected villages under Dimapur district is shown in Table 2.5.3. Out of the 50 selected farmers from Nihoto village, there are 25 (50%) farmers who are in the age group of 41-60, followed by 15 (30%) farmers who are in the age group of 21-40, while 10 (20%) farmers are in the age group of above 61 years

Table 2.5.3: Average Age distribution of Farmers of three Villages under Dimapur District

(in years)

Sl. No.	Age of Farmers	Nihoto	Nihokhu	Singrijan	Total
1	21-40	15 (30%)	13 (26%)	10 (20%)	38 (25.33%)
2	41-60	25 (50%)	32 (64%)	28 (56%)	85 (56.66%)
3	61-above	10 (20%)	05 (10%)	12 (24%)	27 (18.00%)
4	ALL	50 (100)	50 (100%)	50 (100%)	150(100%)

Source: Field survey 2016-17
Note: Figure in the parenthesis is percentages to the total

of age. Similarly, Nihoku village has 32 (64%) farmers who are in the age group of 41-60, followed by 13 (26%) farmers and 5 (10%) farmers respectively in the age group of 61 and above. The data indicates that, Singrijan village has a total of 28 (56%) farmers in the age group of 41-60 years, followed by 12 (24%) farmers in the age group of 61 years and above and only 10 (20%) farmers in the age group of 21-40.

The average age distribution of farmers of the selected districts of Mokokchung, Phek and Dimapur reveals that, out of 150 selected respondents under Mokokchung district, 85 (56.67%) farmers are in the age group of 41-60 years, who are the majority group, followed by above 61 years who comprises around 45 (30%), while 20 (13.33%) farmers belong to the age group of 21-40 during the study period.

Table 2.5.4: Average Age distribution of Farmers of selected Districts in Nagaland

(in years)

Sl No.	Age of Farmers	Mokokchung	Phek	Dimapur	Total
1	21-40	20 (13.33%)	42 (28.00%)	38 (25.34%)	100 (22.23%)
2	41-60	85 (56.67%)	89 (59.34%)	84 (56.00%)	258 (57.34%)
3	61-above	45 (30.00%)	19 (12.67%)	28 (18.67%)	92 (20.44%)
4	ALL	150 (100%)	150 (100%)	150 (100%)	450(100%)

Source: Field survey 2016-17

Note: Figure in the parenthesis is percentages to the total

Similarly, in Phek district, out of 150 respondents about 89 (59.34%) farmers are in the age group of 41-60 years, followed by 42 (28%) farmers in the age group of 21-40 years and 19 (12.67%) farmers in the age group of 61 and above. On the other hand, in Dimapur district, about 84 (56%) farmers are in the age group of 41-60 years, followed by 38 (25.34%) farmers in the age group of 21-40 years, while there are 28 (18.66%) farmers who are in age group of above 61 years. The data reveals that, in all the selected districts, the age group of 41-60 years is more predominant at 258 (57.34%), followed by 21-40 years age, with a total of 100 (22.23%) farmers and above 61 years at an account of 92 (20.44%) farmers during the study year of 2016-17.

2.4.3 EDUCATIONAL STATUS

Education plays a very important role in understanding the problems faced by the farmers and the ability to adopt, learn and understand the modern means of technology and bring improvement and changes to increase the efficiency of farming. Education becomes a relevant tool for agricultural development process. Increased agricultural productivity depends primarily on the education of the farmers to understand and accept the complex scientific changes which are difficult for the illiterate to understand. Hence, we cannot increase the productivity of the rural farmer except through the provision of adult education. Women empowerment through education will also enable to be self-reliant. Hence, women education is viewed as a process of enabling women to develop the capacity to actualize their potentials and also contribute to productivity and production. M Niaz Asadullah and Sanzidur Rahman (2005)[9], educated individual in the household has the greatest influencing in raising productivity, boosting potential output and reducing technical inefficiency and also shows that farm production is centralized so that even if the household-head is uneducated, productivity and potential output are augmented so long as an educated adult co-resides in the same household.

Table 2.6.1: Distribution of Education levels among the Farm Size Groups in Mokokchung District, Nagaland

Type	Primary	Secondary	Inter	Degree	Illiterate	Total
MF	10	11	1	0	0	22 (14.66)
SF	27	14	1	0	1	43 (28.67)
MDF	40	31	0	1	1	73 (48.67)
LF	6	5	1	0	0	12 (8.00)
Total	83 (55.33)	61 (40.67)	3 (2.00)	1 (0.67)	2 (1.33)	150 (100)

Source: Field Work-2016-17, figures in parentheses is percentages.
Note: MF- Marginal farmer, SF- Small Farmer, MDF- Medium Farmer and LF- Large Farmer

As per the data shown in Table 2.6.1, out of 150 selected rice growers from the three selected villages under Mokokchung district, about 83 (55.33%) farmers have attained primary education, while 61 (40.67%) farmers have studied up to secondary level and 3 (2.00%) farmers have studied upto intermediate. While only 1 (0.67%) farmer is

[9] M Niaz Asadullah and Sanzidur Rahman (2005), "Farm productivity and efficiency in rural Bangladesh: The role of education revisited". SKOPE, Department of Economics,University of Oxford, Oxford, OX1 3UQ, UK.School of Geography, Faculty of Social Science and Business,University of Plymouth, Plymouth, PL4 8AA, UK.

graduate and there are only 2 (1.33%) illiterate. The data shows that, out of the total educated farmers, 22 (14.66%) farmers belong to marginal farmers, 43 (28.67%) belong to small farmers, while 73 (48.67%) are medium farmers and 12 (8.00%) are large in Mokokchung district.

Table 2.6.2: Distribution of Education Levels among the Farm Size Groups in Phek District, Nagaland

Type	Primary	Secondary	Inter	Degree	Illiterate	Total
MF	23	9	0	2	0	34 (22.67)
SF	25	15	3	1	2	46 (30.67)
MDF	35	18	2	7	0	62 (41.33)
LF	1	4	3	0	0	8 (5.33)
Total	84 (56.00)	46 (30.66)	8 (5.34)	10 (6.67)	2 (1.33)	150 (100)

Source: Field Work-2016-17, figures in parentheses is percentages.
Note: MF-Marginal farmer, SF-Small Farmer, MDF-Medium Farmer and LF- Large Farmer.

Similarly, in Phek district the data shown in Table 2.6.2 indicates that, 84 (56%) farmers are have attained primary level education, followed by 46 (30.66%) secondary and 8 (5.34%) intermediate and 10 (6.67%) farmers attained degree level respectively and only 2 (1.33%) illiterate farmers. Among the farm size groups according to their education, 34 (22.67%) farmers belong to marginal farmers, 46 (30.67%) are small farmers. While medium farmers constitute 62 (41.33%) and remaining 8 (5.33%) farmers belongs to large farm size groups in Phek district.

Table 2.6.3: Distribution of Education Levels among the Farm Size Groups in Dimapur District, Nagaland

Type	Primary	Secondary	Inter	Degree	Illiterate	Total
MF	18	7	0	0	1	26 (17.33)
SF	36	15	5	4	5	65 (43.34)
MDF	32	4	1	0	9	46 (30.67)
LF	7	2	1	1	2	13 (8.66)
Total	93 (62.00)	28 (18.66)	7 (4.66)	5 (3.33)	17 (11.33)	150 (100)

Source: Field Work-2016-17, figures in parentheses is percentages.
Note: MF-Marginal farmer, SF-Small Farmer, MDF- Medium Farmer and LF- Large Farmer.

On the other hand, in Dimapur district, 93 (62%) farmers attained primary level of education, while 28 (18.66%) farmers and 7 (4.66%) farmers have attained secondary and intermediate education and around 5 (3.33%) farmers have degree and about 17 (11.33%) farmers are illiterates and most of the illiterate farmers are migrants from other states and

Nepal and cultivating as tenants. Among the farm size group, marginal farmers constitute around 26 (17.33%), small farmers constitute 65 (43.34%), 46 (30.67%) farmers belong to medium farm size and 13 (8.66%) are from large farm size group. The data reveals that, in all the districts the respondents have attained primary and secondary education and intermediate and degree level. Illiterate farmers are very less in Mokokchung and Phek districts, while there is a significant level in Dimapur district those are tenants migrated to Dimapur from other states as well as from Nepal.

2.4.4 LAND USE

Land as a factor of production is of immense importance for agriculture. Land is very much limited especially in India where the ever-growing population is taking away all the cultivated land for human settlement and on top of that the geographical factors also come into effect when cultivation is concerned. Ownership of land is another factor that decides the size of land holding. To increase the amount of land is practically impossible in one hand, while, on the other hand, it is the basis of agrarian living, production, and recreation, in other words, the basis of existence for a rural society, the amount of land controlled and the type of distribution determines the social conditions.

2.7.1: Distribution of Land Holdings among the selected Respondents Villages in Mokokchung District

(in Acres)

Sl. No.	Area of the selected 50 household	Longkhum	Mongsenyimti	Longmisa	Total
1	Total land area	388.5 (100)	267 (100)	269.5 (100)	925 (100)
2	Operational Land area	281.5 (72.46)	186.5 (69.85)	204 (75.70)	672 (72.65)
	i. Leased in land	0	0	0	0
	ii. Leased out land	0	0	0	0
	iii. Area under Rice	142 (36.55)	101 (37.83)	119.5 (44.35)	362.5 (39.18)
	iv. Area under vegetation	84 (21.62)	26.5 (9.93)	20.5 (7.60)	131 (14.17)
	v. Area under plantation	55.5 (14.29)	59 (22.09)	64 (23.75)	178.5 (19.30)
3	Unused land area	107 (27.54)	80.5 (30.15)	65.5 (24.30)	253 (27.35)

Source: Field survey 2016-17
Note: Figure in the parenthesis is percentages to the total

Table 2.7.1 shows the average size land holdings among the three selected villages under Mokokchung district. Longkhum village has a total land area of 388.5 acres and out of this 281.5 acres are under operational lands. Out of total operated land, about 142

(36.55%) acre under rice cultivation and around 84 (21.62%) acres under vegetation, while 55.5 (14.29%) acres comes under area under plantation. The village has an area of 107 (27.54%) acres of unused land. Similarly, in Mongsenyimti village, 186.5 (69.85%) acres of land is operational land, in which about 101 (37.83%) acres is under rice cultivation, while 26.5 (9.93%) acres and 59 (22.09%) acres of land are under vegetation and area under plantation respectively. Longmisa village on the other hand, has a total land area of 269.5 acres, in which 204 (75.70%) acres under operational land area. The village has around 119.5 (44.35%) acres of land under rice cultivation, followed by 64 (23.75) acres and 20.5 (7.60%) acres under plantation and vegetation respectively. The data reveals that, there is no leased in or leased out land in all three villages under Mokokchung district because the lands belong to community or individuals, in which all the cultivation practices are under jhum farming.

Table 2.7.2: Distribution of Land Holdings among the selected Respondents Villages in Phek district

(in Acres)

Sl. No.	Area of the selected 50 household	Kikruma	Chizami	Pfutseromi	Total
1	Total land area	277 (100)	245.5(100)	290 (100)	812.5 (100)
2	Operational Land area	167 (60.29)	152 (61.92)	191 (65.87)	510 (62.77)
	i. Leased in land	0	0	0	0
	ii. Leased out land	0	0	0	0
	iii. Area under Rice	86.5 (31.23)	96.5 (39.31)	112 (38.63)	295 (36.31)
	iv. Area under vegetation	4.5 (1.62)	3 (1.23)	8 (2.76)	15.5 (1.91)
	v. Area under plantation	76 (27.44)	52.5 (21.38)	71 (24.48)	199.5 (24.55)
3	Unused land area	110 (39.71)	93.5 (38.08)	99 (34.13)	302.5 (37.23)

Source: Field survey 2016-17
Note: Figure in the parenthesis is percentages to the total

As per the Table 2.7.2, Kikruma village has a total land area of 277 acres, in which operational holdings are 167 (60.29) acres and unused land is 110 (39.71) acres. The village has an area of 86.5 (31.23) acres under rice cultivation, while 4.5 (1.62) acres under vegetation and 76 (27.44) acres under plantation area. Whereas, in Chizami village the total land of respondents is 245.5 acres and unused is 93.5 acres. The total operational land holdings of respondents is 152 (61.92) acres in which 96.5 (39.31) acres are under rice and 52.5 (21.38) acres comes under plantation area and 3 (1.23%) acres are under vegetation. For Pfutseromi village, the respondents have a total of 290 acres of land and about 99 (34.13) acres of land come under unused land. The village has about 191 (65.87) acres of operational land, of which 112 (38.63) acres under rice cultivation. The respondents have about 8 (2.76) acres under vegetation and around 71 (24.48) acres under plantation. There is no leased in or leased out land in Phek district during the study year.

Table 2.7.3: Distribution of Land Holdings among the selected Respondents Villages in Dimapur District

(in Acres)

Sl. No.	Area of the selected 50 household	Nihoto	Nihokhu	Singrijan	Total
1	Total land area	289 (100)	341.5(100)	220.5 (100)	851(100)
2	Operational Land area	250 (86.51)	335 (98.09)	206 (93.43)	791 (92.95)
	i. Leased in land	0	300 (87.84)	0	300 (35.25)
	ii. Leased out land	0	0	0	0
	iii. Area under Rice	201.5 (69.73)	280 (81.99)	159.5 (72.34)	641 (75.33)
	iv. Area under vegetation	10.5 (3.64)	49.5 (14.49)	43 (19.51)	103 (12.11)
	v. Area under plantation	38 (13.14)	5.5 (1.61)	3.5 (1.58)	47 (5.52)
3	Unused land area	39 (13.49)	6.5 (1.91)	14.5 (6.57)	60 (7.05)

Source: Field survey 2016-17

Note: Figure in the parenthesis is percentages to the total

The above Table 2.7.3 indicates that, out of 289 acres of total land for Nihoto village, 250 (86.51) acres are operational land and 39 (13.49) acres as area unused. The village has an area of 201.5 (69.73) acres under rice cultivation and about 10.5 (3.64) acres and 38 (13.14) acres of land under vegetation and plantation respectively. Similarly, in Nihokhu village, the total land is 341.5 acres and out of which 6.5 (1.19) acres is unused. About 280 (81.99) acres of land are under rice cultivation, while 49.5 (14.49) acres under vegetation and 5.5 (1.61) acres under plantation. Singrijan village on the other hand, owns 220.5 acres of total land, of which 206 (93.43) acres are under operational. Rice is being cultivated in an area of 159.5 (72.34) acres, followed by 43 (19.51) acres under vegetation and only 3.5 (1.58) acres under plantation. Data reveals that, Singrijan and Nihoto villages has no land leased market, while Nihokhu village an area of 300 acres under land leased markets giving land to tenants for cultivation, while the land owners involves in other activities for improvement of their livelihoods.

Table 2.8.1: Distributions of Land Holdings across Farm Size Groups (MOKOKCHUNG)

(in Acres)

	LONGKHUM					LONGMISA					MONGSENYIMTI				
Farm Size	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating
MF	4 (8.00)	9 (2.35)	2.25	9 (3.20)	2.25	8 (16.00)	14.5 (5.38)	1.82	14.5 (7.10)	1.81	10 (20.00)	18.5 (6.93)	1.85	18.5 (9.82)	1.85
SF	7 (14.00)	32.5 (8.47)	4.65	29.5 (10.49)	4.21	19 (38.00)	80.5 (29.88)	4.24	72.5 (35.54)	3.81	17 (34.00)	70 (26.22)	4.12	58.5 (31.03)	3.44
MDF	31 (62.00)	236 (61.54)	7.62	186 (66.07)	6	21 (42.00)	148.5 (55.10)	7.08	102 (50)	4.85	21 (42.00)	151.5 (56.74)	7.23	91.5 (48.54)	4.35
LF	8 (16.00)	106 (27.64)	13.25	57 (20.24)	7.12	2 (4.00)	26 (9.64)	13	15 (7.36)	7.5	2 (4.00)	27 (10.11)	13.5	20 (10.61)	10
Total	50 (100)	383.5 (100)	6.94	281.5 (100)	4.89	50 (100)	269.5 (100)	6.53	204 (100)	4.49	50 (100)	267 (100)	6.67	188.5 (100)	4.91

Source: Field Survey 2016-17, Figures In parentheses are percentages.
Note: MF- Marginal Farmers, SF- Small Farmers, MDF- Medium Farmers, LF- Large Farmers.

Land holding across different farm size in the three selected villages under Mokokchung District

The distribution of land holdings among the farms size groups in selected villages of Mokokchung is shown in Table 2.8.1. The table indicates that, out of 383.5 acres of total land, there are 4 household who belong to marginal farm size category and owns a land area of 9 (2.35) acres, with an average operational area of 2.25 acres per family. While small farmers with a number of 7 household have an average land holding of 4.65 acres and its average operational area is about 4.21 acres, while there are 31 medium farmers and they are the largest among all the four groups. Medium farmers occupy an average land holding of 7.62 acres and its average operational area is 6 acres per family. Whereas, 8 household from large farm category and they own an average land holding of 13.25 and out of this only 7.12 acres comes under operational land area.

Similarly, in Longmisa village, 8 household from marginal farm size group owns an average land of 1.82 acres and operating about 1.81 acres. There are a total of 19 household from small farm size group and their average land holding is around 3.82 acres and their operational land area is 3.81 acres. While medium farmers with a total of 21 household owns an average of 7.08 acres and the average operation land is around 4.85 acres. There are only 2 large farmers owning an average of 13 acres and operating an average of 7.5 acres per family. The village has an overall land area of 269.5 acres with an average of 6.53 acres and operating about 4.49 acres during the study period.

In the same way, in Mongsenyimti village, the selected respondents have a total of 267 acres, owning an average of 6.67 acres and its operating land area is 4.91 acres. The 10 household who are from marginal farm group have an average of 1.85 acres and with same size of operational land cultivating entire land. About 21 medium farmers have an average land holding of 7.23 acres and their average operational area is 4.35 acres. Only 3 household who belong to the large farm category owns an area of 13.5 acres and their operational area is about 10 acres in Mokokchung district during the study year.

Table 2.8.2 Distributions of Land Holdings across Farm Size Groups (PHEK)

(in Acres)

	KIKRUMA					CHIZAMI					PFUTSEROMI				
Farm Size	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating
MF	15 (30.00)	27 (9.71)	1.8	25.5 (15.26)	1.7	15 (30.00)	25.5 (10.39)	1.7	20.5 (13.80)	1.36	4 (8.00)	9 (3.10)	2.25	9 (4.72)	2.25
SF	10 (20.00)	45.5 (16.37)	4.55	30.5 (18.27)	3.5	15 (30.00)	58 (23.62)	3.86	43.5 (29.30)	2.9	21 (42.00)	85 (29.31)	4.05	71.5 (37.43)	3.4
MDF	21 (42.00)	156.5 (56.30)	7.45	87.5 (52.39)	4.16	18 (36.00)	136 (55.40)	7.55	72.5 (48.82)	4.02	23 (46.00)	172 (59.31)	7.47	95.5 (50)	4.15
LF	4 (8.00)	49 (17.62)	12.25	23.5 (14.08)	5.87	2 (4.00)	26 (10.59)	13	12 (8.08)	6	2 (4.00)	24 (8.28)	12	15 (7.85)	7.5
Total	50 (100)	278 (100)	6.51	167 (100)	3.80	50 (100)	245.5 (100)	6.52	148.5 (100)	3.57	50 (100)	290 (100)	6.44	191 (100)	4.32

Source: Field Survey 2016-17, Figures In parentheses are percentages.
Note: MF- Marginal Farmers, SF- Small Farmers, MDF- Medium Farmers, LF- Large Farmers.

Land holding across different farm size in the three selected villages under Phek district

Similarly, the distribution of land holding among the farm size groups in Phek district is shown in Table 2.8.2. The data indicates that, in Kikruma village out of total land holding of 278 acres, average owned land is 6.51 acres and operational area is 3.80 acres. There are 15 household from marginal farm size who have an average land holding of 1.8 acres and their operational area is 1.7 acres. Similarly, for small farmers who constitutes around 10 household has an average land holding of 4.55 acres and their average operational area is 3.5 acres. While medium farm size group consist of 21 households, owning an average land holding of around 7.45 acres and their operational land area is only 4.16 acres. Only 4 household belong to large farm group among the selected respondents in Kikruma village and they have an average land of 12.25 acres and their operational land is 5.87 which is higher than the average operational holding of the village.

Chizami village on the other hand has 15 household from marginal farm size, who have an average land holding of 1.7 acres and their operational area is 1.36 acres. Small farmer accounts to 15 household and they have an average land area of 3.86 acres with an operational land area of 2.9 acres. While there are 18 household belonging to medium farm size, who have an average land area of 7.55 acres and their average operational land holding is 4.09 acres. There are only 2 household from large farm size category and they have an average land holdings of about 13 acres and only 6 acres are operational land. The village as a whole for the selected respondents, out of the total area of 245.5 acres, the average land holding is 6.52 acres and average operated land is 3.57 acres during the study period.

In the same way, Pfutesromi village has a total land of 290 acres with an average of 6.44 acres owned lands and 4.32 acres of average operational land holding for 50 selected respondents. Four (4) household from marginal farm size category have an average land holding of 2.25 acres and their operational area is also same amount. While there are 21 household from small farm size and they have an average area of 4.05 acres and 3.4 acres are under operational land. Medium farmers have the maximum number of households (23) holding, with an average area of 7.47 acres and 4.15 acres operational holding. While there are only 2 household from large farm size, with an average land holding of 12 acres and 7.5 acres of operational lands in

Pfutseromi village during the study year. The data reveals that, medium farmers in all the selected villages are more predominant, followed by small farmers and marginal farmers. There are very less number of large farm size groups in the selected villages by existence of nuclear family system ruining after children getting married.

Land holding across different farm size in the three selected villages under Dimapur district

The overall land area of selected respondents in Singrijan village is 220.5 acres, with an average of 6.29 acres and 6.22 acres as operational lands. Marginal farmers comprise of 10 household and their average land ownership is 2.35 acres and the same size of operational holdings. Small farm size group of 28 households occupies the largest number and they have a land holding on an average of 3.87 acres with an operational area of 3.60 acres. Medium farmers have altogether 11 household with an average size of 6.95 acres and operating all the landholdings. While there is only 1 household from large farm size group and owns an average land of 12 acres with the same amount of operational lands.

Similarly, in Nihoto village the total land holding for selected farmers is around 289 acres, with an average of 7.62 acres, owning an average operational land of 6.41 acres. There are 13 household from marginal farmers category and they have an average land holding of 2 acres and an average operational area of 1.96 acres. There are about 19 small farmers, who are the largest numbers in this village and they have an average land holding of 3.77 acres, with an average operational area of 3.57 acres. While there are 12 household from medium farm category, of which they have an average land holding of 7.21 acres and 6.29 acres are under operational land. There is only 1 large farmer in the selected category and owning about 17.5 acres with 13.83 acres of operated land.

On the other hand, Nihokhu village has 3 household from marginal farm size category owning as well as operational land of 2 acres. About 18 household are from small farm category, with an average land holding of 4.06 acres and an average operational area of 4.02 acres. While 23 household are from medium farm category and they have an average hold of 7.89 acres with an average operational area of 7.84 acres. Only 6 household are from large farm size category and they have an average of 13.33 both owning and operational land. The total land for all selected groups is 340.5 acres and its average ownership and operational land are 6.82 acres and 6.70 acres respectively.

Table 2.8.3: Distributions of Land Holdings across Farm Size Groups (DIMAPUR)

(in Acres)

	SINGRIJAN					NIHOTO					NIHOKHU				
Farm Size	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating
MF	10 (20.00)	23.5 (10.67)	2.35	23.5 (9.87)	2.35	13 (26.00)	26 (8.99)	2	25.5 (10.11)	1.96	3 (6.00)	6 (1.77)	2	6 (1.77)	2
SF	28 (56.00)	108.5 (49.20)	3.87	101 (52.96)	3.60	19 (38.00)	71.5 (24.75)	3.77	68 (26.99)	3.57	18 (36.00)	73 (21.44)	4.06	72.5 (21.39)	4.02
MDF	11 (22.00)	76.5 (34.69)	6.95	76.5 (32.13)	6.95	12 (24.00)	86.5 (29.93)	7.21	75.5 (29.96)	6.29	23 (46.00)	181.5 (53.30)	7.89	180.5 (53.25)	7.84
LF	1 (2.00)	12 (5.44)	12	12 (5.04)	12	6 (12.00)	105 (36.33)	17.5	83 (32.94)	13.83	6 (12.00)	80 (23.49)	13.33	80 (23.59)	13.33
Total	50 (100)	220.5 (100)	6.29	213 (100)	6.22	50 (100)	289 (100)	7.62	252 (100)	6.41	50 (100)	340.5 (100)	6.82	339 (100)	6.79

Source: Field Survey 2016-17, Figures In parentheses are percentages.
Note: MF- Marginal Farmers, SF- Small Farmers, MDF- Medium Farmers, LF- Large Farmers.

Table 2.8.4: District wise Land Holdings distribution among the Rice Farmers in Nagaland

(in Acres)

	Mokokchung					Phek					Dimapur				
Farm Size	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating	No. of HH	Land Owned	Average Holding	Operated Land	Average Operating
MF	22 (14.66)	42 (4.56)	1.90	42 (6.23)	1.90	34 (22.66)	61.5 (7.56)	1.80	55 (10.85)	1.61	26 (17.33)	55.5 (6.53)	2.13	55 (6.83)	2.11
SF	33 (22.00)	183 (19.89)	5.54	160.5 (23.82)	4.86	46 (30.66)	188.5 (23.17)	4.09	145.5 (28.72)	3.16	65 (43.33)	253 (29.76)	3.89	241.5 (30.02)	3.71
MDF	73 (48.66)	536 (58.27)	7.34	379.5 (56.31)	5.19	62 (41.33)	464.5 (57.09)	7.49	255.5 (50.45)	4.12	46 (30.66)	344.5 (40.52)	7.48	332.5 (41.33)	7.22
LF	12 (8.00)	159 (17.28)	13.25	92 (13.64)	7.66	8 (5.33)	99 (12.16)	12.37	50.5 (9.97)	6.31	13 (8.66)	197 (23.17)	15.15	175 (21.76)	13.46
Total	150 (100)	920 (100)	7.01	674 (100)	4.90	150 (100)	813.5 (100)	6.43	506.5 (100)	3.8	150 (100)	850 (100)	7.16	804.5 (100)	6.62

Source: Field Survey 2016-17, Figures In parentheses are percentages.
Note: MF- Marginal Farmers, SF- Small Farmers, MDF- Medium Farmers, LF- Large Farmers.

District wise Land Use/Holding among the selected Rice Farmers

In Mokokchung district, out of the total 150 household surveyed 22 household comes under marginal farmers who owns 42 acres (i.e. 4.56%) of the total land area and the average land holding is 1.90 acre, with an average operational area of 1.90 acre. There are 33 small farmers who own 183 acres (19.89%) of the total land area, with an average holding and operational area of 5.54 acre and 4.86 acres respectively. Medium farmers constitute of 73 household, who owns 536 acres (58.27%) of the total land, with an average holding and operational area of 7.34 acre and 5.19 acres. Large farmers own an area of around 159 acres (17.28%) of the total land, with an average of 13.25 acres and 7.66 acres of own lands and operating lands. Thus, the study reveals that, in Mokokchung district, 48.66 % of the household belongs to medium farmers, 22% of the household belongs to small farmer, 14.66% of the household belongs to marginal framers and only 12% of the household belongs to large farmers during the study period.

Out of the total 150 selected household in Phek, there are 34 marginal farmers owning 61.5 acres (10.85%) of the total land, with an average holding and average operational area of 1.80 acres and 1.61 acres respectively. Small farmers constitute around 46 household, with land area of 188.5 acres (23.17%), owning and operating land about 4.09 acres and 3.16 acres, while there are 62 medium farmers who hold the majority in number, as well as holding land of about 464.5 acres (57.09%) of the total land area, with average land holding and average operational holding of 7.49 acres and 4.12 acres respectively. There are only 8 large farmers, owning 99 acres (12.16%) of the total land area. They have an average land holding and average operational area of 12.37 acres and 6.31 acres. The study reveals that, medium farmers constitute the largest number, comprising around 41.33%, followed by small farmers 30.66%, marginal farmers 22.66% and large farmers constituting 5.33% only.

While Dimapur district has 26 marginal farmers, who owns 55.5acres (6.53%) of the total land area, with an average land holding and average operational area of 2.13 acres and 2.11 acres respectively. Small farmers constitute of 65 household, who owns 253 acres (29.76%), with an average land holding and average operation area of 3.89 acres and 3.71 acres. There are 46 household who belong to medium farmers, holding an area of 344.5 acres (40.52%) of the total land area, and an average land holding and average operational area of 7.48 acres and 7.22 acres. 13 household belong to large farmers owning 197 acres (23.17%) of the total area, they have an average land holding and average operational area of 15.55 acres and 13.46 during the study period.

RECAPULATION

This chapter discusses on extend of rice farming in India, Northeast and Nagaland. It presents the extent of rice cultivation in terms of area, production and productivity at macro and micro perspectives. It also discusses on socio-economic profile of the study areas, average family size, age, educational qualification, marital status, experience and their occupational activities. Many schemes and policies were introduced by the Government to increase production and productivity of rice and to attain self-sufficiency. For this training, machineries, improved seeds, and subsidies etc, were provided to farmers. Though the increase in area of rice is very negligible but production and productivity have increased considerably compared to change in area under rice. Productivity of rice in India has witnessed an increase from 1900 Kg/Hectares to 5686.91 Kg/Hectares (1997-98 to 2015-16), while the North-Eastern Region has witnessed an increase in yield from 12443 Kg/Ha in 1997-98 to 15720.8 Kg/Ha in 2010-11 but again the productivity decreases to 15235 Kg/Ha in 2015-16. On the other hand, Nagaland witnessed an increase in yield from 1234.06 Kg/Ha in 1998-99 to 1996.83 Kg/Ha in 2016-17 under jhum cultivation and WRC/WTC witnessed an increase by 1548.33Kg/Ha in 1998-99 to 2799.08Kg/Ha in 2016-17.

CHAPTER 3

PRODUCTION FUNCTION, RESOURCE ALLOCATION AND EFFICIENCY ESTIMATION

INTRODUCTION

The processes and methods used to transform tangible and intangible inputs into goods or services are called production. Agricultural productivity is measured as the ratio of agricultural outputs to agricultural inputs[10]. Rice is cultivated in more than a hundred countries, with approximately 158 million hectares coming under total area harvested and producing more than 700 million tons annually (i.e. 470 million tons of milled rice). Nearly 640 million tons of rice is grown in Asia, which representing 90% of global production. Sub-Saharan Africa produces about 19 million tons and Latin America produces about 25 million tons. In Asia and sub-Saharan Africa, almost all rice is grown on small farms of 0.5–3 ha[11]. Crop yields range from less than 1 tones/hectare under very poor rainfed conditions to more than 10 tonnes per hectare in intensive temperate irrigated systems. Rice grows in a wide range of environment and has the advantage of being productive in many cases where other crops would fail. The highest rice yields have been traditionally obtained from plantings in high-latitude areas, where it has long day length and where intensive farming techniques are practiced, and also in low latitude desert areas that have a very high solar energy. Southwestern Australia, Hokkaido in Japan, Spain, Italy, Northern California, and the Nile Delta provide the best examples.

The 'Green Revolution' is the name given to the dramatic increase in cereal crop yields through modern agricultural inputs, improved seeds, and pesticides irrigation, fertilizers in the 1960s. For rice, the revolution began with the release by IRRI of the high- yielding semi dwarf variety IR8 in 1966. The world average rice yield in 1960 which was, the product of thousands of years of experience, was about 2 per hectare. Astonishingly, as the Green Revolution spread, in only 40 more years, it doubled, reaching 4 ton per hectare in the year 2000. The rice varieties and technologies developed during the Green Revolution have increased yields in some

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[10]Measuring Agricultural Productivity Using the Average Productivity Index (API) by Lal Mervin Dharmasiri. Retrieved on 16/9/18, from https://en.wikipedia.org/wiki/Agricultural_productivity

[11] Consultative Group on International Agricultural Research (CGIAR). Retrieved on 15/9/18, fromhttp://ricepedia.org/rice-as-a-crop/rice-productivity

areas to 6–10 per hectare. Due to the widespread hunger and malnutrition, especially in Asia, it made clear that, production of wheat and rice needed to be boosted in order to avoid famine. Global rice production has reached more than tripled between 1961 and 2010, with an annual compound growth rate of 2.24% per year (i.e. 2.21% in rice-producing Asia). Most of the increase in production was mainly due to higher yields, which increased at an average rate of 1.74% annually, compared with an annual average growth rate of 0.49% for area harvested. In absolute terms, rice yields increased at an annual average rate of 51.1 kg/ha per year, although this rate of increase has declined in both percentage and absolute terms.

The chapter is divided into two (2) sections: Section I focuses on presentations of the results of Production Function; Section II emphasizes on Resource Allocations and Efficiency Estimations and factor determinants of rice farming under different farming systems in the selected study villages during the study period.

3.1 LAND USE PATTERN

Agricultural land is used primarily for the production of farm commodities. Agriculture lands are categorized as cropland and pasture, orchards, vineyards, bush fruits, groves, and horticultural areas (such as nurseries), feeding operations and others. The economic prosperity of any country is closely connected with the richness of natural resources it owns, and also the fertility and quality of land. The system of land ownership regulates the relationship of the people with the land and specifically the power of disposition over land and the right to use the land. It is practically impossible, on one hand, to increase the amount of land, while, on the other hand, it stands as the basis of agrarian production, living, and recreation. Therefore, the social conditions in a rural society or setups are determined by the amount of land controlled and the type of distribution. Land issues in India are plagued by an ever growing population converting cultivated lands for human settlements, geographical factors and ownership of land also determines the size of land holding.

Table 3.1: Area under Rice Farming of the three selected Districts

(Area in HA=Hectare, Acr=Acre)

Area of the three districts				
Sl. No.	**Area of selected districts**	**Mokokchung**	**Phek**	**Dimapur**
1	Total area of the district	161500 Ha	202600	92700
2	Total land under Rice of the district	15890 Ha	15730 Ha	48430 Ha
3	Total land of 150 selected household	920Acr	813.5 Acr	850Acr
4	Land under rice (selected 150 household)	362.5 Acr	295 Acr	641 Acr

Source: Statistical Handbook of Nagaland 2016
Field survey 2016-17

As per Table 3.1, the total area of Mokokchung district is about 161500 hectares, while Phek district is about 202600 hectares and Dimapur district is 92700 hectares. Out of the total area, the area that comes under rice cultivation in Mokokchung district is 15890 hectares, Phek district covers an area of 15730 hectares and Dimapur district covers an area of 48430 hectares under rice cultivation during the study period. Similarly, among the selected respondents in villages of selected districts indicates that in Mokokchung district, the total land of 150 household is 925 acres and out of which 362.5 acres are under rice cultivation. While in Phek district, out of 812.5 acres of total land about 295 acres are under rice cultivation. Whereas, in Dimapur district, out of 851 acres of total land around 641 acres are under rice cultivation. Data from the table clearly indicates that, Dimapur district has more land under rice cultivation with an average of 75.32%, while Phek district has the lowest area under rice with an average of 36.30% and the district of Mokokchung is slightly higher than Phek district and it has about 39.18% under rice cultivation during the study year.

3.2 LABOUR UTILIZATION

The term 'agricultural labour' includes all the kinds of services performed on a farm by a person, in connection with cultivating the soil, or in connection with raising or harvesting any agricultural or horticultural commodity, including the raising, shearing, training, and management of livestock, feeding, caring for, poultry is called agriculture labour. Labour is an important factor of production and supply of labour cannot quickly adjust to the change in demand. Labours can be differentiated between productive labour and unproductive labour. Labour which adds net value to the product is productive labour, while unproductive labour is that which does not add net value.

3.2.a Labour Absorption under Jhum cultivation

The distribution of labour used under Jhum cultivation among the three selected villages in Mokokchung district is shown in Table 3.2.1. The data indicates that, about 48.02 man days per acre absorbed in Longmisa village. Out of total man days, 28.14 man days are male and about 19.88 man days are female counterpart. It is interesting to observe that, about 90% of total man days are from family labour and less than 10% of the labours are hired labours in the village. Similarly, among the activities, clearing absorbs higher man days of about 10.24, followed by weeding (8.1), and Clearing the field after burning (7.16) man days respectively. The average male labour absorption was highest in land clearing (8.18) and clearing the field after burning (3.98), while female labour absorption was found to be highest in weeding (5.16) and seedling (3.38). Though the labour requirement is very less for bunding and spraying, it varies according to the field type and a slope terrain would require more bunding to protect the soil from being washed away by rain and to withstand the force of water. Whereas, the other activities like threshing and winnowing, loading/unloading and transport, absorbs the least labour man days than their counterpart villages during the study period.

Similarly, in Longkhum village, the total labour absorption per acre is about47.88 labour man days, which is the lowest among the three villages in Mokokchung district. Out of this, 28.6 labour are male (25.8 family and 2.88 hired) and 19.2 female (17.26 family and 1.94 hired) labours. Among the activities, land clearing absorbs the highest labour with an average of 10.64 man days and is also the activity that absorbs the highest male labour. An economic practice in Longkhum village is that, the field clearance after burning is done by using own labours than hired labours. Spraying, burning field and bunding are the activities that absorbs the lowest labour man days and since the jhum fields are steep, it maximizes the use of labour. Weeding activity absorbs the second highest labour of 7.94 labour man days, and is the activity where maximum female labour is absorbed. Sowing seeds and harvesting also absorb high labour with an average of 5.74 and 5.82 labour man days respectively. Threshing and winnowing (5.94 labour man days) and loading/unloading and transport (2.6labour man days) are also the major activities where labours is required and the participation of male labour was found to be higher than the female labour counterparts in Longkhum village during the study year.

On the other hand, the total labour absorption was found to be highest in Mongsenyimti village with an average of 48.56 labour man days per acre and out of this, 28.24 are male and 20.32 are female. The village has the highest family labour absorption among the three selected villages. Like the other villages, Mongsenyimti village also absorbs higher man days for land clearing10.58, followed by weeding 8.3 and harvesting 6.2. While burning field and spraying are the activities that absorb less man days. Land clearing and clearing field after burning predominate male labour, while sowing seeds and weeding activities absorb the highest female labour. Interestingly, the village absorbs more labour for threshing and winnowing and loading/unloading activities with an average of 5.54 and 3.18 labour man days, which is higher than their counterpart villages and the involvement of own family labour in Mongsenyimti village was found to be more when compared to other two villages.

Out of the three selected villages under jhum cultivation, Mongsenyimti village absorbs higher labour with an average of 48.56 man days per acre, while farmers from Longmisa village and Longkhum village use an average of 48.02 and 47.88 labour man days respectively. The reason for higher labour absorption in Mongsenyimti village is due to the location of the fields, which are steeper and thus, require more labours, specially with labour intensive activities like burning field, bunding and sowing seeds. Farmers of Mongsenyimti village also use higher own family labour, with an average of 44.56 man days, followed by Longkhum and Longmisa villages. It is interesting to note that, in all the selected villages, family labour absorption was found to be more as compared to hired labour. The use of male labour is more than female labour because some activities like land clearing, harvesting and transportation requires more physical strength in which male labour are involved highly, while female labours are engaged highly in seedling, transplanting, weeding etc.

Table 3.2.1: Activity wise Average Labour Absorption among the selected Villages under Jhum cultivation in Mokokchung District

(Per acre)

Sl. No.	Labour activities	LONGMISA					LONGKHUM					MONGSENYIMTI				
		Family		Hired		Tot	Family		Hired		Tot	Family		Hired		Tot
		Male	Female	Male	Female		Male	Female	Male	Female		Male	Female	Male	Female	
1	Land clearing	6.22	2	1.96	0.06	10.24	6.4	1.92	2.32	0	10.64	6.74	1.98	1.86	0	10.58
2	Burning	1	0	0	0	1	1.06	0	0	0	1.06	1	0	0	0	1
3	Clearing field after burning	3.98	2.58	0	0.60	7.16	2.74	2.56	0	0	5.3	2.68	2.8	0	0	5.48
4	Bunding	0.38	0.04	0	0	0.42	1.72	0.12	0	0	1.84	0.94	0.18	0	0	1.12
5	Sowing seed/ Transplanting	2.44	3.02	0	0.36	5.82	2.34	3.0	0	0.4	5.74	2.56	3.06	0	0.54	6.16
6	Spraying / Fertilizer application	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1
7	Weeding	2.94	4.16	0	1	8.1	2.90	3.94	0	1.1	7.94	3.18	4.0	0	1.12	8.3
8	Harvesting	3.0	2.44	0.32	0.42	6.18	3.2	2.48	0.14	0	5.82	3.2	2.68	0.18	0.14	6.2
9	Threshing & winnowing	2.30	2.56	0.36	0.64	5.86	2.44	3.0	0.06	0.44	5.94	2.48	2.9	0	0.16	5.54
10	Loading / Unloading/Transport	2.24	0	0	0	2.24	2.0	0.24	0.36	0	2.6	2.42	0.76	0	0	3.18
11	Total labour absorption	25.5	16.8	2.64	3.08	48.02	25.8	17.26	2.88	1.94	47.88	26.2	18.36	2.04	1.96	48.56

Source: Field survey 2016-17

The total labour absorption of Jhum cultivation per acre under Mokokchung district as per Table 3.2.1a is 48.25, which is the highest among all the three rice farming systems. The reason is that, Jhum cultivation is labour intensive with complete absence of use of modern technology. For Jhum cultivation, it requires clearing of forest once every year in order to carry out the cultivation unlike WTC/WRC, where rice is cultivated on the same field for decades or if not forever. Nearly 20% of the labours used are being absorbed just for clearing and burning the field under Jhum cultivation. The average male labour absorption is more predominant with 28.32 man days, while female labour accounts for 19.93 man days and out of this hired labour is very meager accounting 2.51 male and 2.31 female man days respectively. Male labour are absorbed mainly in clearing the jungle, burning the field, harvesting and loading, unloading and transporting. While, female labours are mainly engaged in seedling, weeding and harvesting etc. The data also reveals that, about 90.01% of labour absorption is from family labour and only 9.99 percent by hired labour respectively in all selected villages under jhum farming in which wage labour market is highly inactive in Mokokchung district.

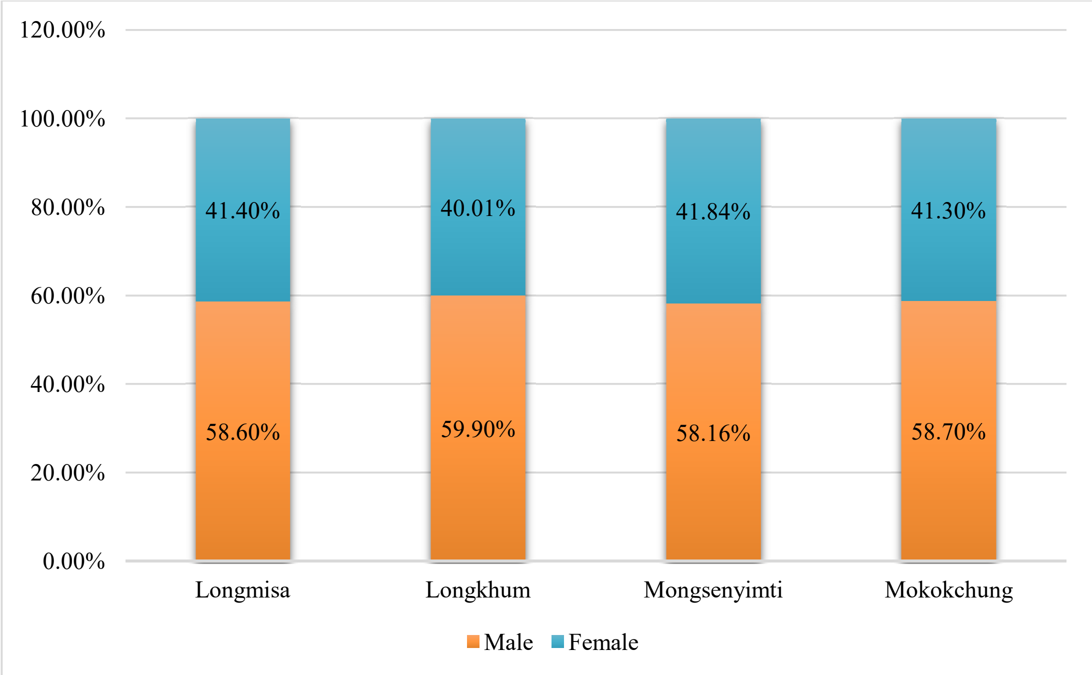
Table 3.2.1.a: Activity wise Average Labour Absorption under Jhum cultivation in Mokokchung District, Nagaland

(Per acre)

Sl. No.	Labour activities	MOKOKCHUNG				
		Family		Hired		Tot
		Male	Female	Male	Female	
1	Land clearing	6.45	1.96	2.04	0.02	10.47
2	Burning	1.02	0	0	0	1.02
3	Clearing field after burning	3.13	2.64	0	0.2	5.97
4	Bunding	1.01	0.11	0	0	1.12
5	Sowing seeds & Transplanting	2.44	3.20	0	0.43	6.07
6	Spraying / Fertilizer application	1	0	0	0	1
7	Weeding	3.01	4.03	0	1.07	8.11
8	Harvesting	3.13	2.53	0.21	0.18	6.05
9	Threshing	2.40	2.82	0.14	0.41	5.77
10	Loading / Unloading/Transport	2.22	0.33	0.12	0	2.67
11	Total labour absorption	25.81	17.62	2.51	2.31	48.25

Source: Field survey 2016-17

Figure 3.1: Average Labour Absorption under Jhum cultivation in Mokokchung District



3.2.b Labour Absorption under WTC

It is imperative from Table 3.2.2 shows that, Pfutseromi village absorbs the highest labour among the three villages under Phek district with an average of 42.72 labour man days. The main reason for higher labour absorption is due to the higher involvement of family labour in Pfutseromi village when compared to the other villages. The total male and female labour absorption per acre is 25.02 and 18.4 female man days respectively. The village also has the lowest hired labour among the three villages. Among the labour absorbing activities, ploughing, leveling and manuring use about 13.04 man days, followed by weeding (7.62), transplanting (6.08) and harvesting (5.62) etc. Whereas, the lowest labour absorption activities are nursery (1.18), bunding (1.16) and spraying (0.18). Weeding is also one of the major activities that absorb the highest female labour with an average of 5.06 labour man days. While threshing, winnowing and loading/unloading, the average labour absorption is 5.12 and 2.72 man days respectively.

Similarly, total labour absorption per acre in Kikruma village is about 41.2 man days, which consist of 24.88 male and 16.32 female man days. Among the activities, ploughing, leveling and manuring absorbs 13 man days, which is the highest male labourabsorbed activity with 9.3 male man days, while highest female labour absorbing activity is weeding with an average of 4.38 labour man days. Transplanting, threshing/winning are the other activities that absorb the highest labour with an average of 5.32 and 5.02 labour man days, while nursery and bunding absorbs the lowest labour days with an average of 1.18 and 1.26 man days. It is interesting to note that the farmers in Kikruma village do not use pesticides and they spray ash to kill the pest without damaging the crop.

On the other hand, in Chizami village the total labour per acre is about 40.98 labour days, which is the lowest number comparing to other villages in Phek district. Out of this, 24.42 are male and 16.56 female as per the data in the table. An interesting observation is that, farmers in Chizami use an average of 2.14 hired male labour and 1.95 female man days, which is the highest hired labour use in all the three selected villages. Ploughing, leveling and manuring are the activities that utilize the highest labour with an average 12.74 man days, followed by weeding (7.06), and transplanting (5.74) activities. Similarly, the male labour is predominant in ploughing, leveling and manuring activities. While, female labours are observed highly in weeding, leveling and transplanting etc.

Participation of family labour is more in all the villages and Pfutseromi village absorbs slightly higher labour than their counterpart villages. On the other hand, Chizami village absorbs the lowest labour days among the selected village in Phek district, while Kikruma village utilizes the highest male labour (60.38%) among all the villages during the study period.

Table 3.2.2: Activity wise Average Labour Absorption among the selected Villages under WTC in Phek District

(Per acre)

Sl. No.	Labour activities	PFUTSEROMI					KIKRUMA					CHIZAMI				
		Family		Hired		Tot	Family		Hired		Tot	Family		Hired		Tot
		Male	Female	Male	Female		Male	Female	Male	Female		Male	Female	Male	Female	
1	Nursery	1.18	0	0	0	1.18	1.18	0	0	0	1.18	1.24	0	0	0	1.24
2	Ploughing ,Levelling & Manuring	7.6	3.72	1.72	0	13.04	7.96	3.7	1.34	0	13	8.04	3.26	1.44	0	12.74
3	Bunding	1.16	0	0	0	1.16	1.26	0	0	0	1.26	1.12	0	0	0	1.12
4	Sowing seed/ Transplanting	2.6	3.12	0	0.36	6.08	2.1	2.54	0.40	0.60	5.64	2.42	2.92	0	0.40	5.74
5	Spraying / Fertilizer application	0.18	0	0	0	0.18	0	0	0	0	0	0	0	0	0	0
6	Weeding	2.56	4.26	0	0.80	7.62	2.88	3.50	0	0.88	7.26	2.66	3.9	0	0.50	7.06
7	Harvesting	2.7	2.25	0.40	0.27	5.62	2.64	2.2	0.50	0	5.34	2.75	2.04	0.35	0.40	5.54
8	Threshing & winnowing	2.26	2.40	0	0.46	5.12	2.02	2.7	0.30	0	5.02	2.22	2.31	0	0.65	5.18
9	Loading / Unloading/Transport	2.26	0.46	0	0	2.72	2.3	0.2	0	0	2.5	1.83	0.18	0.35	0	2.36
10	Total labour absorption	22.9	16.51	2.12	1.89	42.72	22.34	14.84	2.54	1.48	41.2	22.28	14.61	2.14	1.95	40.98

Source: Field survey 2016-17

Table 3.2.2a shows that, WTC absorbs the second highest labour man days per acre among the three rice farming systems in Nagaland, with an average of 41.57 labour man days. It indicates that, WTC is also labour intensive even though it absorbs lesser labour than jhum cultivation. The average male and female labour absorption are 24.60 and 16.97 man days per acre for male and female respectively. Though the machines are not fully utilized, the use of some machines reduces the use of labour. Activities like ploughing, leveling and manuring absorbs 12.92 man days, which absorbs the highest and also maximum male labours. Weeding and transplanting with an average labour absorption of 7.3 and 5.81 respectively in which female are predominant. The average hired male and female labour is 2.25 and 1.66 man days which is the lowest among all the three farming systems and this is because all members of the family are fully dependent on agriculture for their livelihood.

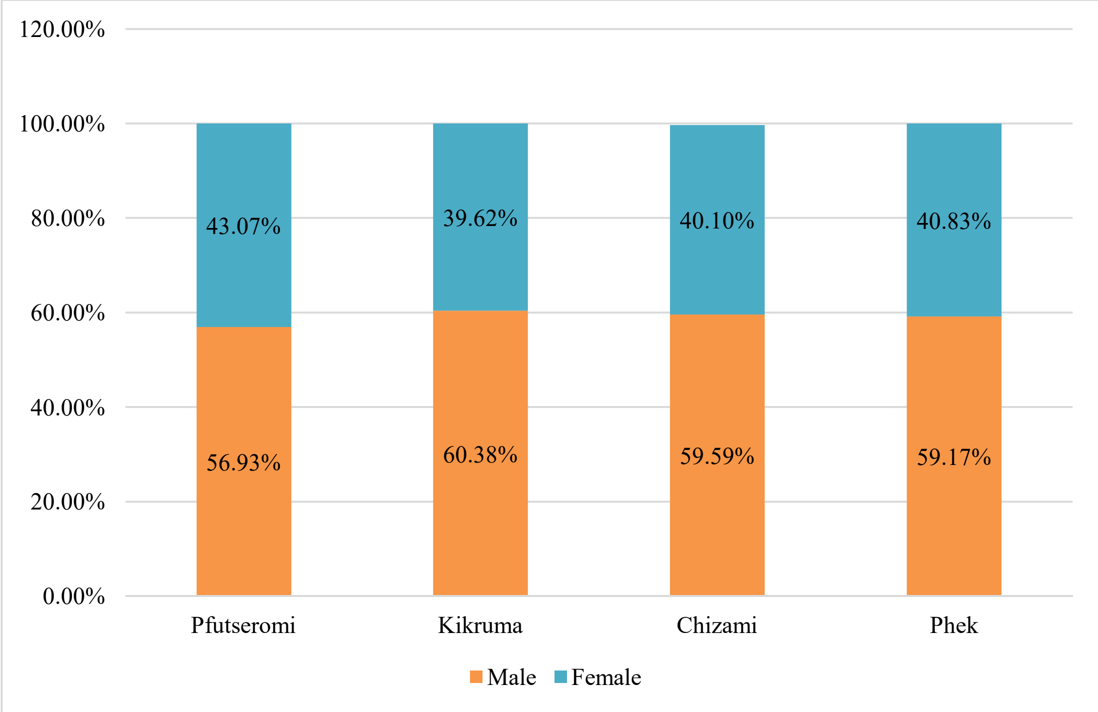
Table 3.2.2a: Activity wise Average Labour Absorption under WTC in Phek District, Nagaland

(Per acre)

Sl. No.	Labour activities	PHEK				
		Family		Hired		Tot
		Male	Female	Male	Female	
1	Nursery	1.2	0	0	0	1.2
2	Ploughing ,Levelling & Manuring	7.86	3.56	1.5	0	12.92
3	Bunding	1.18	0	0	0	1.18
4	Sowing seeds & Transplanting	2.37	2.86	0.13	0.45	5.81
5	Spraying / Fertilizer application	0.06	0	0	0	0.06
6	Weeding	2.7	3.98	0	0.62	7.3
7	Harvesting	2.69	2.16	0.41	0.22	5.48
8	Threshing	2.16	2.47	0.1	0.37	5.1
9	Loading / Unloading/Transport	2.13	0.28	0.11	0	2.52
10	Total labour absorption	22.35	15.31	2.25	1.66	41.57

Source: Field survey 2016-17

Figure 3.2: Average Labour Absorption under Wet Terrace Cultivation in Phek District



3.2.c Labour Absorption under WRC

The total labour absorption per acre in Singrijan village is 43.04 labour man days as shown in Table 3.2.3. The total male labour absorption is 25.82 man days, while the female labour absorption is 17.22 man days. Among the activity wise, ploughing, leveling and manuring predominates with 13.02 labour man days, while transplanting absorbs 6.78 man days. Weeding, harvesting and threshing and winnowing also absorb significantly at8.16, 6.38 and 5.26 man days respectively. Whereas, nursery, bunding and spraying absorbs less labour man days at 1.3, 1.14 and 1 man days respectively. An interesting observation is that, Singrijan village absorbs the highest labour among the three villages, and also the highest family in Dimapur district. Interestingly, for loading, unloading and transportation, the farmers does not incur any expenses since the houses are located next to the farm land and the buyers use to come directly to the field to buy the produce.

Similarly, in Nihoto village the total labour absorption is about 41.66 man days per acre, which is the lowest man day among selected villages in Dimapur. Interestingly, the farmers from this village also absorbs the lowest labour both in terms of family and hired labour, while male labour absorption is more than female labour. Among the activity wise distribution, ploughing, leveling and manuring absorbs more labour with an average of 12.9 man days, followed by weeding, transplanting, threshing and winnowing which consist of 7.74, 6.58 and 5 man days respectively. The lowest labour absorption among the activities are nursery, bunding and spraying in which only 1.42 (male) labour man days, 1.1 and 1 man days are being used in these activities respectively.

On the other hand, in Nihokhu village, total labour absorption is about 42.58 man days per acre and out of this 25.7 are male and 16.88 are female man days. Ploughing, leveling and manuring are the activities in which male labours are predominant with an average of 9.92 man days, while weeding, transplanting and threshing and winnowing absorbs more female than their male counterparts. The lowest labour absorption activities are in nursery, bunding and spraying in which less than 1.32, 1.26 and 1 man days are used per acre respectively. It is interesting to note that, the village has the highest number of hired male and female labours among all the three villages, with an average labour man days of 3.66 male and 2.0 female. The main reason for this is due to infertile land and the difficulties being faced when ploughing, weeding and harvesting in which labour demand was high during the study year.

The above table indicates that Singrijan village absorbs the highest labour among the three villages, while Nihoto village absorbs the lowest labour per acre. On the other hand, Nihokhu village absorbs the highest hired male and female with an average of 3.66 and 2.02 man days respectively. Family labour participation is more in all the three villages, while male labour predominates than their female counterparts. The use of hired labour is slightly higher under under WRC then the other two farming systems, i.e. Jhum and WTC in Nagaland.

Table 3.2.3: Activity wise Average Labour Absorption among the selected Villages under WRC in Dimapur District

(Per acre)

Sl. No.	Labour activities	SINGRIJAN					NIHOTO					NIHOKHU				
		Family		Hired		Tot	Family		Hired		Tot	Family		Hired		Tot
		Male	Female	Male	Female		Male	Female	Male	Female		Male	Female	Male	Female	
1	Nursery	1.3	0	0	0	1.3	1.42	0	0	0	1.42	1.32	0	0	0	1.32
2	Ploughing ,Levelling & Manuring	7.28	3.14	2.54	0.06	13.02	7.32	2.82	2.6	0.16	12.9	7.2	3.36	2.72	0.1	13.38
3	Bunding	1.14	0	0	0	1.14	1.1	0	0	0	1.1	1.26	0	0	0	1.26
4	Sowing seed/ Transplanting	3.16	2.9	0	0.72	6.78	2.62	2.46	0.44	1.06	6.58	3.16	2.90	0.04	0.56	6.66
5	Spraying / Fertilizer application	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1
6	Weeding	2.98	5	0	0.18	8.16	2.7	4.66	0.14	0.24	7.74	2.98	4.22	0	0.70	7.9
7	Harvesting	3.3	2.08	1	0	6.38	4.02	1.76	0.14	0	5.92	3.04	1.9	0.9	0.06	5.9
8	Threshing & winnowing	2.12	2.14	0	1	5.26	2.08	2.78	0.04	0.1	5	2.08	2.48	0	0.60	5.16
9	Loading / Unloading/Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	Total labour absorption	22.28	15.26	3.54	1.96	43.04	22.26	14.48	3.36	1.56	41.66	22.04	14.86	3.66	2.02	42.58

Source: Field survey 2016-17

Figure 3.3: Average Labour Absorption under Wet Rice Cultivation in Dimapur District

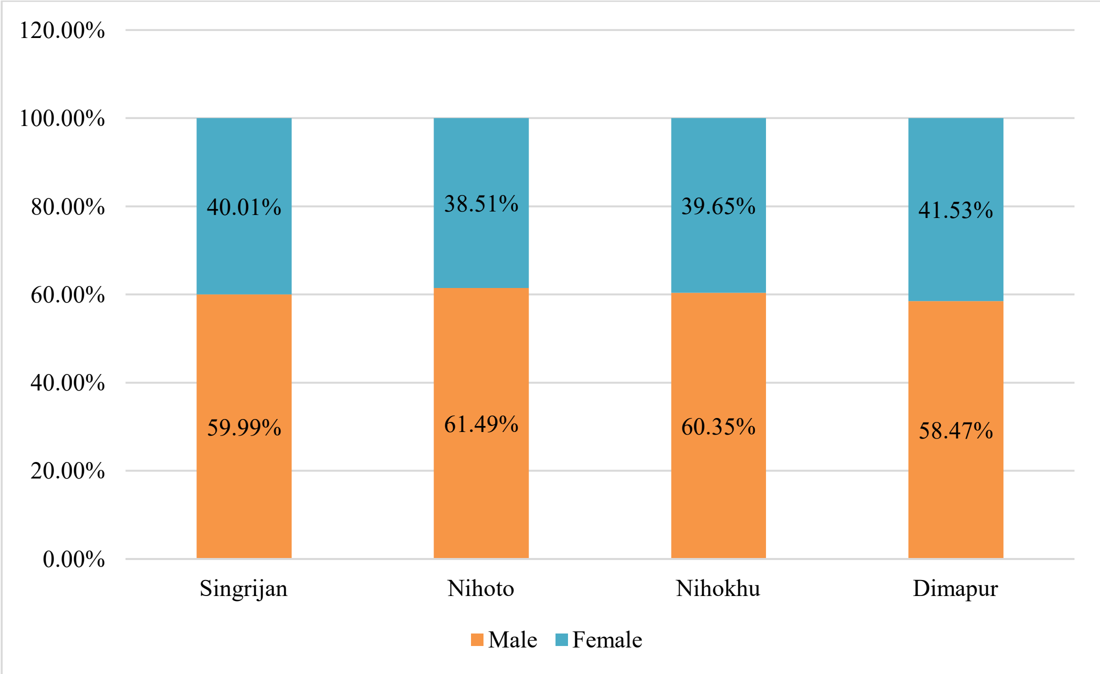


Table 3.2.3a shows the overall average labour absorption per acre of WRC under Dimapur district. The overall average labour absorption is 43.9 man days, which consist of 25.67 male and 18.23 female labour days. WRC absorbs the second highest labour man days among the three faming systems. Among the activities, ploughing, leveling and manuring, sowing seeds and transplanting and weeding absorbs the major labour with an average of 13.08, 8.23 and 7.19 labour man days respectively. Whereas, activities like spraying fertilizer and bunding absorbs the lowest labour days, with an average of 1 and 1.16 man days. It has been observed that, the ratio of hired male and female labour is more or less equal in WRC, unlike Jhum and WTC. Interestingly, WRC absorbs the highest hired labour (both male and female) among all the three farming systems.

Table 3.2.3a: Activity wise Average Labour Absorption under WRC in Dimapur District, Nagaland

(Per acre)

Sl. No.	Labour activities	DIMAPUR				
		Family		Hired		Tot
		Male	Female	Male	Female	
1	Nursery	1.34	0	0	0	1.34
2	Ploughing ,Levelling & Manuring	7.26	3.10	2.62	0.10	13.08
3	Bunding	1.16	0	0	0	1.16
4	Sowing seeds & Transplanting	2.98	2.75	0.16	2.34	8.23
5	Spraying / Fertilizer application	1	0	0	0	1
6	Weeding	2.88	4.62	0.04	0.37	7.91
7	Harvesting	3.45	1.91	0.68	0.02	6.06
8	Threshing	2.09	2.46	0.01	0.56	5.12
9	Loading / Unloading/Transport	0	0	0	0	0
10	Total labour absorption	22.16	14.84	3.51	3.39	43.9

Source: Field survey 2016-17

3.3 COST OF CULTVATION

Cost is the value or the amount of money that has been used up to produce something or to deliver a service, and hence is not available for use anymore. While in business, the cost may be one of acquisition, in which case, the amount of money spend to acquire it is counted as cost. In this case, money is the input that is spend in order to acquire the thing. Similarly, acquisition cost may be the sum of the cost of production as incurred by the original producer, and further costs of transaction as incurred by the acquirer over and above the price paid to the producer.

Agricultural costs are mostly of two types input cost and labour cost. Input cost is the cost incurred for buying machines, equipments, fertilizers, pesticides, manures etc, which will enhance the level of production and productivity of the farmers. The higher will be the yield if modern machines along with adequate quantities of fertilizers, manures and pesticides are used. Therefore, proper and efficient use of inputs is very essential for a farmer to get a good harvest or yield. Whereas, the labour cost is defined as the total cost of all labour used in a business. It is one of the most substantial operating costs. These are particularly important in any business which experience heavy human resource labor costs: agriculture, construction, manufacturing, and other industries which have partially or non-automated operations. These costs include two main categories: Direct labour costs and indirect labour cost. Direct labour cost is summarized as the cost of labor which is used directly to make products. Meanwhile, the indirect labour cost is simply explained as the cost of labour which is used to support or make direct labour more efficient.

3.3.1 Cost of Production under Jhum cultivation in Longmisa Village

Table 3.3.1 shows the average cost of production of Jhum cultivation per acre in Longmisa, which stands at ₹.15,821.28, consisting of input cost of ₹.1,453.09 and labour cost of ₹.14,368.19. The highest input cost is incurred on transport with an average of ₹.798.75, followed by pesticides/weedicides ₹.504.34. Among the farm size groups, small farmers are the ones that incur the highest cost with an average cost of ₹.1,611.44, while the lowest cost is incurred by marginal farmers with an average of ₹.1,200. The reason for high cost is due to hiring vehicles for transportation of inputs as compared to marginal farmers, who have their own vehicles and shorter distance from the village to the field.

Table 3.3.1: Cost of Production among the Farm Size Groups under Jhum cultivation in Longmisa Village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	150	150	150	150	150
	ii. Pesticides, weedicides	525	548.94	543.45	400	504.34
	iii. Transport	525	912.5	807.5	950	798.75
	Total Input Cost	**1,200**	**1,611.44**	**1,500.95**	**1,500**	**1,453.09**
2	**Labour Cost**					
	i.Landclearing/ ploughing	3,475	3,336.84	3,369.04	3,475	3,413.97
	ii. Burning Field	350	350	350	350	350
	iii. Clearing Field after Burning	1,700	1,613.15	1,607.14	1,575	1,623.82
	iv. Bunding& Drainage	325	350	345	0	255
	v. Sowing/Seed Planting	1,750	1,671.05	1,688.09	1,875	1,746.03
	vi. Spraying	350	350	350	350	350
	vii. Weeding	2,387.5	2,268.42	2,335.71	2,350	2,335.40
	Viii. Harvesting	1,887.5	1,871.05	1,873.80	1,975	1,901.83
	ix. Threshing/Winnowing	1,756.25	1,668.42	1,759.52	1,925	1,777.29
	x. Transport Loading/Unloading	875	718.42	783.33	700	769.18
	Total Labour Cost	**14,856.25**	**14,197.35**	**14,461.63**	**14,575**	**14,368.19**
3	**Total Cost (INPUT + LABOUR)**	**=16,056.25**	**=15,808.79**	**=15,962.53**	**=16,075**	**=15,821. 28**

Source: Field Survey: 2016-17

Similarly, the distribution of abour cost among the activities, the highest labour cost is recorded from land clearing/ploughing activities with an average cost of ₹.3,413.97 where marginal farmers and large farmers incurs the highest labour cost of ₹.3,475 and while small farmers with an average of ₹.3,336.84spend the least. Weeding and harvesting are the other activities that incur higher cost of ₹.2,335.40, and ₹.1,901.83 respectively. While the least cost is spend on activities like bunding, spraying and burning field with an average cost of ₹.255 and ₹.350 respectively. Marginal farmers incur the highest labour cost among all the farm size, with an average cost of ₹.14,856.25, while small farmers spend the least with an average of ₹.14,197.35. Apart from small differences, the overall cost of all the farm size groups seems to be the same in almost all activities. Among the farm size group, large farmers incur the highest average cost and marginal farmers incur the lowest with an average of ₹.16,075 and ₹.16,056.25 respectively. Small farmers incur the lowest cost among the farms size group, which is lower than the average production cost of the Village.

Table 3.3.2: Cost of Production among the Farm Size Groups under Jhum cultivation in Longkhum Village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	150	150	150	150	150
	ii. Pesticides, weedicides	525	521.42	558.06	550	538.62
	iii. Transport	0	800	911.53	837.5	637.25
	Total Input Cost	**675**	**1,471.42**	**1,619.59**	**1,537.5**	**1,325.87**
2	**Labour Cost**					
	i.Land clearing/ploughing	3,475	3,364.28	3,662.90	3,506.25	3,502.10
	ii. Burning Field	350	400	372.58	350	368.14
	iii. Clearing Field after Burning	1,437.5	1,750	1,616.12	1,481.25	1,571.21
	iv. Bunding & Drainage	612.5	650	624.19	656.25	635.73
	v. Sowing/Seed Planting	1,637.5	1,671.42	1,670.96	1,675	1,663.72
	vi. Spraying	350	350	350	350	350
	vii. Weeding	2,175	2,357.14	2,261.29	2,306.25	2,274.92
	Viii. Harvesting	1,875	1,742.85	1,795.16	1,762.5	1,793.87
	ix. Threshing/ Winnowing	1,687.5	1,764.28	1,696.77	1,750	1,724.63
	x. Transport Loading/Unloading	1,250	1,464.28	867.74	831.25	1,104.56
	Total Labour Cost	**14,850**	**15,514.25**	**14,917.71**	**14,668.75**	**14,988.88**
3	**Total Cost (INPUT + LABOUR)**	**=15525**	**=16,985.67**	**=16537.3**	**=16,206.25**	**=16,314.75**

Source: Field Survey: 2016-17

3.3.2 Cost of Production under Jhum Cultivation in Longkhum Village

Distribution of cost of cultivation under jhum in Longkhum village is shown in Table 3.3.2. The data indicates that, the total cost of production in Longkhum village is ₹.16,314.75, comprising of input cost of ₹.1,325.87 and average labour cost of ₹.14,988.88. The input cost among the farm size group, marginal farmers incur the lowest cost with an average of ₹.675 only due to zero transport (vehicles) cost since most of them use human labour for transporting the grains. While the highest input cost is incurred by medium farmers, with an average cost of ₹.1,619.59, followed by large farmers and small farmers respectively.

Similarly, the highest labour cost is used on activities like land clearing/ploughing with an average cost of ₹.3,502.10, followed by weeding and harvesting spending about ₹.2,274.92 and ₹.1,793.87 respectively, while the lowest cost is on burning field and spraying with an average of ₹.368.14 and ₹.350. The cost on transport, loading and unloading is highest for small farmers with an average of ₹.1,464.28, which is higher than average of all farm size groups of ₹.1,104.56 and it is due to higher fragmented land distribution for small farms and also the transportation from the field to the village charges higher fares.

However, some farmers have their own vehicle which reduces the cost on transport spending only on fuel. The higher labour cost is incurred by small farmers, with an average of ₹.15,514.25, which is higher than the average labour cost of the village ₹.14,988.88, while marginal farmers spends the lowest labour cost with an average of ₹.14,850. Similarly, among all the farm size groups, the overall cost of production of marginal farmers is the lowest (₹.15,525) due to lower input cost as well as labour cost. On the other hand, small farmers incur the highest cost on production, with an average of ₹.16,985.67, which is higher than the average cost of the village due to high input and labour cost than their counterparts.

3.3.3 Cost of Production under Jhum cultivation in Mongsenyimti Village

The above Table 3.3.3 shows the cost of production of jhum cultivation in Mongsenyimti village and the data indicates that, the total cost of production stands at ₹.16,297.14, which consists of input cost and labour cost of ₹.1,381.87 and ₹.14,915.27 respectively. Like other village, even in Mongsenyimti village the highest input cost is concentrated on transport, followed by pesticides/weedicides, with an average cost of ₹.636.45 and ₹.595.41 respectively. The cost distribution among farm size groups, small farmers are the ones that incur the highest input cost with an average cost of ₹.1,530, followed by medium farmers and large farmers.

However, the distribution of labour cost in Mongsenyimti indicates that, the highest labour cost is incurred on land clearing/ploughing, with an average cost of ₹.3,525.72 and large farmers are the ones who incur the highest cost with an average of ₹.3,650,

Table 3.3.3: Cost of Production among the Farm Size Groups under Jhum cultivation in Mongsenyimti Village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	150	150	150	150	150
	ii. Pesticides, weedicides	642.85	530	558.82	650	595.41
	iii. Transport	450	850	695.83	550	636.45
	Total Input Cost	**1,242.85**	**1,530**	**1,404.65**	**1,350**	**1,381.87**
2	**Labour Cost**					
	i.Landclearing/ploughing	3,405	3,526.47	3,521.42	3,650	3,525.72
	ii. Burning Field	350	350	350	350	350
	iii. Clearing Field after Burning	1,155	1,626.47	1,642.85	2,100	1,631.08
	iv. Bunding& Drainage	337.5	388.23	385.71	350	365.36
	v. Sowing/Seed Planting	1,775	1,788.23	1,797.61	1,950	1,827.71
	vi. Spraying	350	350	350	350	350
	vii. Weeding	2,240	2,435.29	2,340.47	2,350	2,341.44
	Viii. Harvesting	1,890	1,908.82	1,902.38	1,800	1,875.3
	ix. Threshing/ Winnowing	1,660	1,594.11	1,640.47	1,750	1,661.14
	x. Transport Loading/Unloading	1,210	1,035.29	1,004.76	700	987.51
	Total Labour Cost	**14,372.5**	**15,002.91**	**14,935.67**	**15,350**	**14,915.27**
3	**Total Cost (INPUT + LABOUR)**	**=15,615.35**	**=16,532**	**=16,340.32**	**=16,700**	**=16,297.14**

Source: Field Survey: 2016-17

while marginal farmers incurs ₹.3,405, which is the lowest cost. The other activities like weeding and harvesting are other major activities incurring significant cost of ₹.2,341.44 and ₹.1,875.3 respectively, while the lowest labour cost is incurred on burning field and spraying with an average cost of ₹.350 each. Cost on transport, loading and unloading is very low in case of large farmers with an average of ₹.700, since most of the large farmers have their own vehicles for transportation. The data reveals that, large farmers incurs the highest labour cost with an average of ₹.15,350 and also total production cost of ₹.16,700, followed by small farmers and medium farmers. While marginal farmers incurs the lowest cost at an average of ₹.15,615.35 by absorbing less labour when compared to other farm size groups.

Table 3.3.4: Cost of Production among the Farm Size Groups under Jhum cultivation in Mokokchung District

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	ITEMS	MARGINAL FARMER	SMALL FARMER	MEDIUM FARMER	LARGE FARMER	ALL
1	i. Seeds	150	150	150	150	150
	ii. Pesticides, weedicides	564.28	533.44	553.44	533.33	546.12
	iii. Transport	325	854.16	804.96	779.16	690.81
	Total Input Cost	**1,039.28**	**1,537.62**	**1,508.39**	**1,462.5**	**1,386.94**
2	**Labour Cost**					
	i.Land clearing /ploughing	3,451.66	3,40919	3,517.78	3,543.75	3,480.59
	ii. Burning Field	350	366.66	357.52	350	356.04
	iii. Clearing Field after Burning	1,430.83	1,663.20	1,622.03	1,718.75	1,608.70
	iv. Bunding & Drainage	425	462.74	451.63	335.41	418.69
	v. Sowing/Seed Planting	1,720.83	1,710.23	1,718.88	1,833.33	1,745.82
	vi. Spraying	350	350	350	350	350
	vii. Weeding	2,267.5	2,353.61	2,312.49	2,335.41	2,317.25
	Viii. Harvesting	1,884.16	1,840.90	1857.11	1,845.83	1,857
	ix. Threshing/Winnowing	1,701.25	1,675.60	1,698.92	1,808.33	1,721.02
	x. Transport Loading/Unloading	1,111.66	1,072.66	885.27	743.75	953.75
	Total Labour Cost	**14,692.91**	**14,904.83**	**14,771.67**	**14,864.58**	**14,808.49**
3	**Total Cost (INPUT + LABOUR)**	**=15,732.19**	**=16,442.45**	**=16,280.06**	**=16,327.08**	**=16,195.43**

Source: Field Survey: 2016-17

3.3.4 Cost of Production under Jhum Cultivation in Mokokchung District

Table 3.3.4 shows the cost of production under Jhum cultivation in Mokokchung district. The average cost of production per acre stands at ₹.16,195.43, consisting of input cost of ₹. 1,386.94, and labour cost of ₹.14,808.49. The table indicates that, labour cost is more than the input cost, while the highest input cost is on transport, than followed by pesticides/weedicides registered at ₹.690.81 and ₹.546.12 respectively. The cost of distribution among the farm size groups, marginal farmers incurs the lowest cost than their counterparts. While small farmers incur the highest labour cost as well as total cost among the farm size groups, followed by large farmers and medium farmers. Whereas, the labour cost across the activities, land clearing/ploughing plays a major role accounting ₹.3,480.59, followed by weeding, sowing, threshing etc. The lowest labour cost is on spraying pesticides and burning field, whose average cost is around ₹.350 and ₹.356.04. Similarly, there is no irrigation cost since it is Jhum cultivation and farmers are wholeheartedly dependent on monsoon for water. It is found that, the overall cost of production is lowest for marginal farmers with a total cost of ₹.15,732.19, which is way below the overall average of the district of ₹.16,195.43.

The cost of production among the selected villages in Mokokchung district reveals that, farmers in Longkhum village incurs the highest cost of production, followed by Mongsenyimti village, while Longmisa village has the lowest cost of production with average cost of production of ₹.16,314.75, ₹.16,297.14 and ₹.15,975.61 respectively during the study period.

3.3.5 Cost of Production under Wet Terrace Cultivation in Kikruma Village

Table 3.3.5 shows the total cost of production of WTC in Kikruma village, with an average cost of production of ₹.16,332.5, comprising of input cost of ₹.3,449.3, and labour cost of ₹.12,883.2. The highest input cost is incurred on rent/fuel of power tiller, with an average of ₹.898.40, followed by manures and transportation with an average cost of ₹.937.5 and ₹.797.82 respectively. The reason behind the higher cost is that, most of the power tillers that the farmers use are being hired and also the cost of manures and transportation cost is also high due to the long distance of field from the village. The average cost on manures varies between the farm size because some use less while some use more based on availability, as well as the capacity of the farmer to buy. Marginal farmers incur the maximum expenditure on power tiller, with an average cost of ₹.1,388.46, while the least is incurred by large farmers whose expenditure is ₹.800 only, as compared to the average cost of the village of ₹.1,025.86. The main reason behind this difference is higher cost of hiring power tiller for marginal farmers and also all the marginal farmers use power tiller but some of the large farmers have their own power tiller so for them the cost is less as they spend only on fuel consumption. The cost on cattle for marginal farmers is shown as nil since they do not use cattle. The lowest input cost is on seeds, pesticides and cattle with an average cost of ₹.300, ₹.100 and ₹.288.12 respectively. Large farmers incur the maximum input cost with an average of ₹.3,775, while marginal farmers incurs the lowest with an average of ₹.3,119.22. The average labour cost of the village is ₹.12,883.2 and the highest labour cost is incurred by large farmer while medium farmers bears a cost of ₹.12,640.44, which is lowest in the village.

Table 3.3.5: Cost of Production among the Farm Size Groups under Wet Terrace Cultivation in Kikruma Village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	300	300	300	300	300
	ii. Pesticides, weedicides	100	100	100	100	100
	iii. Manures	600	900	1,050	1,200	937.5
	iv. Transport	730.76	725	810.53	925	797.82
	v. Power Tiller	1,388.46	1,015	900	800	1,025.86
	vi. Cattle	0	240	462.5	450	288.12
	Total Input Cost	**3,119.22**	**3,280**	**3,623.03**	**3,775**	**3,449.3**
2	**Labour Cost**					
	i.Land clearing/ploughing	3,273.33	3,445	3,266.66	3,437.5	3,355.62
	ii. Bunding& Drainage	513.33	385	400	525	455.83
	iii. Manuring, leveling/Fertilizer Application	933.33	875	819.04	800	856.84
	iv. Sowing/Seed Planting	413.33	375	461.90	500	437.55
	v. Transplanting	1,626.66	1,705	1,657.14	1,687.5	1,669.07
	vi. Spraying	0	0	0	0	0
	vii. Weeding	2,030	2,190	2,104.76	2,150	2,118.69
	Viii. Harvesting	1,636.66	1,695	1,654.76	1,550	1,634.10
	ix. Threshing/ Winnowing	1,513.33	1,470	1,466.66	1,537.5	1,496.87
	x. Transport Loading/Unloading	930	820	809.52	875	858.62
	Total Labour cost	**12,869.97**	**12,960**	**12,640.44**	**13,062.5**	**12,883.2**
3	**Total Cost (INPUT + LABOUR)**	**=15,989.19**	**=16,240**	**=16,263.47**	**=16,837.5**	**=16,332.5**

Source: Field Survey: 2016-17

On the other hand, the distribution of labour cost among the activities in Kikruma village is ₹.12,883.2, with the highest cost incurred on land clearing/ploughing, at an average of ₹.3,355.62 per acre, followed by weeding, transplanting and harvesting with an average cost of ₹.2,118.69, ₹.1,669.07, and ₹.1,634.10 respectively. While seed planting, bunding/drainage and manuring/fertilizer application are the activities where the labour cost is less with an average of ₹.437.55, ₹.455.83, and ₹.856.84. Interestingly, the cost on spraying is nil because farmers in Kikruma village do not use any chemical pesticides for spraying. The table shows that, large farmers incur the highest labour cost with an average of ₹.13,062.5, while medium farmers are the ones who incurs the minimum labour cost with an average cost of ₹.12,640. Among the farm size groups, large farmers incurs the highest cost per acre with an average of ₹.16,837.5, while marginal farmers spends the lowest of ₹.15,989.19 in the village during the study period.

Table 3.3.6: Cost of Production among the Farm Size Groups under Wet Terrace Cultivation in Chizami Village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	300	300	300	300	300
	ii. Pesticides, weedicides	100	100	100	100	100
	iii. Manures	825	900	975	1,200	975
	iv. Transport	737.5	786.66	983.33	750	814.37
	v. Power Tiller	1,137.5	1,037.5	1,063.63	825	1,015.90
	vi. Cattle	550	500	600	400	512.5
	Total Input Cost	**3,650**	**3,624.16**	**4,021.96**	**3,575**	**3,717.77**
2	**Labour Cost**					
	i.Land clearing/ploughing	3,356.66	3,413.33	3,400	3,200	3,342.33
	ii. Bunding& Drainage	420	373.33	388.88	350	383.05
	iii. Manuring, leveling/Fertilizer Application	783.33	953.33	741.66	825	825.83
	iv. Sowing/Seed Planting	420	443.33	427.77	525	454.02
	v. Transplanting	1,663.33	1,660	1,694.44	1,750	1,691.94
	vi. Spraying	0	0	0	0	0
	vii. Weeding	2,033.33	2,113.33	1,944.44	2,175	2,066.52
	Viii. Harvesting	1,643.33	1,713.33	1,738.88	1,550	1,661.38
	ix. Threshing/ Winnowing	1,503.33	1,486.66	1,527.77	1,750	1,566.94
	x. Transport Loading/Unloading	866.66	773.33	813.88	700	788.46
	Total Labour cost	**12,689.97**	**12,929.97**	**12,677.72**	**12,825**	**12,780.47**
3	**Total Cost (INPUT + LABOUR)**	**=16,339.97**	**=16,554.13**	**=16,699.68**	**=16,400**	**=16,498.24**

Source: Field Survey: 2016-17

3.3.6 Cost of Production of Wet Terrace Cultivation in Chizami Village

Table 3.3.6 shows that, the average cost of production of WTC in Chizami village is ₹.16,498.24, consist of input cost ₹.3,717.77 and labour cost ₹.12,780.47. Similar, in Kikruma village, the highest input cost is incurred on power tiller with an average of ₹.1,015.90, followed by manures and transport with average cost of ₹.975 and ₹.814.37 respectively. It is interesting to know that, the average cost on power tiller in case of large farmers is very low because the location of their farms is impossible for the power tiller to reach the field. While the average cost on manures of large farmers is higher than the average cost of the village because they use more manures than their counterparts. Medium farmers incurs the highest input cost, with an average of ₹.4,021.96, while the lowest input cost is incurred by large farmers with a cost of ₹.3,575, due to the lower cost on power tiller.

However, table indicates that, the average labour cost is about ₹.12,780.47, with the higher labour cost incurred on land clearing/ploughing with an average cost of ₹.3,342.33 per acre, while weeding, transplanting and harvesting are the other significant activities incurs major costs with an average cost of ₹.2,066.52, ₹.1,691.94, and ₹.1,661.38 respectively. Seed planting, bunding/drainage and manuring/fertilizer application are the activities where the labour cost is low, with an average of ₹.454.02, ₹.383.05, and ₹.825.83. From the data, it is interesting to observe that there is no significant difference among the farm size groups in respect of labour cost. The table shows that, medium farmers are the ones who incurs the maximum or highest cost both in terms on input and labour cost with an average cost of ₹.16,699.68, while marginal farmers incurs the lowest cost with an average of ₹.16,339.97 respectively.

3.3.7 Cost of Production under Wet Terrace Cultivation in Pfutseromi Village

The total cost of production of WTC in Pfutseromi village is shown in Table 3.3.7 and it indicates that the total cost per acre is about ₹.16,565.02, which consist of input cost ₹.3,075.63 and labour cost ₹.13,489.39 respectively. The highest input cost is incurred on transportation with an average of ₹.898.40 followed by manures and power tiller ₹.714.64 and ₹.711.88 respectively. Higher cost on transport is due to the distance of field from the village, while the higher cost on manure is due to the non availability of

Table 3.3.7: Cost of Production among the Farm Size Groups under Wet Terrace Cultivation in Pfutseromi Village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	300	300	300	300	300
	ii. Pesticides, weedicides	100	100	100	100	100
	iii. Manures	0	930	1,028.57	900	714.64
	iv. Transport	675	883.33	935.29	1,100	898.40
	v. Power Tiller	1,183.33	808.33	855.88	0	711.88
	vi. Cattle	0	560	392.85	450	350.71
	Total Input Cost	**2,258.33**	**3,581.66**	**3,612.59**	**2,850**	**3,075.63**
2	**Labour Cost**					
	i.Land clearing/ploughing	3,237.5	3,326.19	3,252.17	3,625	3,360.21
	ii. Bunding& Drainage	350	416.6	395.65	525	421.81
	iii. Manuring, leveling/Fertilizer Application	1,950	842.85	819.56	700	1,078.10
	iv. Sowing/Seed Planting	437.5	433.33	395.65	350	404.12
	v. Transplanting	1,837.5	1,819.04	1,813.04	1,925	1,848.64
	vi. Spraying	100	137.5	140	100	119.37
	vii. Weeding	2,100	2,128.57	2,189.13	2,300	2,179.42
	Viii. Harvesting	1,637.5	1,721.42	1,741.30	1,500	1,650.05
	ix. Threshing/ Winnowing	1,512.5	1,511.90	1,489.13	1,625	1,534.63
	x. Transport Loading/Unloading	1,125	842.85	904.34	700	893.04
	Total Labour cost	**14,287.5**	**13,180.25**	**13,139.97**	**13,350**	**13,489.39**
3	**Total Cost (INPUT + LABOUR)**	**=16,545.83**	**=16,761.91**	**=16,752.56**	**=16,200**	**=16,565.02**

Source: Field Survey: 2016-17

manures within village and has to buy from other places unlike the farmers in Dimapur district who rear cattle and get manures that can be used in the field. The average cost of transport varies between the farm size groups because in some cases the fields are far from village so the cost of transport is high like in the case of large farmers where the average cost is about ₹.1100, while for marginal farmers the average cost is ₹.675 only due to shorter distance from the field as well as use of own transport. The cost on power tiller in case of large farmers is nil because the location of their fields are steep that it is not possible to reach the power tiller till the field. Even in the case of use of manures, the data shows that the average cost on manures for marginal farmers is nil since marginal farmers in Pfutseromi village were not using any manures in their field. The data also shows that, total average input cost in case of medium farmers is more than the average due to the higher cost on manures. While the lowest input cost is incurred by marginal farmers, which is lower than the average cost because it does not bear cost on manures and cattles by marginal farmers.

On the other hand, the average labour cost is shown as ₹.13,489.39, with the highest labour cost incurred for land clearing/ploughing of ₹.3,360.21 per acre. The other activities like weeding, transplanting and harvesting are the activities having significant cost with an average cost of ₹.2,179.42, ₹.1,848.64, and ₹.1,650.05 respectively. While other activities like spraying, seed planting, and bunding/drainage are the activities where the labour cost is low with an average cost of ₹.119.37, ₹.404.12, ₹.421.81. The data reveals that, there is a wide difference in labour cost between marginal farmers and other farming groups where the average total labour cost is ₹.14,287.5, which is higher than the average labour cost of the village. Among the farm size groups, medium farmers incur the lowest labour cost with an average of ₹.13,139.97, while small farmers incurs the highest total cost at an average of ₹.16,761.91, while large farmers incurs the lowest cost with an average of ₹.16,200 respectively.

3.3.8 Cost of Production under Wet Terrace Cultivation in Phek district

Table 3.3.8 shows the average cost of production per acre of WTC in Phek district as ₹.16,561.47, which consist of input cost ₹.3,414.23 and labour cost ₹.13,147.24. The farmers are spending more on inputs like power tiller, followed by manures and transport with an average cost of ₹.917.88, ₹.875.71 and ₹.836.86 respectively. Most of the power tillers that the farmers use are hired, while manures are also purchased from others. Medium farmers incur the highest input cost with an average of ₹.3,752.5, while the marginal farmers incur the lowest input cost ₹.3009.18.The average labour cost of the district is shown as ₹.13,147.24 and the major share of labour cost is on land clearing/ploughing activity with an average of ₹.3,352.77, followed by weeding, transplanting and harvesting with averages of ₹.2,121.54,

₹.1,736.55 and ₹.1,665.17 respectively. Among the farm size groups, marginal farmers incur the highest labour cost with an average of ₹.13,349.12. While medium farmers incur the lowest labour cost, with an average of ₹.12,912.69. The data reveals that, under Phek district, Pfutseromi village has the highest cost of production followed by Chizami village, while Kikruma village has the lowest cost of production accounted for ₹.16,565.02, ₹.16,498.24 and ₹.16,332.5 respectively during the study period.

Table 3.3.8: Cost of Production among the Farm Size Groups under Wet Terrace Cultivation in Phek District

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	300	300	300	300	300
	ii. Pesticides, weedicides	100	100	100	100	100
	iii. Manures	475	910	1,017.85	1,100	875.71
	iv. Transport	714.42	798.33	909.71	925	836.86
	v. Power Tiller	1,236.43	953.61	939.83	541.66	917.88
	vi. Cattle	183.33	433.33	485.11	433.33	383.77
	Total Input Cost	**3,009.18**	**3,495.27**	**3,752.5**	**3,400**	**3,414.23**
2	Labour Cost					
	i.Land clearing/ploughing	3,289.16	3,394.84	3,306.27	3,420.83	3352.77
	ii. Bunding& Drainage	427.77	391.64	394.84	466.66	420.22
	iii. Manuring, leveling/Fertilizer Application	1,222.22	890.39	793.42	775	920.25
	iv. Sowing/Seed Planting	423.61	417.22	428.44	458.33	431.9
	v. Transplanting	1,709.16	1,728.01	1,721.54	1,787.5	1,736.55
	vi. Spraying	100	137.5	140	100	119.37
	vii. Weeding	2,054.44	2,143.96	2,079.44	2,208.33	2,121.54
	Viii. Harvesting	1,639.16	1,776.58	1,711.64	1,533.33	1,665.17
	ix. Threshing/ Winnowing	1,509.72	1,489.3	1,494.52	1,637.5	1,532.76
	x. Transport Loading/Unloading	973.88	812.06	842.58	758.33	846.71
	Total Labour cost	**13,349.12**	**13,181.5**	**12,912.69**	**13,145.81**	**13,147.24**
3	**Total Cost (INPUT + LABOUR)**	**=16,358.3**	**=16,676.77**	**=16,665.21**	**=16,545.81**	**=16,561.47**

Source: Field Survey: 2016-17

Table 3.3.9: Cost of Production among the Farm Size Groups under Wet Rice Cultivation in Singrijan village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	ITEMS	MARGINAL FARMER	SMALL FARMER	MEDIUM FARMER	LARGE FARMER	ALL
1	i. Seeds	300	300	300	300	300
	ii. Fertilizer	630	630	630	630	630
	iii. Pesticides	98	113.57	105.45	120	109.25
	iv. Manures	1,260	1,371.42	1,445.45	1,350	1,356.71
	v.Tractor/Equipment	1,200	1,082.14	1,000	1,200	1,120.53
	vi. Power Tiller	980	1,050	572	600	800.5
	vii. Cattle	124	128.21	130.90	120	125.77
	Total Input Cost	**4,592**	**4,675.34**	**4,183.8**	**4,320**	**4,442.76**
2	**Labour Cost**					
	i.Land clearing/ploughing	2,300	2,287.75	2,340.90	2,150	2,269.66
	ii. Bunding& Drainage	300	276.78	704.54	250	382.83
	iii. Manuring, leveling/Fertilizer Application	865	783.9	754.54	700	775.86
	iv. Sowing/Seed Planting	300	330.35	340.90	250	305.36
	v. Transplanting	1,535	1,501.78	1,518.18	1,600	1,538.74
	vi. Spraying	250	250	250	250	250
	vii. Weeding	1,170	1,791.07	1,768.18	1,750	1,619.81
	Viii. Harvesting	1,495	1,492.85	1,490.90	1,400	1,469.68
	ix. Threshing/ Winnowing	1,140	1,158.92	1,177.27	1,100	1,144.04
	x. Transport Loading/Unloading	0	0	0	0	0
	Total Labour cost	**9,355**	**9,873.4**	**10,345.41**	**9,450**	**9,755.95**
3	**Total Cost (INPUT + LABOUR)**	**=13,947**	**=14,548.74**	**=14,529.21**	**=13,770**	**=14,198.74**

Source: Field Survey: 2016-17

3.3.9 Cost of Production under Wet Rice Cultivation in Singrijan village

The distribution of cost of production in Wet rice cultivation in Singrijan village is shown in Table 3.3.9 and the data indicates that, the overall average cost is ₹.14,198.74 per acre, input cost ₹.4,442.76 and labour cost ₹.9,755.95. Expenditure on manures is the highest input cost, with an average of ₹.1,356.71, while tractors and power tillers constitute the next highest cost with an average cost of ₹.1,120.53 and ₹.800.5 respectively. Power tillers are used for ploughing the field at maximum level and tractors are also used for both ploughing and threshing activities. The data shows that, the average cost of tractors and power tiller for medium and large farmer is low as compared to marginal and small farmers since most of the medium and large farmers have their own tractors and power tiller. Small farmers incur the highest input cost with an average of ₹.4,675.34, which is mostly due to cost on power tiller, while medium farmers incur the least with an average of ₹.4,183.8.

On the other hand, the average labour cost of the village is ₹.9,755.95. Out of this, major cost is incurred on the activities like land clearing/ploughing with a cost of ₹.2,269.66, followed by weeding, transplanting and with an average cost of ₹.1,619.81, ₹.1,538.74 and ₹.1,469.68 respectively. Whereas, the lowest labour cost is incurred on activities like spraying, bunding and drainage, sowing/seed planting with an average cost of ₹.250, ₹.382.83 and ₹.305.36 respectively. Among the farmers, the highest cost is incurred by medium farmers, with an average of ₹.1,0345.41, while the marginal farmers bears least with an average of ₹.9,355. As a whole, the highest cost of production is incurred by small farmers when compared to the other farmers cultivating wet rice in Singrijan village.

3.3.10 Cost of Production under Wet Rice Cultivation in Nihokhu village

Similarly, the cost of production in Nihokhu village is shown in Table 3.3.10, and the data indicates the average cost of production of ₹.14,686.39 per acre, which consist input cost ₹.4,822.68 and labour cost ₹.9,863.71. The data indicates that, the highest input cost is incurred on manures with an average of ₹.1,157.33, followed by the cost on tractors and power tillers to plough the land with an average of ₹.1,124.03 and ₹.901.93 respectively. Large farmers are the ones that spend the maximum on manures, with an average of ₹.1,350, while marginal farmers incurs lowest cost on manures at an account of ₹.950. Unlike other villages, there is no much difference on the cost incurred on different input items by all the farm size groups and among all the groups, medium farmers incur the highest input cost, while marginal farmers incur ₹.4,591.99, which is the lowest input cost in Nihokhu village.

On the other hand, the average labour cost is about ₹.9,863.71 and among the activities, the highest cost is incurred on land clearing/ploughing, followed by weeding, transplanting and harvesting with an average cost of ₹.1,720.02, ₹.1,511.28, and ₹.1,423.91 respectively. It is quite contracting to that, activities like spraying, bunding and drainage, sowing/seed planting incurs the lowest cost, with an average labour cost of ₹.250, ₹.339.21 and ₹.325.32. Interestingly, there is not much difference on labour cost among the farm size groups in all the activities and large farmers incur slightly higher labour cost with an average of ₹.9,966.63 and small farmers bears the lowest cost with an average of ₹.9,788.86. Whereas, the overall cost of production shows that medium farmers are the one who incurs the highest expenditure when compared to others in Nihokhu village.

Table 3.3.10: Cost of Production among the Farm Size Groups under Wet Rice Cultivation in Nihokhu Village

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	300	300	300	300	300
	ii. Fertilizer	532	541.33	553.30	560	546.65
	iii. Pesticides	160	169.33	166.95	170	166.57
	iv. Manures	950	1025	1304.34	1350	1157.33
	v. Tractor/Equipments	1133.33	1188.88	1173.91	1000	1124.03
	vi. Power Tiller	900	855.55	952.17	900	901.93
	vii. Cattle	283.33	336.11	319.13	316.66	313.80
	viii. Transport	333.33	353.57	250	312.5	312.35
	Total Input Cost	**4591.99**	**4769.77**	**5019.8**	**4909.16**	**4822.68**
2	Labour Cost					
	i.Land clearing/ploughing	2233.33	2327.77	2415.21	2308.33	2321.16
	ii. Bunding & Drainage	416.66	291.66	315.21	333.33	339.21
	iii. Manuring, leveling/Fertilizer Application	833.33	800	813.04	916.66	840.75
	iv. Sowing/Seed Planting	333.33	361.11	315.21	291.66	325.32
	v. Transplanting	1483.33	1552.77	1467.39	1541.66	1511.28
	vi. Spraying	250	250	250	250	250
	vii. Weeding	1616.66	1680.55	1800	1783.33	1720.02
	Viii. Harvesting	1516.66	1375	1395.65	1408.33	1423.91
	ix. Threshing/ Winnowing	1116.66	1150	1128.26	1133.33	1132.06
	x. Transport Loading/Unloading	0	0	0	0	0
	Total Labour cost	**9799.96**	**9788.86**	**9899.97**	**9966.63**	**9863.71**
3	**Total Cost (INPUT + LABOUR)**	**=14,391.95**	**=14,558.63**	**=14,919.77**	**=14,875.79**	**=14,686.39**

Source: Field Survey: 2016-17

3.3.11 Cost of Production under Wet Rice Cultivation in Nihoto village

As per Table 3.3.11, it shows the average cost of production of WRC per acre in Nihoto village. The overall average cost of the village is ₹.13,692.41, which comprises of input cost ₹.4,405.97 and labour cost ₹.9,260.87. Among the inputs, the highest cost is incurred on manures with an average of ₹.1,124.39 and this is due to the availability of manures at cheaper price when compared to fertilizers. Tractors and power tillers constitute the next highest cost, with an average of ₹.1,014.26 and ₹.816.98 respectively. The reason is due to the use of more tractors and power tillers, which they have hired from others that results in higher expenditure. Data shows a wide difference in the average cost of tractors and power tiller among the farm size groups, specially the large farmers spending at an average ₹.800 and ₹.600 respectively, when compared to the village of ₹.1,014.26 and ₹.816.98. The main reason is that, some of the large farmers have their own tractors and power tiller so the cost for them is mainly on buying fuels. The lowest input cost is incurred on pesticides, transport and cattle whose average cost is just ₹.166.20, ₹.197.37, and ₹.230.62 respectively. Small farmers incur the highest input cost while large farmers incur the lowest in their village.

Similarly, the average labour cost in Nihoto village is ₹.9,260.87, with the highest labour cost is on land clearing/ploughing, whose average cost per acre is ₹.2,112.34, followed by weeding, transplanting and harvesting. Among the farm size groups, small farmers incur the highest labour cost with an average of ₹.9,526.28, as more labour is spend on weeding, while medium farmers spend the least with an average of ₹.8,983.3 and it is due to lower labour cost of ploughing of land. The data on total cost of production indicates that, small farmers incurs the highest expenditure, while large farmers incur the least with an average cost of ₹.13,279.96, showing inverse relationship between labour absorption and farm size in Nihoto village.

Table 3.3.11: Cost of Production among the Farm Size Groups under Wet Rice Cultivation in Nihoto Village

(in ₹.Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	300	300	300	300	300
	ii. Fertilizer	521.45	559.66	583.5	560	556.15
	iii. Pesticides	134	147.5	180	203.33	166.20
	iv. Manures	992.30	1105.26	1125	1275	1124.39
	v.Tractor/Equipment	1,030.76	1,026.31	1,200	800	1,014.26
	vi. Power Tiller	892.30	863.15	912.5	600	816.98
	vii. Cattle	270	270	222.5	160	230.62
	viii. Transport	190	202.63	207.5	190	197.37
	Total Input Cost	**4,330.81**	**4,474.51**	**4,731**	**4,088.33**	**4,405.97**
2	**Labour Cost**					
	i. Land clearing/ploughing	2,173.07	2,226.31	1,741.66	2,308.33	2,112.34
	ii. Bunding & Drainage	307.69	250	270.83	291.66	280.04
	iii. Manuring, leveling/Fertilizer Application	684.61	773.68	791.66	791.66	760.40
	iv. Sowing/Seed Planting	346.15	368.42	375	291.66	345.30
	v. Transplanting	1,426.92	1,465.78	1,491.66	1,525	1,477.34
	vi. Spraying	250	250	250	250	250
	vii. Weeding	1,665.38	1,728.94	1,629.16	1,058.33	1,520.45
	Viii. Harvesting	1,400	1,371.05	1,350	1,441.66	1,390.67
	ix. Threshing/ Winnowing	1,088.46	1,092.10	1,083.33	1,233.33	1,124.30
	x. Transport Loading/Unloading	0	0	0	0	0
	Total Labour cost	**9,342.28**	**9,526.28**	**8,983.3**	**9,191.63**	**9,260.87**
3	**Total Cost (INPUT + LABOUR)**	**=13,673.09**	**=14,000.79**	**=13,714.3**	**=13,279.96**	**=13,692.4**

Source: Field Survey: 2016-17

3.3.12 Cost of Production under Wet Rice Cultivation in Dimapur district

Table 3.3.12 shows the average cost of production of WRC per acre under Dimapur district based on the data collected from the three selected villages. The average cost of the district is ₹.14,270.52, which comprises of input cost and labour cost of ₹.4,642.15 and ₹.9,628.37respectively. As per the data, the highest input cost is incurred on manures with an average of ₹.1,212.81, followed by tractors and power tillers constitute of ₹.1,086.27 and ₹.839.80 respectively. Large farmers are the ones that incurs the highest cost on manures with a cost of ₹.1,325 by the use of higher quantity of manures when compared to others. The lowest input cost is on pesticides, cattle and transport whose average cost is only ₹.147.34, ₹.223.39 and ₹.254.94 respectively. The reason is due to the less use of pesticides by farmers and most of the ploughing is done by power tillers instead of cattles and since most of the inputs are easily available within the villages and the town is also not too far from the village. The overall average input cost of all the farm groups of all the input items taken together is almost the same, even though small farmers incurs slightly higher, while large farmers incur the lowest with an average of ₹.4,732.55 and ₹.4,522.9 respectively.

Table 3.3.12: Cost of Production among the Farm Size Groups under Wet Rice Cultivation in Dimapur District

(in ₹. Per Acre)

COST OF PRODUCTION (IN ₹)						
Sl. No.	**ITEMS**	**MARGINAL FARMER**	**SMALL FARMER**	**MEDIUM FARMER**	**LARGE FARMER**	**ALL**
1	i. Seeds	300	300	300	300	300
	ii. Fertilizer	561.15	576.99	588.94	583.33	577.60
	iii. Pesticides	130.66	143.46	150.8	164.44	147.34
	iv. Manures	1,067.43	1,167.22	1,291.59	1,325	1,212.81
	v.Tractor/Equipments	1,121.36	1,099.11	1,124.63	1,000	1,086.27
	vi. Power Tiller	924.1	922.9	812.22	700	839.80
	vii. Cattle	225.77	244.77	224.17	198.88	223.39
	viii. Transport	261.66	278.1	228.75	251.25	254.94
	Total Input Cost	**4,592.13**	**4,732.55**	**4,721.1**	**4,522.9**	**4,642.15**
2	Labour Cost					
	i. Land clearing/ploughing	2,235.46	2,280.61	2,165.92	2,255.55	2,234.38
	ii. Bunding & Drainage	341.45	272.81	430.19	291.66	334.02
	iii. Manuring, leveling/Fertilizer Application	794.31	785.86	786.41	802.77	792.33
	iv. Sowing/Seed Planting	326.49	359.29	343.70	277.77	325.37
	v. Transplanting	1,481.75	1,506.77	1,492.41	1,555.55	1,509.12
	vi. Spraying	250	250	250	250	250
	vii. Weeding	1,484.01	1,733.52	1,732.44	1,530.55	1,620.9
	Viii. Harvesting	1,470.55	1,412.96	1,412.18	1,416.66	1,428.08
	ix. Threshing/ Winnowing	1,115.04	1,133.67	1,129.62	1,155.55	1,133.47
	x. Transport Loading/Unloading	0	0	0	0	0
	Total Labour cost	**9,499.06**	**9,735.49**	**9,742.87**	**9,536.06**	**9,628.37**
3	**Total Cost (INPUT + LABOUR)**	**=14,091.19**	**=14,468.04**	**=14,463.97**	**= 14,058.96**	**= 14,270.52**

Source: Field Survey: 2016-17

On the other hand, the average labour cost of the district is ₹.9,628.37. Land clearing/ploughing incurs the highest cost, with an average of ₹.2,234.38, followed by weeding, transplanting and harvesting. Small farmers incur the highest average cost on weeding, with an average of ₹.1,733.52, while marginal farmers incur the least with an average of ₹.1,484.01. Spraying, sowing/seed planting and bunding and drainage are the activities which incurs low cost with an average of ₹.250, ₹.325.37 and ₹.334.02 respectively. Small farmers incur the highest cost, with an average of ₹.9,735.49, while marginal farmers spend the least cost. The overall cost of production shows that, small farmers are the ones who incur the highest expenditure with an average cost of ₹.14,468.04, which is due to higher labour cost, while large farmers incur the least with an average cost of ₹.14,058.96 as per the data given in the table. The study reveals that, among the selected villages under Dimapur district, the total cost of production of rice per acre is highest in Nihokhu village with an average of ₹.14,686.39, which is higher than the average cost of the district of ₹.14,270.52. The village of Singrijan incurs an average cost of ₹.14,198.74, while Nihoto village incurs the lowest cost with an average of ₹.13,692.41 during the study period.

3.4 PRODUCTIVITY/YIELD

The term Productivity can be defined as the ratio of output to input in relation to land, labour, capital and over all use of resources employed in agriculture. Since agriculture is the main source of sustenance for human beings in India and due this it is very necessary to give more attention on productivity to meet the demands of the growing population. In India, some of the regions are agriculturally more advanced than other while some are very backward. The term agricultural productivity is dynamic, relative and complex. Various scholars have developed different methods of the measurement of productivity. Productivity can also be defined as the return from use of arable land by exploiting the land using various modern technologies.[12]Farmers of individual regions use the same technology but that technology may not exhibit constant returns to scale, and farmers of various ages may display different efficiencies in utilizing the technology (Loren Tauer, 1995).

[12]Loren Tauer (1995), "Age and Farmer Productivity". *Review of Agricultural Economics*, Vol. 17(1), Pp.63-69. Oxford University Press on behalf of Agricultural & Applied Economics Association

Table 3.4.1: Yield under Jhum cultivation in the selected Villages under Mokokchung District

(Y=Yield/kgs Per Acre)

Farm Size	LONGKHUM				LONGMISA				MONGSENYIMTI			
	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags
MF	4	66.36	929.04	12.38	8	67.14	939.96	12.53	10	69	966.00	12.88
SF	7	66.4	929.6	12.39	19	68.25	955.92	12.33	17	70	980.00	13.06
MDF	31	68.82	963.40	12.84	21	68.73	962.22	12.82	21	70.76	990.64	13.20
LF	8	66.92	936.88	12.49	2	70	980.00	13.06	2	62.5	875.00	11.66
ALL	50	67.12	939.68	12.52	50	68.53	959.52	12.68	50	68.06	952.84	12.70

Source: Field survey 2016-17

MF=Marginal farmer, SF=Small farmer, MDF=Medium farmer, LF=Large farmer

3.4.1 Yield Per Acre under Jhum cultivation

Table 3.4.1 shows the distribution of production and productivity of rice among different farm size groups in selected villages under Mokokchung district. Measurement is done on the basis of 1 tin of grain equaling 14 kilograms of grain which is converted to 75 kg per bag as per the standard measurement set by the Govt. of India. The overall data of selected 50 household in Longkhum village shows that, the average yield of the village is 939.68 kgs or 12.52 bags. The data indicates that, among the farm size groups there is no much difference in productivity/yield per acre since it is jhum cultivation where most of the farmers are using same proportion of inputs as well as labour utilization per acre. Interestingly, in jhum cultivation, farmers do not use of any chemical fertilizers and applying traditional methods of farming systems leads to low productivity when compared to wet terrace and wet rice cultivation in other selected districts of Phek and Dimapur.

Similarly, in Longmisa and Mongsenyimti village the average productivity is about 959.52 and 952.84 kgs per acre, which is equal to 68.53 and 68.03 tins per acre. However, in these two villages there are significant differences prevailing among the farm size groups. In Longmisa village, the marginal farmers yield lowest at an account of 939.96 kgs per acre, while large farmers yield an account of 980 kgs per acre. On contrary to that, in Mongsenyimti, the large farmers yields lowest at an account of 875 kgs per acre, while medium farmers yields higher returns with an average of 990 kgs per acre. The data reveals that, though there is slight variation in productivity in all selected villages, the differences among the farm size is very meager and it is due to adoption of traditional method in all villages during the study year.

Table 3.4.1a: Yield under Jhum cultivation in Mokokchung District

(Y=Yield/kgs Per Acre)

Farm Size	MOKOKCHUNG DISTRICT			
	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags
MF	22	67.5	944.80	12.60
SF	43	68.21	954.94	12.73
MDF	73	69.43	972.09	12.96
LF	12	67.72	930.62	12.40
ALL	150	68.21	950.61	12.67

Source: Field survey 2016-17
MF=Marginal farmer, SF=Small farmer, MDF=Medium farmer, LF=Large farmer

As per Table 3.4.1a, the yield per acre of Mokokchung district is 950.61 kgs or 12.67 bags per acre. Medium farmers are the ones who yield slightly higher when compared to other growers in all selected villages under Mokokchung district, on an average of 972.09 kgs or 12.96 bags per acre. The main reason is due to the better utilization of available resources efficiently and effectively as a result of higher spending on the resources. Whereas, large farmers receives the lowest yield of 930.62 kgs or 12.40 bags per acre among all farm size groups. Though the cost of production is high in respect of large farmers, they are unable to get higher yield due to the difficulty to manage the large farm size, and inefficiency to use resources for enhancing productivity since they adopt traditional methods of farming practices. Interesting observation found in jhum cultivation is that, farmers hardly use any inputs such as fertilizers, machines etc and they resort to use of traditional seeds and practices which results in lower productivity when compared to Wet Rice and Wet Terrace cultivation. Moreover, since jhum is practiced by clearing jungles every year and since the jhum cycle is less than eight years, chances of getting fertile land is low. The attack by weeds is also found to be higher under jhum, which lowers the productivity.

Table 3.4.2: Yield under Wet Terrace Cultivation in the selected Villages under Phek District

(Y=Yield/kgs Per Acre)

Farm Size	KIKRUMA				CHIZAMI				PFUTSEROMI			
	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags
MF	15	93.73	1218.49	16.24	15	96.53	1254.89	16.73	4	91	1183	15.77
SF	10	83.73	1088.49	14.51	15	93.98	1221.74	16.28	21	94.6	1229.8	16.39
MDF	21	93.78	1219.14	16.25	18	94.54	1229.02	16.38	23	90.45	1175.85	15.67
LF	4	96.88	1259.44	16.79	2	95.88	1246.44	16.61	2	94	1222	16.29
ALL	50	92.03	1196.39	15.95	50	95.23	1237.99	16.50	50	92.01	1196.13	15.94

Source: Field survey 2016-17
MF=Marginal farmer, SF=Small farmer, MDF=Medium farmer, LF=Large farmer

3.4.2 Yield under Wet Terrace Cultivation

The distribution of productivity under wet terrace cultivation among the selected villages in Phek district is shown in Table 3.4.2 and the data indicates that the average productivity in Kikruma and Pfutseromi villages are equal with an average of 1,196.13 kgs per acre, while in Chizami village it is found to be higher with an average of 1,237.99 kgs per acre. The yield distribution among the farm size groups, large farmers in Kikruma village, marginal farmers in Chizami village and small farmers in Pfutseromi village receives slightly higher yield with an average of 1,259.4, 1,254.9 and 1,230 kgs per acre respectively. Though there is slight difference among the farm size groups in all the three selected villages, the average productivity is more or less same in two villages, i.e., Kikruma and Pfutseromi village. Land fragmentation, input use, farm size, farm location and other socio economic factors are some of the reasons for variation among the farm size groups across the villages in Phek district.

As per Table 3.4.2a, out of the 150 selected household, medium farmers were found to be the majority household 62 (41.34%) in all the villages under Phek district. The average yield of the district is 1,212.35 kgs per acre and large farmers were found to be getting the highest yield among the farm size groups in the district. Ability to use resources effectively and lesser land fragmentation of land holding under large farm size group is the main reason for receiving higher yield when compared to their counterparts. Whereas, small farmers with an average yield of 1,180.01 kgs or 15.72 bags per acre gets the lowest yield among the different farm size groups. It is the inability of the small land holders to use resources effectively in their small farms which hinders their efficiency to get higher yield. Although, some inputs are used but it is very difficult to use machines such as tractors and power tillers for WTC under Phek district specially under small land area due to the topography of the farms, where it becomes difficult to reach the machines till the field, and also the fragmentation of land that leads to a higher cost on production and fall in the efficiency.

Table 3.4.2a: Yield under Wet Terrace Cultivation in Phek district

(Y=Yield/kgs Per Acre)

Farm Size	PHEK DISTRICT			
	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags
MF	34	93.75	1218.79	16.24
SF	46	90.77	1180.01	15.72
MDF	62	92.92	1208.00	16.10
LF	8	95.58	1242.62	16.56
ALL	150	93.25	1212.35	16.15

Source: Field survey 2016-17
MF=Marginal farmer, SF=Small farmer, MDF=Medium farmer, LF=Large farmer

3.4.3 Yield Per Acre under Wet Rice Cultivation

On the other hand, the productivity distribution in Dimapur district is shown in Table 3.4.3 and the data indicates that, on an average Singrijan village receives highest yield per acre followed by Nihoto and Nihokhu accounting about 1,573.45, 1,545.57 and 1,416.16 kgs per acre respectively. Among the farm size groups, in Singrijan village the medium farmers yields highest productivity, followed by marginal farmers with an average of 1,600.04 kg and 1,598 kg per acre. While large farmers yields lowest on account of 1,515.8 kg per acre only. Whereas, in Nihokhu and Nihoto village, small farmers registered the highest yield on an average of 1,652.3 and 1,573.45 kg per acre respectively, followed by marginal farmers. It is interesting to note that, though medium and large farmers cultivating more land, produces less yields which indicates the inverse relationship between farm size and productivity, supporting the empirical system of A.K. Sen (1962), Deepak Mazumdar (1963), CHH Rao (1966). Similarly, among the villages across the farming systems, the farmers in Wet rice gets yield higher than the counter parts farmers growing rice in wet terrace and jhum cultivation by adopting better capital intensifying farming practices and assessing more infrastructural developments in Dimapur district.

Table 3.4.3: Yield under Wet Rice Cultivation in the selected Villages under Dimapur District

(Y=Yield/Kg Per Acre)

Farm Size	SINGRIJAN				NIHOTO				NIHOKHU			
	No of HH	Avg. Yield (Tin)	Yield In Kg	Bags	No of HH	Avg. Yield (Tin)	Yield In Kg	Bags	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags
MF	10	122.96	1598.48	21.31	13	120.54	1567.02	20.89	3	118.54	1541.02	20.54
SF	28	121.50	1579.5	21.06	19	121.18	1575.34	21.00	18	127.10	1652.3	22.03
MDF	11	123.08	1600.04	21.33	12	119.91	1558.83	20.78	23	105.56	1372.28	18.29
LF	1	116.6	1515.8	20.2	6	113.93	1481.09	19.74	6	84.71	1101.23	14.68
ALL	50	121.03	1573.45	20.97	50	118.89	1545.57	20.60	50	108.97	1416.61	18.88

Source: Field survey 2016-17
MF=Marginal farmer, SF=Small farmer, MDF=Medium farmer, LF=Large farmer

Table 3.4.3a shows that, small farmers are majority in Dimapur district with a household of 65 (43.34%) and they are found to be doing better than the rest of the farm size as it gets the highest yield per acre of 1,602.38 kgs or 21.36 bags per acre. The main reason for small farmers doing better is that, they can make use of the available resources more efficiently and effectively due to the smaller size of the farm. While the average yield of the district stands at 1,511.91 kgs or 20.15 bags per acre, which is the highest among all the farming systems. Use of almost all the required inputs and also the easy availability of resources due to the shorter distance of the villages from the main towns are the positive factors that resulted in farmers under WRC getting higher yield than other farming systems. However, large farmers with a household of 13 (8.66%)gets the lowest yield per acre of 1,366.04 kg or 18.20 bags, which is the lowest yield among four farm size of the district. Inspite of the large land holding, large farmers are unable to get higher yield because it is difficult to do intensive cultivation since the farmers do not have the required amount of resources and it becomes difficult for them to manage large farm size, which automatically results in lower yield per acre.

Table 3.4.3a: Yield under Wet Rice Cultivation in Dimapur District

(Y=Yield/Kgs Per Acre)

Farm Size	DIMAPUR DISTRICT			
	No. of HH	Avg. Yield (Tin)	Yield In Kg	Bags
MF	26	120.68	1568.84	20.91
SF	65	123.26	1602.38	21.36
MDF	46	116.18	1510.38	20.13
LF	13	105.08	1366.04	18.20
ALL	150	116.3	1511.91	20.15

Source: Field survey 2016-17

MF=Marginal farmer, SF=Small farmer, MDF=Medium farmer, LF=Large farmer

HYPOTHESES: 1

$Y = a + bx$

$Y_{jc} = -140.47 + 1.664\ (20.17)$, N= 150, $R^2 = 0.989$

$Y_{wt} = -2079.94 + 2.009\ (33.55)$, N= 150, $R^2 = 0.995$

$Y_{wr} = -8231.80 + 5.795\ (22.38)$, N= 150, $R^2 = 0.980$

Where,

Y_{jc}= Jhum cultivation, Y_{wt}= Wet Terrace and Y_{wr}= Wet Rice

The study reveals that, all the three farming systems are showing a highly significance level. While, Wet Terrace Cultivation and Wet Rice Cultivation are showing to have higher return when compared to Jhum cultivation, which proves the first hypothesis is accepted. The R^2 value is 0.98, 0.99 and 0.98, which clearly indicates that the effect of area and yield on production is significant and it implies 98 and 99 percent variations in production are explained by the explanatory variables.

Table 3.5.1: Average Cost, Average Revenue and Profit/Loss of Jhum cultivation in the three selected Villages of Mokokchung District

(Y=Yield/ Kgs Per Acre)

FARM TYPE	LONGMISA VILLAGE		
	AVG COST	AVG REVENUE	PROFIT&LOSS
Marginal Farmer	16,056.25	15,036	-1,020.25
Small Farmer	15,808.79	15,288	-520.79
Medium Farmer	15,962.53	15,384	-578.53
Large Farmer	16,075	15,672	-403
ALL	15,975.61	15,345	-630.61
MONGSENYIMTI VILLAGE			
Marginal Farmer	15,615.35	15,456	-159.35
Small Farmer	16,532	15,672	-860.00
Medium Farmer	16,340.32	15,840	-500.32
Large Farmer	16,700	13,992	-2708
ALL	16,297.14	15,240	-1,057.14
LONGKHUM VILLAGE			
Marginal Farmer	15,525	14,856	-669
Small Farmer	16,985.69	14,868	-2,117.69
Medium Farmer	16,537.3	15,408	-1,129.3
Large Farmer	16,206.25	14,988	-1,218.25
ALL	16,314.75	15,030	-1,284.75
MOKOKCHUNG			
Marginal Farmer	15,732.19	15,116	-616.19
Small Farmer	16,442.45	15,276	-1,166.45
Medium Farmer	16,280.06	15,544	-736.06
Large Farmer	16,327.08	14,884	-1,443.08
ALL	16,195.43	15,205	-990.43

Source: Field survey 2016-17

3.4.4 Average Cost, Average Revenue and Profit/Loss of Jhum cultivation in the three selected Villages in Mokokchung district

Table 3.5.1 shows that, rice cultivators in Longmisa village spend on an average of around ₹.15,975.61 per acre and earns a revenue of around ₹.15,345. The data shows that, the farmers do not make any profit but instead incur loss on an average of ₹.630.61. The cost of production among the farm size groups, marginal farmers were found to be around ₹.16,056.25 per acre and earning a revenue of ₹.15,036, which is the lowest revenue among the farm size and as a result they incur a loss of ₹.1,020.25, which is the highest among all the farm size. While small farmers incurs the lowest cost among the farm size groups, with an average of ₹15,808.79, and earns a revenue of ₹.15,288. Though the cost of production for small farmer is lesser than the others, the revenue is also less and it suffers a loss of around ₹.520.79. On the other hand, the average cost of medium farmers was found to be around ₹.15,962.53 and makes a revenue of ₹.15,384 and incurring a loss of ₹.578.53. Large farmers on the other hand, incurred the highest production cost in the village ₹.16,075, earning the highest revenue among the farm size group of ₹.15,672. It is interesting to note that, Longmisa village incurs the lowest cost of production and higher production and productivity than their counterpart villages in Mokokchung district though all the farm size groups incur losses.

Similarly, farmers in Mongsenyimti village incurs an average production cost of ₹.16,297.14 per acre, while its average revenue is ₹.15,240 which is lower than the cost of production and as a result it incurs a loss of around ₹.1,057.14. Small farmers were found to incur the lowest cost of production of ₹.15,615.35, which was lower than the average cost of the village, while it earns a revenue of ₹.15,456 and incur a loss of ₹.159.35 which is the lowest among all the four farm size. However, medium farmers were found to earn the highest revenue of ₹.15,840, and incurred an average cost of ₹.16,340.32. Another interesting thing to note is, among the farm size, Large farmers incurred the highest cost of production of ₹.16,700 but they earns the lowest revenue among all the farms size of only ₹.13,992 and as a result it face a loss of ₹.2,708, which is the highest loss among all the farm size.

However, Longkhum village with an average cost of ₹.16,314.75 was found to incur the highest cost of production among the villages and it earns a revenue of ₹.15,030, which is also the lowest revenue among the counterpart villages. Not only that, but the village also incurs the highest loss of ₹.1,284.75 among the three villages. Marginal farmers incurs the lowest cost of production of ₹.15,525 and earns a revenue of ₹.14,856, which is the lowest average revenue in the village. Small farmers on the other hand incurred the highest cost of production of ₹.16,985.69, but due to its low revenue of ₹.14,868 it incurs a loss of ₹.2,117.69, which is the highest loss among all the four farm size. From the data it indicates that, marginal farmers have more efficiency, while small farmers are the least efficient in Longkhum village.

The study reveals that, among the villages in Mokokchung district, Longkhum village is found to be incurring the highest cost, with an average cost of ₹.16,314.75 and Longmisa village has the least cost of ₹.15,975.61. Whereas, among the different farm size, marginal farmers were found to be more efficient in Longkhum village, while medium farmers in Mongsenyimti village and large farmers in Longmisa village incurs the highest cost. However, small farmers seem to incur maximum loss in

Longkhum village and large farmers in Mongsenyimti incur the highest loss. On the other hand, marginal farmers incur the highest loss in Longmisa village, while Longmisa village was found to earn the highest revenue among the three and Longkhum village earns the lowest revenue among the selected villages.

The data indicates that, the cost of production per acre in Mokokchung district is ₹.16,195.43, and the farmers earn an average revenue of ₹.15,205. From this, it shows that farmers incur loss of around ₹.990.43. Marginal farmers on the other hand, incur the lowest cost of production and small farmers incur the highest. All the growers were found to incur losses in jhum cultivation in the selected villages, in which the cost of production is higher than revenue. Another interesting observation found in jhum farming villages was, though the farmers incurs losses in rice production but they are getting additional and regular income from their fields by adopting mix cropping pattern, planting maize and other fruits and vegetables such as cucumber, pineapple, banana, green chilies, tomatoes, cabbage etc along with rice gives the farmers with additional income to compensate the losses in jhum cultivation in all selected villages during the study period.

3.4.5 Average Cost, Average Revenue and Profit/Loss of WTC in the three selected Villages under Phek District

From Table 3.5.2, it shows that, farmers of Chizami village incurs a production cost of ₹.16,498.24 per acre and earns a revenue of around ₹.19,800 and make a profit on an average of ₹.3,335.94 and this shows that the village earns the highest revenue as well as the highest profit among all the villages. Marginal farmers incurs an average cost of around ₹.16,339.97 per acre, which is the lowest cost among the farm size groups and it earns the highest revenue, as well as the highest profit of ₹.20,076 and ₹.3,836.03 respectively. However, medium farmers incur an average cost of ₹.16,699.68, which is the highest cost among the farm size group, earning a revenue of ₹.19,656 and make a profit of ₹.3,056.32 per acre, which is the lowest profit among all the farm size group. The data reveals that, marginal farmers are doing better among all the farm size group, while medium farmers are the ones lacking behind when compared with the average profit margin of all the farm size groups in Chizami village.

Table 3.5.2: Average Cost, Average Revenue and Average Profit/Loss of WTC in the three selected Villages under Phek district

(in ₹. Per Acre)

FARM TYPE	CHIZAMI VILLAGE		
	AVG COST	AVG REVENUE	PROFIT&LOSS
Marginal Farmer	16,339.97	20,076	3,836.03
Small Farmer	16,554.13	19,536	3,081.87
Medium Farmer	16,699.68	19,656	3,056.32
Large Farmer	16,400	19,932	3,632.00
ALL	16,498.24	19,800	3,335.94
KIKRUMA VILLAGE			
Marginal Farmer	15,989.19	19,488	3,598.81
Small Farmer	16,240	17,412	1,272.00
Medium Farmer	16,263.47	19,500	3,336.53
Large Farmer	16,837.5	20,140	3,402.5
ALL	16,332.5	19,140	2,834.47
PFUTSEROMI VILLAGE			
Marginal Farmer	16,545.83	18,924	2,490.67
Small Farmer	16,761.91	19,668	3,043.59
Medium Farmer	16,752.56	18,804	2,261.01
Large Farmer	16,200	19548	3,548
ALL	16,565.02	19,128	2,424.55
PHEK			
Marginal Farmer	16,358.3	19,496.00	3,308.50
Small Farmer	16,676.77	18,872.00	2,465.82
Medium Farmer	16,665.21	19,320.00	2,884.62
Large Farmer	16,545.81	19,873.33	3,527.5
ALL	16,561.47	19,356.00	2,864.98

Source: Field survey 2016-17

The data reveals that, the farmers in Pfutseromi village incur the highest average cost, while Kikruma village incurs the lowest average cost. On the other hand, Chizami village receive largest revenue, while Pfutseromi village earns lowest revenue per acre. The data indicates that, in Phek district, large farmers are more efficient to enhance more yield and revenue, while small farmers were found to be less efficient. However, WTC is found to be more productive than Jhum cultivation but it is less productive when compared to WRC.

Similarly, farmers of Kikruma village incur an average cost of ₹.16,332.5 per acre, earning a revenue of ₹.19,140, with an average profit of ₹.2,834.47. Interestingly, the village incurs the highest production cost and also earns the lowest revenue among the three selected villages. Among the farm size group, large farmers incur the highest cost of production with an average of ₹.16,837.5 and earns a revenue of ₹.20,140, which is also the highest and earns a profit of ₹.3,402.5. Marginal farmers on the other hand, incurs the lowest cost of production with an average cost of ₹.15,989.19 and receives a revenue of ₹.19,488 and earns a profit of ₹.3,598.81, which is the highest among all the farm size group. The data reveals that, marginal farmers are found to more efficient to adopt intensive cultivation practices and earns more profit per acre than their counterpart rice growers in Kikruma village.

On the other hand, in Pfutseromi village the average cost is ₹.16,565.02 per acre, which is highest cost of production among all three selected villages in Phek district. While they earn Lowest revenue as well as profit compared to their counterpart villages. Among the farm size group, small farmers incurs the highest cost of production, with an average of ₹.16,761.91, while it also earns the highest revenue of ₹.19,668 and earns a profit of ₹.3,043.59. On the contrary to that, large farmers incurs the lowest cost of production with an average of ₹.16,200, earning a revenue of ₹.19,548 and earn a profit of ₹.3,548 which is the highest among all the farm size groups. Whereas, medium farmers gets the lowest revenue as well as profit, with an average of ₹.18,804 and ₹.2,261.01 respectively. Data from the table clearly indicates that, large farmers are more efficient to enhance productivity in Pfutseromi village, while medium farmers are the ones with the less efficiency earning the lowest profit among the farm size groups.

3.4.6 Average Cost, Average Revenue and Profit/Loss of WRC in the three selected Villages under Dimapur District

As per the data in Table 3.5.3, the average cost of production per acre under WRC in Singrijan village is ₹.14,198.74 and earn a revenue of ₹.25,170 and a profit of ₹.10,971.26. Large farmers incurs the lowest cost of production among all the farm size groups, with an average cost ₹.13,770 per acre and earns a revenue of around ₹.24,240 and make a profit of ₹.10,470. Whereas, marginal farmers incurs an average cost of around ₹.13,947, earning a revenue of ₹.25,572 with a profit of ₹.11,625 which is the highest profit among all the farm size groups. On the other hand, small farmers with an average cost of ₹.14,548.74 incurs the highest cost of production among the farm size groups and earns a revenue of ₹.25,272, and makes a profit of ₹.10,723.26, which is the lowest profit in the village. However, the highest revenue in the village is earned by medium farmers with an average revenue of₹.25,596, incurring an average cost of ₹.14,529.21 and also make a profit of ₹.11,066.79. Singrijan village was found to be getting highest revenues among the selected villages and marginal farmers seems to be more efficient to minimize cost and receives higher revenue and earn more profits than the counterpart rice growers in Singrijan village.

Table 3.5.3: Average Cost, Average Revenue and Profit/Loss of WRC in the three selected Villages under Dimapur District

(in ₹. Per Acre)

FARM TYPE	SINGRIJAN VILLAGE		
	AVG COST	**AVG REVENUE**	**PROFIT&LOSS**
Marginal Farmer	13,947	25,572	11,625
Small Farmer	14,548.74	25,272	10,723.26
Medium Farmer	14,529.21	25,596	11,066.79
Large Farmer	13,770	24,240	10,470.00
ALL	14,198.74	25,170	10,971.26
NIHOTO VILLAGE			
Marginal Farmer	13,673.09	25,068	11,394.91
Small Farmer	14,000.79	25,200	11,199.21
Medium Farmer	13,714.3	24,936	11,221.70
Large Farmer	13,279.96	23,688	10,408.04
ALL	13,692.41	24,720	11,027.59
NIHOKHU VILLAGE			
Marginal Farmer	14,391.95	24,648	10,256.05
Small Farmer	14,558.63	26,436	11,877.37
Medium Farmer	14,919.77	21,948	7,028.23
Large Farmer	14,875.79	17,616	2,740.21
ALL	14,686.39	22,656	7,969.61
DIMAPUR			
Marginal Farmer	14,091.19	25,096	11,004.81
Small Farmer	14,468.04	25,636	11,167.96
Medium Farmer	14,463.97	24,160	9,696.03
Large Farmer	14,058.96	21,848	7,789.04
ALL	14,270.52	24,185	9,914.48

Source: Field survey 2016-17

Similarly, in Nihoto village, the average cost is ₹.13,692.41 per acre and earning a revenue and a profit of ₹.24,720 and ₹.11,027.5, which was found to be the lowest cost per acre and also the highest profit among the villages. Among the farm size group, small farmers incur the highest cost of production with an average cost ₹.14,000.79 per acre and earns a revenue of around ₹.25,200, which is the highest revenue among all the farm size group. Marginal farmers on the other hand, incurs an average cost of around ₹.13,673.09 and earns a revenue of ₹.25,068 and receives highest profit among the farm size groups. Whereas, large farmers on the other hand, though they incurs low cost, their revenue as well as profit is also low when compared to their farmer counter parts in Nihoto village during the study period.

Farmers in Nihokhu village on the other hand, incurs an average cost of ₹.14,686.39 per acre earning a revenue of ₹.22,656 and making a profit of ₹.7,969.61. It clearly indicates that, Nihokhu village has the lowest production efficiency among the three villages under Dimapur district. Among the farm size group, medium farmers were found to spend the highest cost on production per acre when compared to the other farm size, while small farmers receive highest revenue as well as earns highest profit with an average of ₹.11,877.37. Interestingly, large farmers spends the second highest cost on production and receives lowest revenue with an average of ₹.17,616 and earns profit of ₹.2,740.21 which is highly insufficient amount when compared to the rice growers in Nihokhu village due to putting less concentration in farming and engaging other non-farm activities in their livelihood promotion.

The study reveals that, among the selected villages in Dimapur district, the rice grower in Nihoto village was found to be more efficient to yield better production and revenue and profit when compared to the villages. While Nihokhu village on the other hand, has the highest cost of production, with an average of ₹.14,686.39 and earns lowest profit of ₹.7,969.61 among all the villages. Whereas, Singrijan village earns the highest average revenue among all the villages with an average of ₹.25,032, in which marginal farmers seems to more efficient in both Singrijan and Nihoto villages, while small farmers were found to be more efficient in Nihokhu village.

The overall cost of production in Dimapur district is ₹.14,270.52, with an average revenue of ₹.24,136 and a profit of ₹.9,864.48. It indicates that, WTC has the highest efficiency when compared to Jhum and WRC. Small farmers were found to incur the highest production cost, as well as the highest revenue and income in Dimapur, with an average of ₹.14,468.04, ₹25,636 and ₹.11,167.96 respectively, while large farmers were the one incurring the lowest cost per acre of ₹.14,058.96 and also the lowest revenue and profit of ₹.21,848 and ₹.7,789.04. The data from table clearly shows that, small farmers are more efficient in cultivation of rice in Dimapur, while large farmers were found to be less efficient during the study period.

3.5 ESTIMATION OF COSTS AND RETURNS:

To fulfill the objective of cost of production and returns, the study was analyzed using a concept from Agriculture Economics and was carried out as per the cost concept of CACP (Commission of Agricultural Cost and prices, New Delhi). Cost were categorized as variable cost and fixed cost. Costs on labour, material inputs, cost on fertilizers, seed, farm yard manures, interest on working capital etc, were included in variable cost, while fixed cost includes interest on fixed capital, depreciation, land revenue, rental value on land etc. The value of own farm assets was imputed taking into account the depreciation due to the use of these assets in the production process. Family labour used in rice production was imputed on the basis of the prevailing wage rate in the market.

The economy of rice farming was assessed using the costs concepts of Cost A, Cost B, Cost C and their variants, where

Cost A_1= Value of purchased inputs (seeds, insecticides and pesticides, manure, fertilizer), hired human labour, animal labour (hired or owned), machine labour (owned and hired), value of machinery (owned and hired).

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

Cost B_1= Cost A_1 + Interest on value of owned fixed capital assets (excluding land)

Cost B_2= Cost B_1 + rental value on Transportation

Cost C_1= Cost B_1 + imputed value of family labour

Cost C_2 = Cost B_2 + Imputed value of family labour

Cost C_3 = Cost C_2 + 10% of cost C_2 (As managerial cost)

Table 3.6.1 Distribution of Cost as per Cost Concept of three selected Villages under Mokokchung District

Cost Concept	Longkhum	Longmisa	Mongsenyimti	Mokokchung
Cost A_1	₹. 2,181.62	₹. 2,348.34	₹. 1,949.41	₹. 2,159.79
Cost A_2	₹. 2,181.62	₹. 2,348.34	₹. 1,949.41	₹. 2,159.79
Cost B_1	₹. 2,181.62	₹. 2,348.34	₹. 1,949.41	₹. 2,159.79
Cost B_2	₹. 2,818.87	₹. 3,147.09	₹. 2,585.86	₹. 2,850.60
Cost C_1	₹. 13,345	₹. 15,473.34	₹. 15,709.41	₹. 14,842.58
Cost C_2	₹. 16,163.87	₹. 16,272.09	₹. 16,345.86	₹. 16,260.60
Cost C_3	₹. 17,780.25	₹. 17,899.29	₹. 17,980.44	₹. 17,886.66
Gross income	₹.15,030	₹.15,345	₹.15,240	₹.15,205
Net income	₹.-2750	₹.-2,554.29	₹.-2,740.44	₹.-2,681.57

Table 3.6.2 Distribution of Cost as per Cost Concept of three selected Villages under Phek District

Cost Concept	Pfutseromi	Kikruma	Chizami	Phek
Cost A_1	₹. 2,679.85	₹. 2,884.62	₹. 3,124	₹. 2,896.15
Cost A_2	₹. 2,679.85	₹. 2,884.62	₹. 3,124	₹. 2,896.15
Cost B_1	₹. 3,391.73	₹. 3,910.48	₹. 4,139.9	₹. 3,814.03
Cost B_2	₹. 4,290.13	₹. 4,708.3	₹. 4,954.27	₹. 4,650.9
Cost C_1	₹. 15,534.23	₹. 15,439.48	₹. 15,590.4	₹. 15,521.37
Cost C_2	₹. 16,432.63	₹. 16,237.3	₹. 16,404.77	₹. 16,358.23
Cost C_3	₹. 18,049.01	₹. 17,861.03	₹. 18,045.24	₹. 17,985.09
Gross income	₹.19,128.00	₹.19,140.00	₹.19,800.00	₹.19,356
Net income	₹.1,078.99	₹.1,278.97	₹.1,754.76	₹.1,370.91

Table 3.6.3 Distribution of Cost as per Cost Concept of three selected Villages under Dimapur District

Cost Concept	Singrijan	Nihoto	Nihokhu	Dimapur
Cost A_1	₹. 3,798.73	₹. 3,529.36	₹. 3,803.35	₹.3,710.48
Cost A_2	₹. 3,798.73	₹. 3,529.36	₹. 7,363.35	₹. 4,897.14
Cost B_1	₹. 5,719.76	₹. 5,360.6	₹. 5,829.31	₹. 5,636.55
Cost B_2	₹. 5,719.76	₹. 5,557.97	₹. 6,141.66	₹. 5,806.46
Cost C_1	₹. 14,341.76	₹. 13,821.6	₹. 14,311.31	₹. 14,158.22
Cost C_2	₹. 14,341.76	₹. 14,018.97	₹. 14,623.66	₹. 14,328.13
Cost C_3	₹. 15,775.93	₹. 15,420.86	₹. 16,086.02	₹. 15,760.93
Gross income	₹.25,170.00	₹.24,720.00	₹.22,656	₹.24,182
Net income	₹.9,394.07	₹.9,299.14	₹.6,569.98	₹.8,421.07

The average cost per acre of Jhum cultivation is ₹.17,886.66. Cost A_1 and A_2 value are same since there is no land leased market involved in jhum cultivation. Similarly, Cost B_1 value is also unchanged since there is no interest on own capital assets and Cost B_2 is ₹.2,850.60, an incremental increase of ₹.690.81. Cost C_1 is ₹.14,842.58, that includes cost on imputed family labour along with Cost B_1. As per the guidelines from CACP, taking management task at 10 percent of cost C_2 since the farmer acts as an entrepreneur taking various management tasks. The average gross income of Jhum cultivation is ₹.15,205. The net income was the income accruing to farmers after all cost including opportunity of factors of production taken into account. The net income under jhum cultivation is ₹.-2,681.57, which shows a negative return after deducting total cost from gross income. Interestingly, all the farm size in all the selected villages earns losses from jhum cultivation but they are willing to continue to cultivate rice under jhum because farming is their culture and livelihood. Another interesting observation made from the study is that, though they incur losses from rice yield but they receive additional income from cultivation of vegetables and fruits like corn, green chili, ginger, and spices etc., which are grown along with rice giving regular and additional income for rice growers in all selected villages in Mokokchung district.

On the other hand, the average cost per acre in WTC is about ₹.17,985.09. Cost A_2 value is same even under WTC since there is no leased in land, while Cost B_1 value is ₹. 3,814.03. Cost B_2 which includes rental value on transport along with Cost B_1 is ₹.4,650.9. On the other hand, Cost C_1 and C_2 is around ₹.15,521.37 and ₹.16,358.23 respectively. The average gross income earned is ₹.19,356 and making a net income of ₹.1,370.91, while the net returns may differ among the farm size groups across the villages under wet terrace cultivation in Phek district.

On contrary to that, the average cost per acre in WRC as per is about ₹.15,760.93, the lowest among the three farming systems. Cost A_2 is ₹.4,897.14, which incurs rent on lease in land. Wet rice cultivation earns the highest gross income compared to all the three farming system with an average of ₹.24,182 and also earns the highest net income of ₹.8,421.07 by implementing intensive modern cultivation practices in plain land of Dimapur district during the study period.

3.6 Multiple Regression Analysis

Multiple regression generally explains the relationship between multiple independent or predictor variables and one dependent or criterion variable. A dependent variable is modeled as a function of several independent variables with corresponding coefficients, along with the constant term[13]. It is a statistical technique that simultaneously develops a mathematical relationship between two or more independent variables and an interval scaled dependent variable. The term multiple

[13] http://www.statisticssolutions.com/regression-analysis-multiple-regression/. Retrieved on 18/9/18

regression, was first used by Pearson in the year 1908. Multiple regression requires two or more predictor variables, and this is why it is called multiple regression[14].

The multiple regression model may be specified as:

$$Y= \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \beta_{12}X_{12} + \mu$$

Where,

Y= Output in (₹) (Total production multiplied by price),

α= Constant,

X_1= Farm Size (₹),

X_2= Household Age (Years),

X_3= Household Education (Literate= 0, Illiterate= 1),

X_4= Family Income (₹),

X_5= Household Assets (₹),

X_6= Cost on Pesticides (₹),

X_7= Seed Cost (₹),

X_8= Fertilizer Cost (₹),

X_9= Manure Cost (₹),

X_{10}= Indebtedness (₹),

X_{11}= Technological (₹),

X_{12}= Labour Cost (₹),

μ= Error Term.

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[14]How to Find Relationship between Variables, Multiple Regression. Retrieved on 28/08/2018 from www.statsoft.com/Textbook/Multiple-Regression#general

Table 3.7.1: Factor distribution for WRC in Dimapur District: Regression Analysis

Sl. No.	Coefficient	Singrijan	Nihoto	Nihokhu	Dimapur
1	Constant	2.564	4.454	3.423	3.365
2	Farm Size	0.095 (10.95)*	0.109 (8.13)*	0.111 (8.16)*	0.073 (12.44)*
3	Household Age	-0.095 (0.75)	-0.017 (0.12)	-0.019 (0.14)	-0.066 (0.70)
4	Household Education	0.035 (2.14)**	-0.027 (0.78)	-0.037 (2.02)**	-0.035 (2.55)**
5	Family Income	0.129 (2.23)**	-0.142 (2.56)*	-0.144 (2.58)*	-0.005 (0.08)
6	Household Assets	-0.051 (0.81)	0.155 (2.87)*	0.146 (2.73)*	0.042 (2.96)*
7	Cost on Pesticides	-0.085 (0.78)	-0.038 (0.44)	-0.042 (0.48)	0.089 (2.39)**
8	Seed Cost	-0.021 (0.60)	-0.041 (0.22)	0.001 (0.01)	-0.062 (0.23)
9	Fertilizer Cost	-0.313 (2.48)**	-0.157 (0.65)	-0.191 (0.79)	-0.245 (2.50)**
10	Manure Cost	0.183 (0.91)	0.029 (0.12)	0.038 (0.16)	-0.018 (0.13)
11	Indebtedness	0.023 (0.64)	0.055 (1.02)	0.053 (0.98)	-0.146 (3.05)**
12	Technological Cost	0.600 (2.28)**	0.065 (0.42)	0.062 (0.41)	0.090 (0.54)
13	Labour Cost	0.702 (0.77)	1.042 (2.12)**	0.274 (0.93)	0.237 (0.76)
	R^2	**0.913**	**0.893**	**0.896**	**0.796**
	F-Change	**47.14**	**29.11**	**26.67**	**44.56**
	N	**50**	**50**	**50**	**150**

Note: Figures in the parenthesis indicates ‘t’ values
*, and ** indicates 1 percent and 5 percent level of significance

Regression Analysis of Dimapur District

Table 3.7.1 shows the regression analysis of WRC of the selected villages under Dimapur district. All the variables show expected signs except seed cost in Singrijan village. The explanatory variables in Singrijan village shows that, the coefficient of farm size is statistically significant at 1 percent level and it indicates that for every 1 percent increase in farm size leads to an increase in production by 0.095 times. However, the coefficient of educational level of household head, family income, and technological cost shows a positive and statistically significant at 5 percent level, indicating that with higher level of education it enables the farmers to attain better knowledge about the use of modern technology thereby increasing production. Similarly, higher income level of the farmers enables to investment more on factors of production which helps to increase the production levels, while increase in technological cost enhances the farmers to carry out farming activities easily and efficiently which automatically increases production and productivity. On the contrary, the coefficient of fertilizer cost shows a negative association and statistically significant at 5 percent level, indicating that if farmers apply more fertilizer than the required amount it leads to fall of production. However, variables such as manure cost, indebtedness and labour cost shows a positive association but is found to be statistically insignificant in Singrijan village during the study period.

Similarly, in Nihoto village the coefficient of both the farm size and household assets shows positive association and statistically significant at 1 percent level. It indicates that, for every 1 percent increase in the level of farm size and household assets productivity increases by 0.109 and 0.155 times respectively. On the other hand, the coefficient of family income shows negative and statistically significant at 1 percent level, indicating that the increase in the level of family income makes them better off and gives less priority on agriculture which leads to lowering the production and productivity. Whereas, the coefficient of labour cost shows a positive and statistically significant at 5 percent level and it indicates that by increasing the number of labours it leads to increase in the level of production and productivity.

On the other hand, in Nihokhu village, the coefficients of farm size and household assets are positively associated with dependent variables and statistically significant at 1 percent level. The result shows for every 1 percent increase in farm size production increases by 0.111 times. On the contrary, farmer's education and family income is associating a negative relation with the dependent variable and is significant statistically at 5 percent and 1 percent levels. Most of the cultivators in Nihoto village are tenants and they are not highly qualified to adopt high technology to yield more production. Similarly, high income level of the farmers will make them give less priority on farming because of better source of income from other activities will make the farmers more active in non-farm activities than farming.

The regression analysis of Dimapur district shows that, the coefficients farm size, household assets have positive and statistically significant at 1 percent level and it indicates 1 percent increase in farm size leads to an increase in production by 0.073 times. Similarly, 1 percent increase in household assets leads to increase in production by 0.042 times by using more intensive cultivation practices. Whereas, the coefficient of fertilizer cost, educational level of head household and family indebtedness shows a negative and statistically significant at 5 percent level. This indicates that, if farmers borrow more, it will not be able to spend more on family which will lead to decline in production and productivity. On the other hand, the coefficient of cost on pesticides indicates a positive and statistically significant at 5 percent level in which wet rice cultivation the chances of pests and diseases are high during the monsoon and the farmers need to spray pesticides to control the pests and enhance the production and productivity. The R^2 values of 0.913, 0.893, 0.896 and 0.796 clearly indicates that the effect of farm size and other selected variables on production is significant and it can be regarded as good fits and it implies that about 91.3, 89.3, 89.6 and 79.6 percent variation in production respectively are explained by the explanatory variables.

Regression Analysis of Mokokchung District

The regression result of Jhum cultivation in the selected villages under Mokokchung district is shown in Table 3.7.2. The explanatory variable in case of Jhum cultivation in Longmisa village shows that, the coefficient of farm size shows a positive and statistically significant at 1 percent level. It indicates that, with 1 percent increase in farm size, production level will increases by 0.171 times. Similarly, the coefficient of household assets shows a positive and statistically significant at 5 percent level, indicating that increase in household assets will boost the farmers to invest more on farming to increase production and productivity. On the contrary, the coefficient of labour cost shows a negative and statistically significant at 5 percent level. It indicates that, increase in labour costs since jhum is highly labour intensive, leads to fall in production and productivity by engaging more labours in activities like, cutting down trees, cleaning forest and bunding etc. Variables like family income, pesticides cost, indebtedness, technological cost and other cost also show a positive association but statistically insignificant with the dependent variable.

Regression result of the coefficient of farm size, household assets and labour cost in Mongsenyimti village shows a positive and statistically significant at 1 percent level. This indicates that, 1 percent increase in farm size, production increases by 0.185. Similarly, the coefficient of household assets also shows a positive and statistically significant at 5 percent level, indicating that production increases by 0.117 times with increase in household assets. On the other hand, labour cost show a positive and statistically significant at 1 percent level, which indicates that spending on labour cost leads to increase in production by 0.134 times. While other explanatory variables such as family income and other cost also show a positive association but is statistically insignificant with the dependent variable.

Table 3.7.2: Factor distribution for Jhum cultivation in Mokokchung District: Regression Analysis

Sl. No.	Coefficient	Longmisa	Mongsenyimti	Logkhum	Mokokchung
1	Constant	4.516	2.26	6.385	3.288
2	Farm Size	0.171 (18.98)*	0.185 (12.27)*	0.205 (14.09)*	0.212 (14.71)*
3	Household Age	-0.009 (0.14)	-0.035 (0.33)	-0.431 (2.32)**	0.398 (0.29)
4	Household Education	-0.019 (0.91)	-0.043 (1.37)	-0.078 (0.83)	0.409 (0.88)
5	Family Income	0.004 (0.14)	0.016 (0.41)	-0.102 (0.90)	0.056 (0.84)
6	Household Assets	0.104 (2.44)**	0.117 (2.87)*	0.007 (0.07)	0.105 (2.23)**
7	Pesticides Cost	0.078 (0.64)	-0.005 (0.09)	-0.049 (0.45)	-0.317 (3.47)*
8	Seed Cost	-0.010 (0.15)	-0.025 (0.43)	0.317 (2.58)*	0.176 (2.27)**
9	Other Cost	0.063 (0.32)	0.183 (0.82)	0.102 (0.25)	0.347 (1.07)
10	Indebtedness	0.018 (0.83)	-0.023 (0.92)	-0.025 (0.52)	0.029 (0.83)
11	Technological Cost	0.008 (0.17)	-0.027 (0.45)	0.714 (4.83)*	0.126 (2.36)**
12	Labour Cost	-0.019 (2.06)**	0.134 (2.78)*	0.537 (2.79)*	0.300 (2.27)**
R^2 F-Change N		**0.945 60.38 50**	**0.913 41.32 50**	**0.934 49.34 50**	**0.801 50.73 150**

Note: Figures in the parenthesis indicates ‘t’ values
*, and ** indicates 1 percent and 5 percent level of significance

Similarly, in case of Longkhum village, the coefficient of farm size, seed cost, technological cost and labour cost shows positive and statistically significant at 1 percent level. This indicates that, increase in farm size result in increase in production by 0.205 times. Whereas, with increase in technological cost and labour cost, production increases by 0.714 and 0.537 times respectively. It means investing more helps to increase in production. On the contrary, the coefficient of age of the head of household shows a negative association and statistically significant at 5 percent level.

It indicates that, as the farmers grow older in age, it will affect his input efficiency level in carrying out the farming activities which will reduce production and yield. The coefficient of household assets and other cost also show a positive association but statistically insignificant with the dependent variable.

The overall regression analysis of the three villages under Mokokchung district reveals that, the coefficient of farms size is positive and statistically significant at 1 percent level. Whereas, variables like household assets, seed cost, capital cost and labour cost show a positive and statistically significant at 5 percent level respectively. On the contrary, the coefficient pesticide cost shows a negative and statistically significant at 1 percent level. It indicates that, misapplication of chemical fertilizers leads to fall in production since the farmers experience that, use of pesticides results in killing the crops sometimes. On the other hand, variables such as age of the household head, educational level of household head, family income, other cost and indebtedness show a positive association but statistically insignificant with the dependent variable. The R^2 value of 0.945, 0.913, 0.934 and 0.801 clearly shows that, the explanatory variables has been significantly influenced and it implies that, about 94.5, 91.3, 93.4 and 80.1 percent variation in production is explained by the explanatory variables in the three selected villages as well as overall Mokokchung district during the study period.

Regression Analysis of Phek District

Table 3.7.3 shows the regression result of Wet Terrace Cultivation of three selected village under Phek district. The explanatory variables in case of Pfutseromi village show that, the coefficient of farm size and technological cost are positive and statistically significant at 1 percent level. It indicates that, 1 percent increase in the farm size production increases by 0.191 times and similarly 1 percent increase in capital cost will increase production by 0.959 times. Though the location of the farm is such that it is difficult to use power tillers but using it enables the farmers to have more production. On the other hand, the age of household head shows a positive and statistically significant at 5 percent level. It indicates that, experienced farmers can enable to apply the ideas and experiences gained over the years to enhance and accelerate production levels. In fact most of the farmers are new to modern technology and are unable to afford use of modern means of techniques and seeds, fertilizers etc. and farming are done mostly based on their knowledge gained through experiences. While the explanatory variables such as seed cost, manure cost, indebtedness, and labour cost also shows a positive association but are statistically insignificant in Pfutseromi village.

Table 3.7.3: Factor distribution for WTC in Phek District: Regression Analysis

Sl. No.	Coefficient	Pfutseromi	Chizami	Kikruma	Phek
1	Constant	3.383	2.168	5.418	3.568
2	Farm Size	0.191 (15.75)*	0.215 (17.21)*	0.214 (8.00)*	0.206 (22.96)*
3	Household Age	0.104 (2.46)**	0.013 (0.18)	0.132 (0.75)	0.063 (1.15)
4	Household Education	-0.004 (0.28)	0.005 (0.30)	-0.000 (0.01)	0.001 (0.07)
5	Family Income	-0.00 (0.01)	-0.013 (0.28)	0.084 (2.18)**	-0.029 (2.11)**
6	Household Assets	-0.028 (0.85)	-0.019 (0.33)	0.009 (0.13)	0.031 (2.59)*
7	Cost on Pesticides	-0.118 (0.86)	0.114 (0.82)	0.210 (0.59)	-0.051 (0.61)
8	Seed Cost	0.030 (0.46)	0.162 (2.03)**	-0.335 (0.74)	-0.003 (0.05)
10	Manure Cost	0.024 (0.60)	0.063 (0.81)	-0.013 (0.13)	0.017 (0.46)
11	Indebtedness	0.009 (0.36)	0.048 (2.29)**	0.040 (0.48)	-0.003 (0.15)
12	Technological Cost	0.959 (2.97)*	-0.014 (0.34)	0.052 (0.48)	0.026 (0.78)
13	Labour Cost	0.150 (0.51)	0.372 (0.99)	-0.299 (0.54)	0.114 (0.52)
R^2		**0.914**	**0.938**	**0.814**	**0.874**
F-Change		**36.75**	**52.80**	**15.11**	**87.09**
N		**50**	**50**	**50**	**150**

Note: Figures in the parenthesis indicates ‘t’ values
*, and ** indicates 1 percent and 5 percent level of significance

Similarly, in Chizami village, the coefficient of farm size to be positive and statistically significant at 1 percent level, while the coefficient of seed cost and indebtedness is positive and significant at 5 percent level. It indicates that, as the farmers try to use better seeds or improved seeds it helps them to get more harvest and it shows that production increases by 0.162 times when new improved seeds are used. Interestingly, farmers indebtedness in Chizami village shows positive association and significant at 5 percent level and it indicates that investing the borrowed money from credit agencies for production purposes leads to increase in production by 0.048 times. Whereas, variables like age and educational qualification of head of the family, pesticide cost, manure cost and labour cost also show a positive association but they are found to be statistically insignificant to the dependent variable.

In the same way, in Kikruma village the coefficient of farm size to be positive and statistically significant at 1 percent level and the coefficient of family income is found to be positive and statistically significant at 5 percent level. It means that, production and productivity of the farmer increase by 0.084 times if more family income is spend to buy more raw materials and other cost in the production process. On the other hand, variables like age of household head, household assets, pesticides cost, indebtedness and technological cost also shows a positive association but are statistically insignificant to the dependent variable.

The overall regression analysis of the three selected villages under Phek district shows the coefficient of farm size and household assets have positive and statistically significant with the dependent variable. The coefficient of farm size and household assets indicates that, 1 percent increase in farm size leads to increase in production by 0.206 times, while increase in household assets by 1 percent leads to an increase in production by 0.031 times respectively. On the contrary, the coefficient of family income shows a negative and statistically significant at 5 percent level. It indicates that, as family income increases the farmers become better off financially and less active to carry out farming activities and they also venture out into other business activities apart from farming which results in negative outcome. On the contrary, age and education of head of household, manure cost, technological cost, and labour cost shows positive association but is statistically insignificant to the dependent variable. The R^2 value in case of three selected villages and all together are 0.914, 0.938, 0.814 and 0.874 reveals that the model is good fit in view of cross section data since it implies that about 91.4, 93.8, 81.4 and 87.4 percent of variation in production is explained by explanatory variables in all selected villages and Phek district respectively.

HYPOTHESIS: 3

The third hypothesis that efficiency of rice production in the study area is influenced by farmer’s characteristics, farm size, household assets is proved by regression results from Table 3.7.1, 3.7.2 and 3.7.3. The result shows that, the following variables have a positive significance level on production efficiency.

3.7 Cobb-Douglas Production Function:

The Cobb–Douglas production function is a particular functional form of the production function, widely used to represent the technological relationship between the amounts of two or more inputs (particularly physical capital and labour) and the amount of output that can be produced by those inputs. The Cobb–Douglas form was developed and tested against statistical evidence by Charles Cobb and Paul Douglas during 1927–1947.

In its most standard form for production of a single good with two factors, the function is

$Y = AL^{\beta}\ K^{\alpha}$

Where:

> Y = total production (the real value of all goods produced in a year or 365.25 days)
>
> L = laborinput (labour in man days multiplied by wages)
>
> K = capital input (the real value of all machinery, equipment, and buildings) Definition of buildings need clarification. In the context of Capital, buildings include labor. Instead, commodities should be added.
>
> A = total factor productivity and your usual depreciation by utility in day after
>
> α and β are the output elasticities of capital and labours, respectively. These values are constants determined by available technology.

Table 3.8.1: Cobb Douglas Production Function of Wet Rice Cultivation (WRC) under Dimapur District

Sl. No.	Variables	Coefficient	Singrijan	Nihoto	Nihokhu	Dimapur
1	Constant	α_0	2.901	16.248	2.658	11.854
2	Capital	β_K	-2.165 (2.05)**	-0.657 (0.59)	1.693 (2.19)**	-1.171 (2.44)*
3	Labour	β_L	2.520 (1.06)	-2.203 (0.91)	-0.910 (2.20)**	-0.582 (1.23)
4	$\sigma^2 = \sigma v^2 + \sigma u^2$		0.081	0.101	0.067	-0.165
5	Log Likelihood		-4.298	0.376	17.524	-6.482
6	No of Observation		50	50	50	150

The result of Cobb-Douglas production of Dimapur district in Table 3.8.1 shows that, capital plays an important role in the production of rice in Dimapur, showing statistically significant at 1 percent level of significance. Among the villages, in Singrijan and Nihokhu village capital plays a predominant role and statistically significant at 5 percent level, while labour have expected signs in both the villages and statistically significant in Nihoku village and insignificant in Singrijan village. Whereas, in Nihoto village though the factors have expected signs, no indicators show significance. However, though the labour is insignificant in Singrijan and Nihoto village, it is an important input to accelerate the production and productivity of rice in Dimapur district. Therefore, the study reveals that both factors are necessary to grow in order to enhance production and productivity.

Table 3.8.2: Cobb Douglas Production Function of Jhum Cultivation under Mokokchung District

Sl. No.	Variables	Coefficient	Longmisa	Mongsenyimti	Logkhum	Mokokchung
1	Constant	α_0	-2.836	0.971	1.572	0.728
2	Capital	β_K	1.300 (4.51)*	0.646 (2.35)**	3.438 (6.01)*	1.596 (5.15)*
3	Labour	β_L	0.793 (0.88)	0.355 (2.06)**	-1.944 (1.22)	-0.308 (2.36)**
4	$\sigma^2 = \sigma v^2 + \sigma u^2$		0.041	0.032	0.83	0.099
5	Log Likelihood		26.773	14.600	-8.755	-40.015
6	No of Observation		50	50	50	150

Cobb-Douglas production function of jhum cultivation in Mokokchung district is shown in Table 3.8.2. The data indicates that, both labour and capital plays important role in the production process. Among the villages, capital plays prominent role in all three selected villages having expected signs and statistically significant at 1 and 5 percent level respectively. In Mongsenyimti village both capital and labour plays significant role to accelerate the production and productivity. Though the labour factor shows statistically insignificant in Longmisa and Longkhum villages, it is an important input to enhance the yield in these villages since jhum cultivation is highly labour intensive and observing highest labour days when compared to other rice growers in wet terrace and wet rice cultivation in Phek and Dimapur district respectively.

Table 3.8.3: Cobb Douglas Production Function of Wet Terrace Cultivation (WTC) under Phek District

Sl. No.	Variables	Coefficient	Pfutseromi	Chizami	Kikruma	Phek
1	Constant	α_0	1.979	9.002	4.604	3.266
2	Capital	β_K	0.383 (0.96)	1.047 (3.61)*	1.284 (4.07)*	0.862 (5.83)*
3	Labour	β_L	0.349 (0.48)	-2.028 (2.07)**	-1.139 (1.28)	-0.411 (0.74)
4	$\sigma^2 = \sigma v^2 + \sigma u^2$		0.026	0.042	0.040	0.037
5	Log Likelihood		35.93	20.537	23.886	71.020
6	No of Observation		50	50	50	150

Similarly, the Cobb-Douglas production function in Phek district from Table 3.8.3 shows that, capital plays a very vital role as compared to labour which is showing a negative sign. The result shows that, capital is statistical significant at 1 percent among the villages, and in Pfutseromi village, both labour and capital are showing a positive sign but are statistically insignificant. On the other hand, in Chizami village both labour and capital are important in the production of rice. The data indicates that, capital is positively associated and significant at 1 percent, while labour is negatively associated and statistically significant at 5 percent level. It reveals that, if farmers absorb additional labour cost beyond the limit it gives negative impact on production, while investing on modern inputs and technology boost the production and productivity in Chizami village. On the other hand, in Kikruma Village only capital gives significant at 1 percent. However, though the labour factors gives insignificant in both villages but the factors are necessary to cultivate in order to accelerate the production and productivity.

HYPOTHESES: 2

Table 3.8.4: Irrigated rice farms are more capital intensive than Jhum

Sl. No.	Variables	Coefficient	Dimapur	Phek	Mokokchung
1	Constant	α_0	11.854	3.266	0.728
2	Capital	β_K	-1.171 (2.44)*	0.862 (5.83)*	1.596 (5.15)*
3	Labour	β_L	-0.582 (1.23)	-0.411 (0.74)	-0.308 (2.36)**
4	$\sigma^2 = \sigma v^2 + \sigma u^2$		-0.165	0.037	0.099
5	Log Likelihood		-6.482	71.020	-40.015
6	No of Observation		150	150	150

Result of Cobb-Douglas production function from Table 3.8.4 shows that, capital plays a very important role in all the farming systems, showing statistically significant at 1 percent level of significance. But capital is found to play the most vital role than labour in Phek and Dimapur districts, when compared to Mokokchung district, which proves the second hypothesis that, irrigated rice farms are more capital intensive than Jhum.

RECAPULATION

The production efficiency of rice cultivation per acre and presentations of the results of production function, emphasizing on resource allocations and efficiency estimations and factor determinants of rice farming under different farming systems in the selected study villages during the study period have been analyzed in this chapter. Production efficiency is found to be more in WRC cultivation, compared to WTC and Jhum cultivation. The Regression analysis of WRC under Dimapur district shows, farm size, household assets have positive and statistically significant at 1 percent level. While the coefficient of fertilizer cost, educational level of household head and indebtedness shows a negative and statistically significant at 5 percent level. Similarly, in Phek district the coefficient of farm size and household assets to be positive and statistically significant with the dependent variable. While the coefficient of family income shows a negative and statistically significant at 5 percent level. On the other hand, Jhum cultivation in Mokokchung district reveals that, the coefficient of farms size is positive and significant at 1 percent level. Whereas, household assets, seed cost, capital cost and labour cost show a positive and statistically significant at 5 percent. It is interesting to know that, farm size in all selected villages shows positive and statistically significant. The overall cost of production per acre is high in case of WTC when compared to jhum and WRC. Among the farm size group, large farmers incur largest cost, while marginal farmers receive the highest returns. The result from Cobb-Douglas production function reveals that, capital plays predominant role than labour but in many cases both capital and labour are necessary to increase the production and productivity irrespective of cropping systems under all three selected districts.

CHAPTER 4

PROBLEMS AND PROSPECTS

INTRODUCTION

Rice is a staple food crop for the Naga people and is grown in all the 11 districts of Nagaland. But still we are not self-sufficient in rice and mostly dependent on import of rice from outside the state. The state has 0.15 million hectares under rice cultivation both jhum and WRC/WTC, which covers mainly rain fed areas. The state average productivity is about 1.7 tones/hectare[15]. The major constraints in production of rice are acid soils, low coverage of high-yielding varieties, soil erosion and inadequate availability of seed and other inputs especially for jhum cultivation. Though the Government has taken up many initiatives in the field of agriculture especially for rice growers by giving them subsidy for tractors/power tillers, tools and equipments, seeds, pesticides and training and other financial assistance, but still most of the rice growers are yet to receive the benefit. In spite of all the disadvantages there is still a great prospect for the state in rice cultivation if proper training is given to the cultivators. The cultivators should also give importance to maximize its yield by undertaking the trainings and adoption of intensive technique and practices. Some of the major problems according to the farmer's perception in the selected three farming systems under three districts is discussed below.

This chapter is divided into three sections. Section I discusses the problems faced by rice growers. Section II illustrates suggestions given by the rice growers and Section III pinpoint the future prospect and policy implication of rice cultivators under different farming systems in the state.

SECTION I

4.1 PROBLEM FACED BY FARMERS

Rice cultivators in all the three farming systems in the study areas have to deal with many problems, beginning from the time of sowing, transplanting seeds, harvesting and till transporting the produce till the village or market. Eventhough the Governemnt is providing the farmers with seeds, fertilizers, materials etc., at

[15] Indian Council of Agricultural Research (ICAR), https://icar.org.in/files/state-specific/chapter/91.htm. Retrieved on 19/9/18

subsidized rates and various trainings are been given but the rice cultivators are not free from various problems, which are dicussed below.

i. Water Scarcity

Irrigation is the artificial application of water to land for the purpose of agricultural production. Effective irrigation will influence the entire growth process from seedbed preparation, germination, root growth, nutrient utilization, plant growth and regrowth, yield and quality. Farmers in Nagaland are fully dependent on monsoon for irrigation, since they don't have a proper irrigation facility. When the monsoon is late it results in bad yield, and when it rains too much it destroys the crops which results in bad yield. Producers can then achieve higher yields and meet market demands, especially if rainfall events do not occur and also use areas that would otherwise be less productive. Irrigation can allow open up areas of farms for farmers where it would otherwise be too dry to grow crops. This also gives the farmers the capability to carry more stock or to conserve more feed.

ii. Attack by Pests and diseases

Pest refers to any plant causing harm or damage to the crops, or possessions, even if it only causes annoyance. Pests belong to a broad spectrum of organisms including insects, mice, rats, mites, ticks, and other rodents, slugs, snails, weeds, fungi, bacteria, viruses. On average, losses due to pests and diseases in the field are between 20 and 40% depending on the crop. In storage, almost 10-15% of the crop can be lost to pests and the value of the harvest can be dropped due to loss of quality by up to 50%. Complete losses of some crops aren't uncommon either. Insect infestation also leads to other problems by encouraging the growth of mold that produces aflatoxins, so the losses due to infestation can lead to larger losses due to a loss of quality.

iii. Problem of heavy Weeds

Weeds are one of the major biological constraints that compete with crops for natural resources, as well as added inputs and are limiting production and productivity in arable crops, fruits, grass lands, forestry and aquatic environment. Weeds continue to cause considerable losses to farming in India despite the continuous research and extension efforts made in weed science. Up to one-third of the total losses in yield are caused by weeds, besides impairing produce quality, nutrient depletion. They serve as alternate hosts to pests insects, and diseases, loss of biodiversity and causes various kinds of health and environmental hazards.

iv. Problem of Weevils

Weevils are insects that feed on grains and other plant material. When the larva hatches from the egg, it begins to feed on the material stored within the grain. Because of the damage they can cause to stored grain and seeds, weevils are considered to be serious agricultural pests. A single female can lay up to 300 eggs at a time, depositing each individual egg into its own grain. Weevils can also be a household pests, like showing up in flour and cereals. Checking this problem can also be another factor to safe our produced grains from being damaged or lost.

v. Inadequate supply of Farm Land

Land as a factor of production is of immense importance. Land may be rightly called the original source of all material wealth. The economic prosperity of a country is closely linked with the richness of her natural resources (Land) and the fertility and quality of land. Land is very much limited especially in India where the ever growing population is taking away all the cultivated land for human settlement and on top of that the geographical factors also come into effect when cultivation is concerned. Nagaland being a mountainous region it's very difficult to get enough farm land for cultivation, specially in shifting cultivation since jhum cycle is more than 10 years in selected villages.

vi. Lack of Rural Finance

Credit plays a vital role in supporting agricultural production, and with coming of green revolution credit requirements have increased. Many empirical study shows that though agricultural credits have increased over the years, several weaknesses in credit distribution have crept in which have affected the viability and sustainability of credit institutions[16]. Access to credit for farmers is very difficult where farmers have to satisfy many requirements from the banks and lack of credit discourages the participation of farmers to save and reinvest[17].There is still a high rate of exploitative practices of village moneylenders on farmers due to lack of co-operative societies in providing sufficient credit facilities to farmers. Money lending is a time consuming

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[16]Rakesh Mohan (2006), "Agricultural Credit in India: Status, Issues and Future Agenda". *Economic and Political Weekly*, Vol. 41(11), Pp. 1013-1023.

[17]VuongQuocDuy (2015), "Access to Credit and Rice Production Efficiency of Rural Households in the Mekong Delta". Proceedings of the Second Asia-Pacific Conference on Global Business, Economics, Finance and Social Sciences (AP15Vietnam Conference), Paper ID: V583. School of Economics and Business Administration, CanTho University, Viet Nam

process and also have to go through lots of paper works which the farmers are scared or reluctant to go through and end up borrowing money from the local money lenders who exploit them with high interest.

vii. Lack of Training

Lack of training on new technology and experience has been opined as the main problems of the farmers. Most of the farmers, specially when it comes to jhum cultivation are still using the traditional methods of cultivation which is time consuming, labour intensive and low yield situation. Farmers can be vastly benefited by adopting new technology which will uplift their socio-economic condition. The adoption of SRI technique has helped increase the rice production without increasing the area under its cultivation and has proved to serve as an alternative method for rice cultivation.

viii. Lack of Quality Inputs

The term farm inputs applies to the resources that are used in farm production, such as chemical fertilizers, pesticides, weedicides, HYV seed, manures and power tiller, tractors and transport, equipments etc. Most farm inputs are purchased at higher cost and making production costs susceptible to non-farm economic conditions. Over time, prices of farm inputs have increased relative to commodity prices, creating what farmers describe as a cost-price squeeze. The relationship between prices paid for inputs compared to prices received for output is quantified in the parity ratio'.

Table: 4.1.1: Problems faced by Farmers under Jhum Cultivation

Sl. No	Problems faced by cultivators	No. of respondents (%)	Rank
1	Monsoon failure	105 (70%)	iv
2	Shortage of Input (seeds, fertilizer, manures etc)	52 (34.66%)	viii
3	Pest attack and Diseases	123 (82%)	ii
4	Heavy Weeds	150 (100%)	i
5	Inadequate Farm Land	35 (23.33%)	x
6	Lack of Scientific knowledge	118 (78.66%)	iii
7	Lack of Credit	90 (60%)	v
8	Lack of Transport and communication	32 (21.33%)	xi
9	Lack of Training	58 (38.66%)	ix
Total no of respondents		150 (100)	

Note: Field survey 2016-17

Figures in parenthesis are percentages to the total

Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, then it is abandoned and allowed to revert to their natural vegetation while the cultivator moves on to another plot. The period of cultivation is usually terminated when the soil shows signs of exhaustion or more commonly, when the field is overrun by weeds. While, the length of time that a field is cultivated is usually shorter than the period over which the land is allowed to regenerate by lying fallow.

Table 4.1.1 shows the problem faced by farmers under Jhum cultivation in production in Mokokchung district, which is ranked according to the respondent's perception on problems that face in the production process. Heavy weeds in the field is the most common problem in which all the farmers (100%) have respondent, followed by attack by pests and disease (82%) and lack of scientific knowledge (78.66%), while (70%) respondent suggested that they are facing unsuitable monsoon (either heavy rain or shortage). While (34.66%) respondents have stated that shortage of input is another problem. It is also seen from the table that, (60%) of the farmers expressed that shortage of credit and finance, while inadequate farm land, lack of training, lack of transport and communication other problems expressed by the farmers under jhum cultivation in Mokokchung district during the study period.

Figure: 4.1: Problems faced by Farmers under Jhum Cultivation

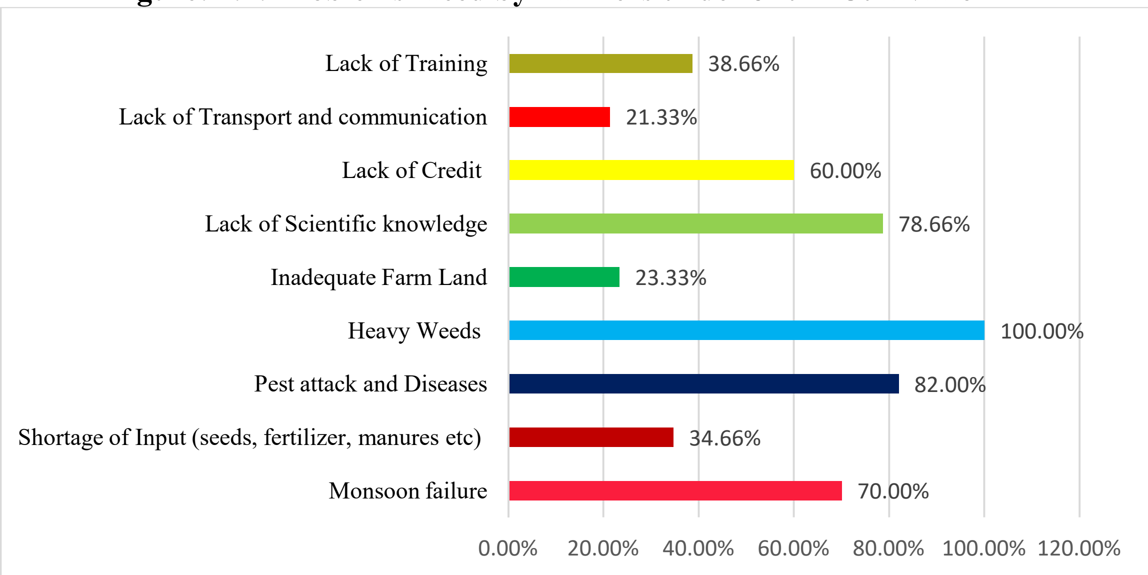


Table 4.1.2: Problems faced by Farmers under Wet Rice Cultivation

Sl. No.	Problems faced by cultivators	No. of respondents (%)	Rank
1	Water scarcity	60 (40%)	xi
2	Shortage of quality Input (seeds, fertilizer, manures etc)	150 (100%)	i
3	Attack by Pest and Diseases	100 (66.66%)	iii
4	Heavy Weeds	75 (50%)	viii
5	Inadequate Farm Land	90 (60%)	v
6	Lack of scientific knowledge	70 (46.66%)	ix
7	Lack of Credit	95 (63.33%)	iv
8	Lack of Transport and Communication	80 (53.33%)	vii
9	Lack of Training	68 (45.33%)	x
Total no of respondents		150 (100%)	

Note: Field survey 2016-17

Figures in parenthesis are percentages to the total

Whereas, Wet Rice Cultivation in Dimapur district, the data from Table 4.1.2 indicates that, the farmers have reported shortage of inputs, such as high yielding variety seeds, chemical fertilizers, pesticides, farm yard manures and equipments as major problem that prevails every rice growers in all selected villages. Similarly, attack by pests and disease is another major problem expressed by about (66.66%) respondent, followed by lack of agricultural credit (63.33%), inadequate farm land (60%) and heavy weeds (58.67) etc. Interestingly, irrigation related problem in Dimapur is seen since the farmer are using canal and borewell irrigation facilities and 40% of farmers reported they face water problem when they do not receive sufficient rainfall during the cultivation. However, about (60%) of the respondents expressed the shortage of farm land as another problem, in which most of the land in Dimapur being occupied for human settlement leads to decline in land for cultivation. The problem of heavy weeds, disease and lack of training are some of the significant problems that cultivators reported during the study period.

Figure 4.2: Problems faced by farmers under Wet Rice Cultivation

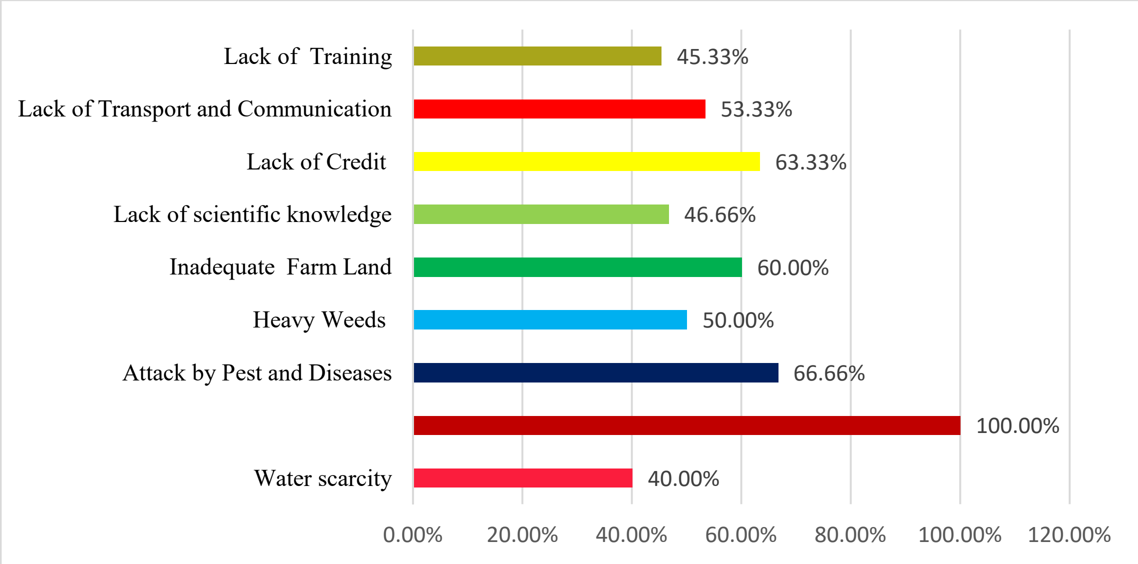


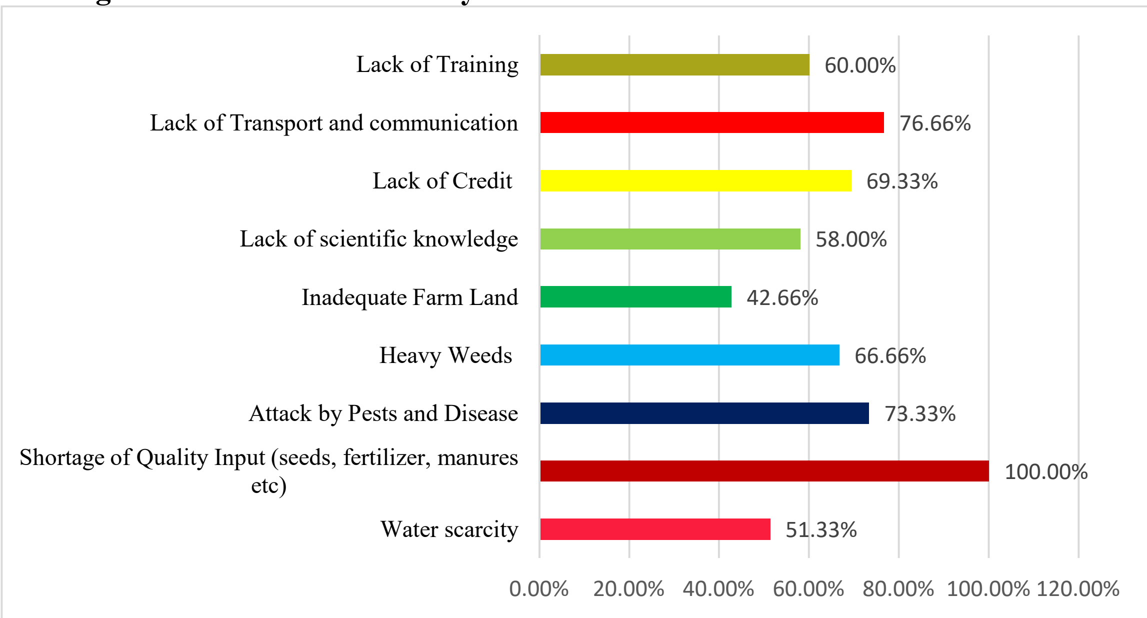
Table 4.1.3: Problems faced by Farmers under Wet Terrace Cultivation

Sl. No.	Problems faced by cultivators	No. of respondents (%)	Rank
1	Water scarcity	77 (51.33%)	ix
2	Shortage of Quality Input (seeds, fertilizer, manuresetc)	150 (100%)	i
3	Attack by Pests and Disease	110 (73.33)	iv
4	Heavy Weeds	100 (66.66%)	vi
5	Inadequate Farm Land	64 (42.66%)	xi
6	Lack of scientific knowledge	87 (58%)	viii
7	Lack of Credit	104 (69.33%)	v
8	Lack of Transport and communication	115 (76.66%)	iii
9	Lack of Training	90 (60%)	vii
Total no of respondents		150 (100)	

Note: Field survey 2016-17
Figures in parenthesis are percentages to the total

The problems faced by the farmers in Wet Terrace Cultivation are shown in Table 4.1.3 and it indicates that, all the respondents have reported that the shortage of quality inputs is the most important constraints that hamper production level. Another major challenge that the farmers expressed was, water shortage 126 (84%), followed by lack of transportation and communication (76.66%), pests and disease attack (73.33) and heavy faced by them is water scarcity, pest attack and disease with 126 (84%), 110 (73.33%), and heavy weeds 100 (66.66%). Since Phek district is located in one of the highest altitude in Nagaland and is not that developed like Dimapur and Mokokchung, the cultivators faces insufficient transportation and communication bottleneck during cultivation. Inadequate farmland, lack of credit, training, lack of scientific knowledge are some of the significant challenges expressed by farmers and it needs to addressed to enhance production and productivity of rice under wet terrace cultivation.

Figure 4.3: Problems faced by Farmers under Wet Terrace Cultivation



SECTION II

4.2 SUGGESTIONS AND ADVICES OF CULTIVATORS

Suggestions and advices from cultivators are very indispensible for the development of agriculture in general and especially rice cultivation in particular for increasing production and productivity and improve their standard of living.

Table 4.2.1 shows the suggestions, advices and activities by the farmers to increase production and to improve rice cultivation. Weed control mechanism is given the top priority by more than 94.60% of the respondents, followed by intensive training facilities which are essential to induce motivation, inculcate efficiency and create confidence in many aspects of cultivation process. Similarly, precision of subsidies input is another area in which the Government intervention is needed, followed by availability of quality seeds. Interestingly, priority in irrigation is very less under jhum cultivation. Since it is rainfed agriculture due to topography, only 30% of the respondents have expressed the view, while 35% of the respondents suggested the land distribution is proportionate in Mokokchung district. Most of the land is under community and most of the farmers are cultivating rice in small farm size land and mainly for self consumption.

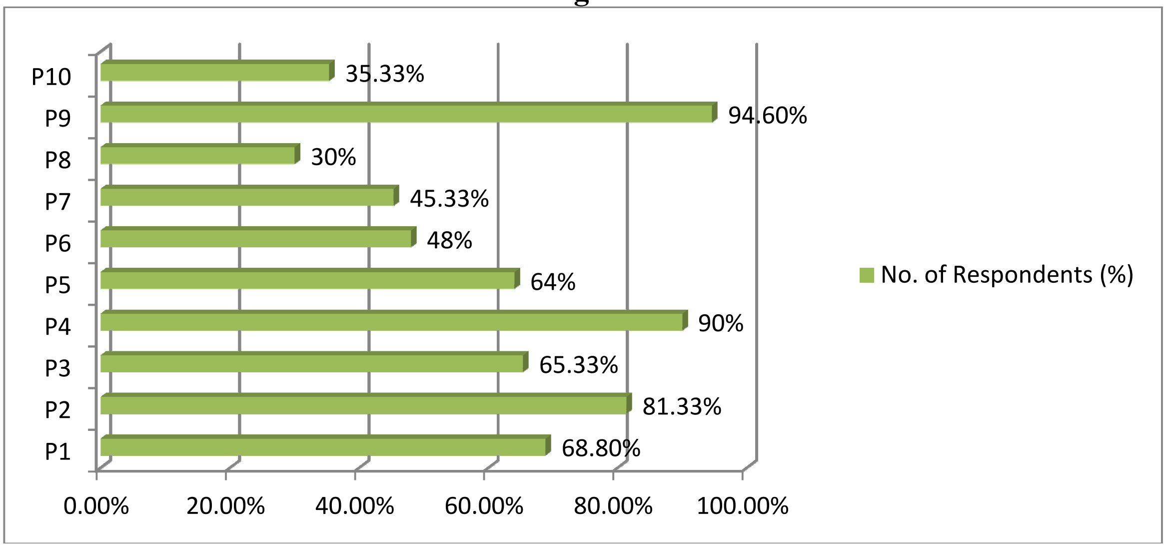
Table 4.2.1: Suggestions to increase Production and Productivity under Jhum Cultivation

Sl. No	Type of activities	No. of Respondents (%)	Rank
1	Quality seeds	102 (68.8%)	iv
2	Subsidies input	122 (81.33%)	iii
3	Efficient means of Transport and Communication	98 (65.33%)	v
4	Intensive Training	135 (90%)	ii
5	Possession of adequate and timely credit	96 (64%)	vi
6	Expansion of Market Infrastructure	72 (48%)	vii
7	Fixation of reasonable price	68 (45.33%)	viii
8	Promoting Irrigation Potentials	45 (30%)	x
9	Weed Control Mechanism	142 (94.60%)	i
10	Proportionate Land Distribution	53 (35.33%)	ix
	Total number of respondent	150	

Source: Field survey 2016-17

Note: Figures in parenthesis are percentage to the total

Figure 4.4: Ways to increase Production in Jhum Cultivation under Mokokchung District



P_1=Quality seeds, P_2= Subsidized Input, P_3=Efficient means of transport and communication, P_4= Intensive Training, P_5=Possession of adequate and timely credit, P_6=Expansion of market infrastructure, P_7=Fixation of reasonable price, P_8=Promoting irrigation potentials, P_9=Weed control mechanism, P_{10}=Proportionate land distribution

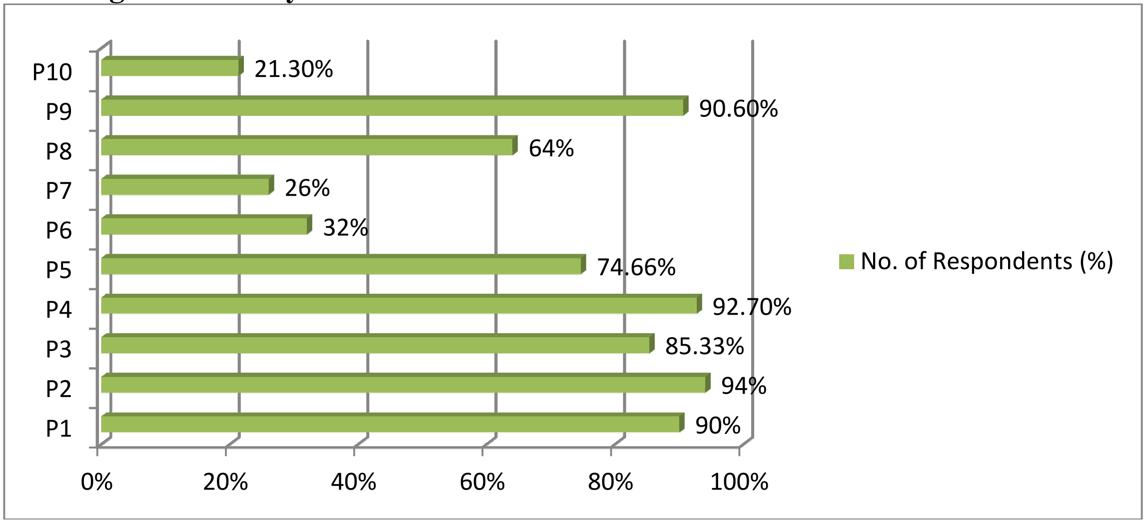
Table 4.2.2: Suggestions to increase Production and Productivity under Wet Terrace Cultivation

Sl. No	Type of activities	No. of Respondents (%)	Rank
1	Quality seeds	135 (90%)	iv
2	Subsidized input	141 (94%)	i
3	Efficient means of Transport and Communication	128 (85.33%)	v
4	Intensive Training	139 (92.7%)	ii
5	Possession of adequate and timely credit	112 (74.66%)	vi
6	Expansion of Market Infrastructure	48 (32%)	viii
7	Fixation of reasonable price	39 (26%)	ix
8	Promoting Irrigation Potentials	96 (64%)	vii
9	Weed Control Mechanism	136 (90.6%)	iii
10	Proportionate Land Distribution	32 (21.3%)	x
Total number of respondent		150	

Source: Field survey 2016-17
Note: Figures in parenthesis are percentage to the total

Similarly, in wet terrace cultivation, the suggestions given by farmers to increase production and productivity are shown in table 4.2.2. The data indicates that, farmers are more concerned about subsidies inputs, intensive training and weed control mechanism, which are the top priorities. About 94% of farmers suggested if Government provides subsidies input like, power tillers, tractors and chemical fertilizers, pesticides which will improve the yield rate, while 92.7% suggested that if Government provides intensive training about how to do farm practices and scientific method to enhance productivity levels. On the other hand, land distribution, price fixation and market infrastructure were given less priority by the respondents since they use to cultivate for self consumption and not for commercial purpose.

Figure 4.5: Ways to increase Production in WTC under Phek District



P_1= Quality seeds, P_2= Subsidized input, P_3= Efficient means of transport and communication, P_4= Intensive training, P_5= Possession of adequate and timely credit, P_6= Expansion of market infrastructure, P_7= Fixation of reasonable price, P_8= Promoting irrigation potentials, P_9= Weed control mechanism, P_{10}= Proportionate land distribution

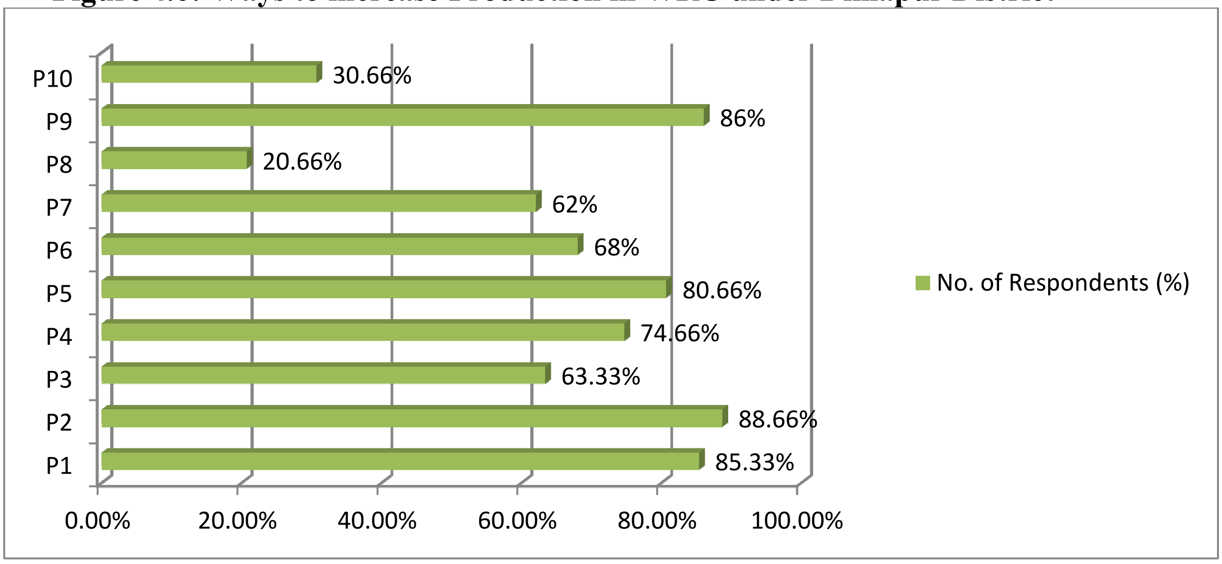
Correspondingly, in Dimapur district, the rice growers suggest on subsidized input as the main priority, followed by weed control mechanism. It can be seen from the Table 4.2.3, that, out of the total respondents, 88.7% of the respondents express their opinion on subsidies inputs like, tractors, power tillers, chemical fertilizers and other farm equipments are needed to improve the productivity through adoption of intensifying farm practices. Weed control mechanism is also another area of concern to give more priority to increase yield level, followed by supply of quality seeds (128), provision of adequate and timely credit (121) and intensive training facilities for the farmers. However, promoting irrigation potentials, land distribution, and fixation of reasonable price are given less importance since most of the farmers are using river canal source and land is not available to expand and majority of the farmers are producing for self consumption. The study reveals that, though there is slighter differences in priorities among the three farming systems, major concern are weed control mechanism, subsidized input, supply of quality seeds, training and credit possession are some of the major areas in which Government needs to focus to improve the production and productivities in the study villages.

Table 4.2.3: Suggestions to increase Production and Productivity under Wet Rice Cultivation

Sl. No	Type of activities	No. of Respondents (%)	Rank
1	Quality seeds	128 (85.33%)	iii
2	Subsidies input	133 (88.66%)	i
3	Efficient means of Transport and Communication	95 (63.33%)	vii
4	Intensive Training	112 (74.66%)	v
5	Possession of adequate and timely credit	121 (80.66%)	iv
6	Expansion of Market Infrastructure	102 (68%)	vi
7	Fixation of reasonable price	93 (62%)	viii
8	Promoting Irrigation Potentials	31 (20.66%)	x
9	Weed Control Mechanism	129 (86%)	ii
10	Proportionate Land Distribution	46 (30.66%)	ix
Total number of respondent		150	

Source: Field survey 2016-17
Note: Figures in parenthesis are percentage to the total

Figure 4.6: Ways to increase Production in WRC under Dimapur District



P_1= Quality seeds, P_2= Subsidized input, P_3= Efficient means of transport and communication, P_4= Intensive training, P_5= Possession of adequate and timely credit, P_6= Expansion of market infrastructure, P_7= Fixation of reasonable price, P_8= Promoting irrigation potentials, P_9= Weed control mechanism, P_{10}= Proportionate land distribution

4.3 POLICY IMPLICATIONS

a) Efforts have been made by Government of India by taking various steps and programmes like, Special Rice Production Programme (SRPP), Integrated Programme for Rice Development (IPRD), High Yielding Varieties etc, for meeting the rice requirement and to attain self-sufficiency but these policies did not have much implication in Nagaland due to various reasons. State Government should take initiatives to implement central sponsored programmes that will encourage the growers to take rice cultivation seriously and for this financial assistance, various trainings and programmes are very important.

b) Government should give efforts and initiate to establish Research and Development centers which will help in developing new genetically modified seeds, that will help in identifying indigenous varieties of rice which will enable the people in general and farmers in particular for promoting livelihood and food security as climate change adaptation strategy. It should stress to promote indigenous practices and to create its awareness and its effective dissemination, which will need the support and coordination between the various concerned department, voluntary organization and the people[18].

c) Efforts should be made to make the farmers efficient and effective by investing in Humans Resource Development which will enable the farmers to adopt all the modern means of ideas and scientific knowledge of cultivation that will result in increasing production and productivity. It will also enable the farmers to keep themselves prepared to overcome situations like bad monsoon, draught, or any natural calamities that might affect their harvest. The adoption of SRI technique help increase rice production without increasing the area under cultivation and serve as an alternative method of rice cultivation since it increases productivity and net profit that helps to attract the farmers[19]. Indigenous crops are not explored to its fullest potential and it will be of great benefit for the State if adequate provisions are made for promotion of these indigenous crops commercially under the programmes of the State.

d) Establishment of formal credit institutions that can help the farmers to avail financial assistance quicker and easier. [20] Strong and viable agricultural financial institutions are needed to cater to the requirements of finance for building necessary institutional and marketing infrastructure. It will attempted to bring together

[18] Longshibeni N Kithan (2014), 'Indigenous for of Paddy Cultivation in Terrace and Jhum fields among the Nagas of Nagaland'. *International Journal of Scientific and Research Publications*, Vol. 4(3)

[19] K. Sita Devi and T. Ponnarasi (2009), "An Economic Analysis of Modern Rice Production Technology andits Adoption Behaviour in Tamil Nadu".*Agricultural Economics Research Review,*Vol. 22, Pp 341-347

[20] Rakesh Mohan (2006), "Agricultural Credit in India: Status, Issues and Future Agenda". *Economic and Political Weekly,* Vol. 41 (11), Pp. 1013-1023

technology inputs, provision of infrastructure inputs like power at subsidized costs, inputs like seeds, fertilizers, tractors, and most importantly, credit provision.

e) A well regulated market and change in policies is very much in need for a state like Nagaland where most of the produce are being sold away to middle man who takes advantage of the ignorance and the conditions of the farmers. A regulated market will help to keep check any malpractices by any third party, as well as the fluctuations in demand, supply and price can be controlled.

f) Every rural household in Nagaland is into rice cultivation and it is a source of income and employment. Since it requires lot of human labours in every stage of production, starting from clearing field, transplanting till harvesting and transporting etc, it gives the people with enough employment opportunities. Government should encourage rice cultivator by providing assistance in the form of training, seeds, fertilizers and equipments etc., to make the farmers self-employed and self-dependent.

g) Improving and providing good road connectivity to the rural areas assumes greater importance to sustain the agrarian based economy. A proper connectivity to the potential areas from the village and from village to highways and then to markets will boost the economy of the rural farmers as it enables for a timely and smooth transportation of the produce. So, construction of rural roads will change rural economy at faster pace having long term socio economic development by improving economy and living standard of rural farming community. Along with this, there is an urgent need for modern storage houses that will help the farmers to keep the yield for a longer period of time and also to reduce grain loss to weather, moisture, rodents, birds, insects and micro-organisms etc.

h) Government should take up initiative along with concerned Agriculture Department in training the rice growers starting from land preparation, crops establishment, harvesting and specially activities like drying the crops after the harvest as it reduces the moisture content in grain to a safe level for storage and it is the most critical operation after harvesting the rice. Delays in drying, incomplete drying or ineffective drying reduce grain quality and result in losses and most of the rice cultivators are unaware of it.

i) Subsidies in the form of financial assistance, machines, seeds, fertilizers etc should be given to those rice cultivators who are cultivating seriously to encourage them to take up rice cultivation more seriously and to expand the area under cultivation because there is enough land area in Nagaland that can be brought under rice cultivation and make the state a self-dependent on rice and if taken up seriously the state can even export rice to other states also but as of now area under rice in Nagaland is mostly small and marginal, like the rest of the country. About 78% of the farmers are small and marginal in the country and they are poor, so they are not in a position to use optimum quantity of inputs, which are essential for increasing the productivity[21].

j) Crop insurance in case of crop failure is also another important policy that the Government needs to take up to encourage farmers to cultivate rice. In India, agriculture is highly susceptible to risks like droughts and floods and it is necessary to protect the farmers from natural calamities and ensure their credit eligibility for the next season. The Government of India have introduced many agricultural schemes throughout the country, like Pradhan Mantri Fasal BimaYojana (Prime Minister's Crop Insurance Scheme) launched on 18 February 2016. But there is hardly any such schemes adopted in Nagaland that can protect the farmers in case of any such calamities. So, the Government should take up measure for crop insurance that will give the farmers the confidence to take up rice cultivation without any fear of being hit by crop failures as most of the farmers are dependent on monsoon for cultivation and a bad monsoon can badly affect their production and productivity.

Rice is a staple food of the people in Nagaland and the state has an area of over 70 per cent under rice cultivation which contribute to about 75 per cent to the total food production in the state. Naga farmers have been practicing Jhum, Wet rice and terrace form of cultivation. But the state is not self sufficient in rice production. Use of chemical and fertilizers are very common in most of the countries and also many rice cultivators even in India use such chemicals to increase production and productivity and also to protect it from pests and diseases etc. Studies found that Dimapur district use the highest amount of chemical fertilizer followed by Phek district whereas the use of chemical fertilizer is totally nil in Mokokchung district. Although the

[21] IkisanAgri-Informatics & Services Division of Nagarjuna Fertilizers and Chemicals Ltd (NFCL).http://www.ikisan.com/ka-rice-crisis-management.html. Retrieved on 6/10/2018

agriculture sector remains one of the largest contributors to the state's economy, the share of agriculture and allied sector in the Gross State Value Added (GSVA), which was 30.9 per cent in 2011-12, has declined to 29.4 per cent as per the quick estimates of 2015-16, reports the 2016-17 economic survey of Nagaland. Agriculture and the allied sector registered a growth of only 1.8 per cent during the corresponding period. Though 71 per cent of the state's population still depends on agriculture, there is a gradual shift from agriculture towards other sectors of the economy.

In order to meet the demand for rice in the state and to become a self-sufficient state we need to take up an inclusive, intensive and integrated agriculture which can be achieved by blending traditional knowledge with time tested climate resilient crops and new technology. Even though there is scope of increasing the area under rice, the state has limited scope of increasing production by expanding the coverage of cultivable land because of the demographic structure. So, it needs to encourage the farmers to go for increasing the cropping intensity, which means raising the number of crops from the same field during an agricultural year. The state witnessed an increase in cropping intensity by 134.9 per cent in 2016-17, registering an increase by 9.7 per cent since 2005-06. Besides increasing cropping intensity, farm water management is also another important criterion for enhancing production and since most of the soil is still very fertile in the state; there should be initiative from the Government to encourage the rice cultivators to go for organic manures, even though the use of chemical fertilizers and all cannot be stopped fully. To encourage the rice cultivators to apply all these policies and make it applicable, bring all these changes and to achieve our target of self-sufficiency in food grains specially rice grain it will be a very difficult task but it is still very much achievable for a state that has witnessed an increase in the total foodgrain production in 2016-17 by 7,11,430 MT, an increase of 34,530 MT from 2015-16, and an increase in production of rice from 2,36,350 MT in 2001-02 to 4,78,210 MT in 2015-16, registering an increase of 102.3 per cent. Even though, the state is still not self-sufficient in rice production but for a state that has been awarded the Krishi Gramin Award by the Union government in 2011, 2012, 2013 and 2014, this is not an impossible dream but it need the support of the Government as well as the willingness from the side of the farmers.

RECAPITULATION

Rice is a staple food crop of the Nagas, and has been practicing rice cultivation for more than 100 years but the state is still importing rice to meet the demands of the ever growing population. Even though the state has been witnessing an increase in yield over the years but still it is not sufficient to meet the needs of the people and there are many reasons for this shortcomings. Most of the area under rice is under jhum cultivation and it is difficult to increase the area under rice due to the geographical factors, there is a lack in use of scientific knowledge and technology specially when it comes to jhum cultivation, lack of support from the Government, no proper regulated market to control demand and supply and to check the fluctuations in prices, no crop insurance, lack of subsidies, and lack of training for the farmers etc. Despite of all the problems, Nagaland has a favorable climate and fertile soil to increase its production and productivity if the Government can take the initiative to take up the challenges by encouraging the rice cultivators.

CHAPTER 5

SUMMARY AND CONCLUSION

BACKGROUND

In the light of analysis in the preceding chapters, it is attempted here to summarize the findings of the study. The main objective of the study is to understand the rice production systems and the available resources are being used by the cultivators in the different farming systems to assess the production efficiency of rice cultivation. Agriculture is a source of livelihood for more than 70% of Indians in the rural areas. It contributes around 14.3% to the total Gross Domestic Product and also the largest employer contributing 52% of the total workforce. The contribution of this sector to total GDP has been continuously falling despite the fact that majority of work force are employed in this sector.

Rice is the second most important food crop in the World and the staple food of over 50% of the world population, particularly in India, China, and a number of other African and Asian countries. In the long and turbulent history of the human race, one of the most important developments that led to the development of civilizations was the domestication of rice. It was the single variety of grain has fed and nourished more people over a longer period of time than any other crop. India has the world's largest area under rice cultivation and is the second largest producers of rice after China, accounting for 20% of global rice production and is one of the leading exporters of rice in the world.

The Green Revolution in India started in the mid 1960s and with its success India attained food self-sufficiency within a decade. However, this first wave of the Green Revolution was largely confined to wheat crop, and in northern India like Punjab resulted in a limited contribution to overall economic development of the country. The agricultural growth in 1980s, and it enabled to raise rural income and alleviate rural poverty substantially. In a span of 65 years from 1950-51 to 2016-17, the production, area and yield of rice have increased by about four times, one and a half times and three times respectively. It is interesting to note that the rate of increase in production of rice is much higher than the rate of increase in area. This is due to the increase in yields as a result of intensifying farm practices in all the states. Increased irrigation facilities, reclamation of follow and waste lands and introduction of high-yielding crops made this possible in recent years.

Agriculture is a way of life that is deeply interwoven in Naga culture and tradition. The development of agriculture and allied activities are therefore the key to overall progress of Nagaland economy and it is a crucial sector not only for ensuring food security but also for improvement of livelihood. There are three distinct agricultural systems under rice farming prevailing in the state, such as shifting (Jhum) cultivation, Wet Terrace Cultivation (WTC) and Wet Rice Cultivation (WRC).Shifting cultivation is the most primitive method, where plot is cleaned and prepared manually and seeds are either broadcast or dilled just before the onset of monsoon, then continues weeding and crop is harvested. No farm animals and machineries are being used. Moreover, Jhum cultivation is associated with soil erosion, forest depletion, destruction of natural habitat of wildlife etc. On the other hand, wet terrace cultivation is traditional rice farming practiced in Kohima and Phek districts, in which the hill slopes through streams on the basis of height and breadth of terrace bench. On contrary to that, wet rice cultivation is done in limited valleys and plain areas in the state using intensive cropping method and practices. Accordingly, the focus of the present study is to understand different farming system and thereby examines the production efficiency with reference to jhum, terrace and wet rice cultivation practices among the farm size groups across the selected villages in three different districts.

With this broad issues in mind, the objectives of the study are: to investigate the existing rice production systems in Nagaland, to evaluate cost of production and causes for cost variations under different rice farming systems in Nagaland, to study the efficiency of production and productivity, study the factors influencing and to analyze the farmer's perceptions on problems and prospects of rice growing farm groups in the study villages. Consistent with the above objectives three major hypotheses have been formulated: The first hypothesis, Wet Terrace Cultivation (WTC) and Wet Rice cultivation (WRC) have higher return compared to and Jhum Cultivation. Secondly, irrigated rice farms are more capital intensive than Jhum cultivation. The third hypothesis is that, farm characteristic, farm size and household assets other are significant factors affecting the efficiency of rice production in the study area.

The study is a comparative study and has been carried out in the three districts of Mokokchung, Phek and Dimapur on the basis of the existence of three different farming systems. The study has been carried out taking both primary and secondary data. Secondary data includes data from both published and unpublished sources of various administrative reports. Primary data has been collected using a well prepared interview schedule. Three districts were selected purposively and from each District, three blocks have been selected and from each block one village was selected randomly. For Mokokchung District, the villages of Mongsenyimti under Chuchuyimlang Block, Longmisa village under Ongpangkong North Block and Longkhum village under Ongpangkong South Block was selected, while for Phek District Pfutseromi village under Pfutsero Block, Chizami village under Chizami Block and Kikruma village under Kikruma Block were selected. On the other hand the village of Singrijan under Dhansiripar Block, Nihoto under Kuhuboto Block and Nihokhu under Nihokhu Block were selected respectively in Dimapur District. 50 household from each village were selected and households were stratified into four farm groupsnamely, Marginal Farmers (MF), Small Farmers (SF), Medium Farmers (MDF) and Large Farmers (LF). The households are selected randomly and the total sample size is 450. For analyzing the data, statistical and econometric tools and techniques have been used.

5.2 Major Findings

The findings of the study are as follows:

5.2.1: Rice Cultivation in India

The overall area under rice cultivation in India registered an increasing trend during the study period. Among the major rice producing states, Punjab registered the highest growth, while other states witnessed a negative growth in which Madhya Pradesh registering the highest fall during the study period. Similarly, production also registered an increasing, in which Punjab registering the highest, while Karnataka witnessed the largest decline among the states. However, all the major rice producing states except Bihar, Odisha witnessed an increasing trend over the study period. On the contrary to that, in productivity Bihar registered highest growth at 6.44%, followed by Odisha, while Punjab witnessed lowest yield growth over the period of study. The regression shows that, both the coefficient of area and yield for the whole country as well as selected states have expected signs and positively associated with dependent variable and it is statistically significant at 1 percent level. R^2 value of 0.777 for all India level clearly indicates that, the effect of area and yield on production is significant and it implies that about 77% variation is explained by explanatory variables.

5.2.2 Rice Cultivation in North East Region

Most of the states in North East Region witnessed an increasing trend in area under rice during the study period and the state of Manipur witnessed the highest increase in area, which was more than the average of the region. While Mizoram witnessed the highest negative trend among the North East Region (NER) states. In case of production, the region witnessed an increasing trend higher than the national average. Among the North East Region (NER) states, Meghalaya registered the highest growth, while Mizoram witnessed the highest fall. Similarly, in productivity of rice in North East Region was found to be lower than the national average. Among the states, Meghalaya registering the highest productivity, while Manipur registered the lowest over the period of time. The regression analysis indicates that, both the factors of area and productivity have expected signs and statistically significant at 1 percent level in Assam, Meghalaya, Mizoram, Nagaland and Tripura, while insignificant in Arunachal Pradesh, Manipur and Sikkim. The R^2 value in case of Assam, Meghalaya, Mizoram, Nagaland and Tripura are .999 and it reveals that, 99 % variation in production are explained by area and yield as explanatory variable.

5.2.3 Rice Cultivation in Nagaland

Rice is stable food crop of Nagaland and about 70% of cultivated area under food grain production. Analysis reveals that area under Jhum and WRC/WTC witnessed an increasing trend in Nagaland during the study period. However, area under jhum increased only by a slight margin when compared to area under WRC/WTC. Among the districts under jhum, Peren registered the highest growth in area, while Phek witnessed the highest fall registering a negative growth. Whereas, area under WRC/WTC, Longleng registered highest growth, while Kohima registered negative growth at higher level during the study period. Even in case of production, both jhum and WRC/WTC registered an increasing trend, though the rate growth factors are different in which production was higher under WRC/WTC then jhum cultivation. Mon district registered the highest growth, while Phek district registered negative growth in production under Jhum. However, all the districts registered a positive trend in production under WRC/WTC, in which Longleng district registering the highest growth, while kohima registering the lowest during the study period. Interestingly, productivity of rice under jhum and WRC/WTC registered an increasing trend in all the districts during the study period. Though WRC/WTC registered higher yield, jhum cultivation also registered positive in yield. Kohima district registered the highest growth, while Kiphire witnessed the lowest in productivity under jhum. On the other hand, Mon district registered the highest, while Peren district registered the lowest increase under WRC/WTC during the study period. The regression result shows that in jhum cultivation as well as WTC and WRC all the coefficient have expected signs and statistically significant at 1 percent level. The R^2 value is 0.99 which indicates that, the effect of area and productivity is significant and about 99% variation in production is explained by area and yield as explanatory variables.

5.2.4: Distribution of Ownership and Operational Land Holdings

Land distributions in all the three rice farming systems are disproportionate and skewed. In jhum cultivation, majority of the land belong to the community or the clan who controls and decides the location of field for cultivation every year, while in wet terrace cultivation the ownership of land belongs to the community, as well as private individuals. However, in wet rice cultivation the ownership of land belongs to private individuals. Longkhum village was found to be having the highest average land holding among the selected villages and medium farmers constitute the largest group and own the highest area of land, while marginal farm size groups were least and also having the less landholding during the study period. Whereas, in Longmisa village, medium farmers owns largest area, while marginal farmers owns the least. Similarly, in Mongsenyimti village, medium farmers constitute the highest in number as well as own largest area, while marginal farmers have the least. In all the three villages under Mokokchung district, medium farmers were found to be the highest in number as well as owns the largest area of land, while marginal farmers have the least in numbers as well as own least indicating that there is an uneven distribution of land among the farm size group across the villages. On the other hand, marginal farmers use the entire land for cultivation, while large farmers operate about sixty percent of their total land holdings.

Similarly, in Kikruma village, medium farmers are larger in number and also have the largest land holding among the farm size groups, while large farmers are the least. In case of Chizami village, the numbers of households are almost equal in proportion, except large farmers who constitute the least but have the highest average holdings. Whereas, marginal farmers obtain the least land area when compared to their counterparts. In Pfutseromi village, medium farmers were found to be slightly bigger in number as well as owning largest land holding. The study reveals that, in wet terrace farming system, medium farm size group constitutes the largest group and also owns the highest lands, while large farm size group are least in number but acquire highest average holdings among the farm size groups.

Wet rice cultivation reveals that, the practice of land leased market was found in Nihokhu village. Medium and large farmers were the ones found to be involved in land lease practices. The contracts are based on oral commitment and the mode of payment was based on 1/3 of the production or a fixed amount of tins of grains. Medium farmers constitute the largest farm size and owning the largest land area in Nihokhu village, while marginal farmers are the least in number and also have the lowest land holding. In Singrijan village, small farmers constitute the largest group and also own the highest land area, while large farmers operate in the entire area of land for cultivation. However, in case of Nihoto village, the largest area is under large farmers who constitute the least in number among the farm size groups. The study reveals that, area under rice is higher under Jhum cultivation, followed by wet terrace cultivation and wet rice cultivation, which reveals that Jhum is still the most prevalent rice farming system in Nagaland. The study also found that, medium farmers were larger in number while large farmers were the least in all the three farming systems. Interestingly, land fragmentation was very common in all the villages under WTC, which was a major hindrance for the farmers during the study period.

5.2.5 Labour Absorption

Analysis reveals that, Jhum cultivation absorbs the highest labour, while Wet Terrace Cultivation absorbs the lowest among the three farming systems. Among the operation wise, the study found that, land clearing, weeding and harvesting absorbs the highest man days. Whereas, spraying and burning use the lowest man days in all the selected farming systems. It was also found that, male labour absorption was higher in all the farming systems, except in wet rice cultivation in which the proportion of female labour was higher compared to their counterparts. Similarly, wet rice cultivation absorbs the highest hired labour, while wet terrace cultivation absorbs the lowest. The study reveals that, the participation of both male and female are equally important for cultivation of rice in all the three farming systems though there are slight variations in the man days.

5.2.6 Cost and Returns

Distribution of cost and returns among the selected farming systems, wet terrace cultivation was found to incur the highest cost of production, while wet rice cultivation incurs the lowest cost. On the other hand, wet rice cultivation incurred the highest input cost, while labour cost was highest under jhum cultivation. Among the farm size groups, small farmers under wet terrace cultivation incur the highest cost of production, while large farmers under wet rice cultivation incur the lowest. In case of returns, wet rice cultivation gets the highest revenue and profit, followed by wet terrace. However, though the farmers under jhum cultivation incur losses in all the study villages, they are receiving additional income through practicing mixed cropping which compensate the losses. Small farmers under wet rice cultivation earn the highest profit among all the farms size groups, while small farmers under wet terrace cultivation earn the lowest.

5.2.7 Land Productivity

Analysis reveals that, Wet Rice Cultivation (WRC) is the most productive among all the three farming systems. However, jhum cultivation was found to be the least productive. Small farmers under wet rice cultivation were found to be the most productive among all the farming systems, getting the highest yield per acre, while large farmers under jhum cultivation were the least productive. The main reason for higher productivity under wet rice cultivation is due to use of all the required inputs, when compared to jhum cultivation where the uses of inputs are very less.

5.2.8 Production function and Efficiency Measurements

The regression analysis reveals that, farm size plays the most vital role in production of rice in all the rice farming systems. Variables like, household age and cost on pesticides shows a positive and statically significant with the dependent variables under wet rice cultivation, whereas, variables like, household head education, fertilizer cost and family indebtedness shows a negative but statistically significant. In case of jhum cultivation, the regression analysis reveals that, variables like household assets, seed cost, capital cost and labour cost show a positive and statistically significant. On the contrary, pesticide cost shows a negative and statistically significant, while variables such, as age and education of the household head, family income etc., show a positive association but statistically insignificant with the dependent variable. The regression analysis of wet terrace cultivation reveals that, family income to be negative and statistically significant. On the contrary, age and education of head of household, manure cost, technological cost, and labour cost shows positive association but is statistically insignificant to the dependent variable.

Cobb-Douglas production result reveals that, capital and labour plays a very important role in production of rice in all the three farming systems, though capital is showing to be playing more prominent role. Capital plays the most important role in the production of rice under wet rice cultivation, while labour is showing to be insignificant but it is an important input to accelerate the production and productivity. While under jhum cultivation, both labour and capital plays important role in the production process, while capital is shown to be playing prominent role. Though the labour factor shows statistically insignificant, it is an important input to enhance the yield in jhum, since it is highly labour intensive, when compared to other rice farming systems. Similarly, in wet terrace cultivation, capital plays a very vital role as compared to labour, which is showing a negative sign but since wet terrace is also highly labour intensive; both labour and capital are important to accelerate the production and productivity.

5.2.9 Problems Faced by the Farmers

In spite of more than 100 years of rice cultivation, farmers in Nagaland face many problems along with the problem of geographical factors. Different rice farming systems have different type of problems. They face problems from the time of production till the time of marketing. Some of the problems that jhum cultivators face are, traditional method of cultivation, over labour intensive resulting in higher cost, fully dependent on monsoon for irrigation and no adequate measures to protect the crops in times of drought or too much rain. On the other hand, farmers under wet terrace cultivation face the problem of fragmented land area, which hinders the use of modern machines like, tractors and power tillers, fields are also located in areas where it is difficult to take the machines till the field. Another problem is the use of very less quantity of fertilizers and manures, no proper irrigation facility, traditional method of cultivation, and no proper transportation facility and lack of credit facilities and training from concerned departments resulting in high cost of production and lower yield. Even though farmers under wet rice cultivation use most of the inputs but still the quantity of fertilizers and manures applied per acre is very less when compared to farmers from other states. Most of the farmers hire machines like tractors and power tillers as only few farmers have their own machines, which results in higher cost of production. There is lack of irrigation facility, over dependence on monsoon for irrigation, no crop protection in case of any calamities.

5.2.10 Suggestions of the Farmers

There are many suggestions given by the farmers to improve the condition of rice cultivation in Nagaland and to increase production and productivity. The top priority under Jhum cultivation was emphasized on, weed control mechanism, followed by intensive training facilities. Farmers also suggested for subsidized inputs and quality seeds from the Government, some respondents also suggested for land distribution, since most of the land is under community. Similarly, the suggestions given by farmers in wet terrace cultivation were subsidized inputs, intensive training and weed control mechanism as the top priorities. On the other hand, land distribution, price fixation and market infrastructure were given less priority by the respondents, since they use to cultivate for self-consumption only. While, the top priorities given by farmers under wet rice cultivation are on subsidized inputs, followed by weed control mechanism. However, promotion of irrigation potentials, land distribution, and fixation of reasonable price were given less importance, since most of the farmers are using river canal source and land is not available to expand and majority of the farmers are producing for self-consumption. The study found that, there are only slight differences in priorities among the three farming systems, and weed control mechanism, subsidized input, quality seeds, training and credit possession were some of the major concerns that were suggested by the respondents to improve the production and productivity.

5.3 Concluding Remarks

Study shows that, rice cultivation has come a long way and it has been a positive path even though the pace has been very slow. Rice cultivation in Nagaland is mostly for self-consumption and jhum is the most dominant rice farming system. The participation of male labour is more than female labour. This is because some activities require more male labours than the female. Efforts from the government as well as the steps and measure taken up by the rice cultivators have resulted in a positive impact. Study shows that, area under jhum has declined but productivity has increased and more area has come under WTC/WRC and the yield has increased by a big margin over the period of study. However, though the productivity increased in all the farming systems, the farmers are not in a position to sell apart from keeping it for self-consumption, giving some quantity in return for the services rendered during cultivation and some quantities are also lost due to pest attack and lack of proper storage. Since WRC is confined to plain area, it has advantages for easy accessibility of all the required inputs and technologies that can be applied in the field when compared to jhum and WTC. This is the reason for WRC getting more efficiency when compared to their counterparts. Only farmers under WRC are in a position to sell a part of their produce as compared to farmers under jhum and WTC but it was also found that, majority of the farmers sell to commission agents at lower price, which results in lowering their profit margins and thereby lowering their savings and investment for the future cultivation.

5.4 Policy Implications

(i). Changing the existing land distribution system in major districts under jhum cultivation (from community to Individual) would encourage the farmers to put more efforts and commitments to enhance productivity.

(ii). Introduction of high yielding rice varieties as per soil nature can enhance productivity substantially.

(iii). Need for sound management practices for soil fertility and pest control for all three farming systems.

(iv). Appropriate training should be provided to the farmers with commitment & skills and help to diffuse the technology.

(v). Strong institutional support, like credit, extension services and marketing facilities can improve the yield rate.

(vi). Promotion of selective mechanization and improved management practices to mitigate crop risks in all the farming systems are equally important to ensure higher productivity.

(vii). Need for special effort for production of quality seeds in adequate quantity for fragile environments conditions in jhum and terrace farming systems.

(viii). Timely supply of essential inputs and promotion of integrated pests as well as nutrient management have enormous potential to accelerate rice productivity.

(ix). Special emphasize on post-harvest management, processing and value addition technologies to improve quality and quantity of rice yield.

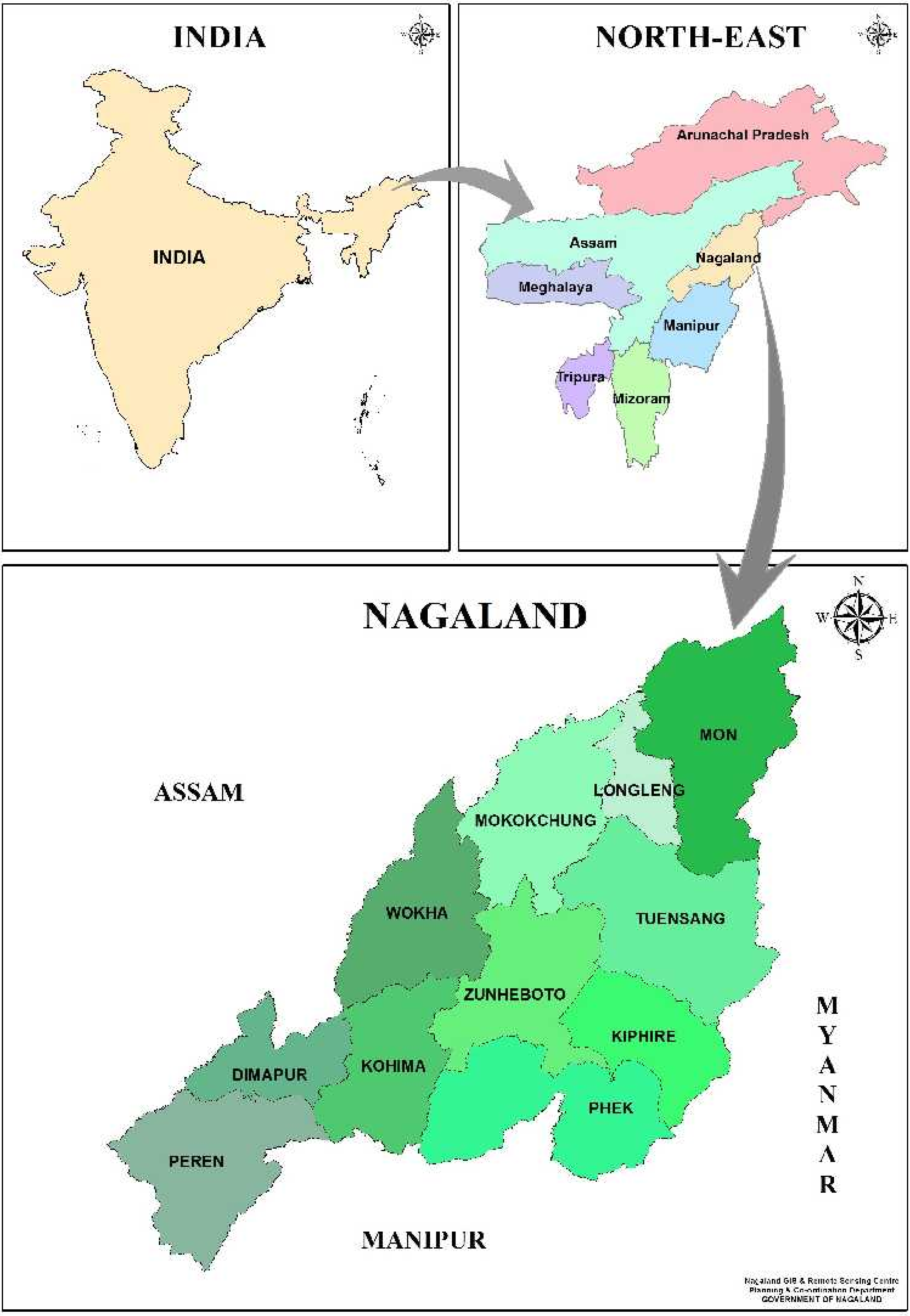
(x). Comprehensive irrigation and drainage systems in wet terrace and wet rice cultivation by integrated water management can increase yield efficiency in the state.

(xi). Agricultural Research and Development need to be reoriented through robust extension programmes and develop coordination between ATMA, KVK, SARS and farmers to reap the benefits of improved technologies.

(xii). There is a need for a strong commitment among farmers, farmer's organizations and government authorities for the development of the upland rice farming and the Government authorities should monitor the programmes from time to time.

5.5 Scope for Future Research

Rice is a staple food crop for the entire Naga people and more than 50% of the world population. The demand for rice keeps increasing every year so the scope for research on rice is very necessary to increase production and productivity so that we can meet these demands. Even though efforts have been made to bring out a reasonable contribution to know the condition of rice cultivators in Nagaland in respect to production and production efficiency under different farming systems, there is a lot of scope to carry out further research on this present study area. The present study has been done only in three districts of Nagaland, Mokokchung (Jhum), Phek (WTC) and Dimapur district (WRC) but we can do further research on the remaining districts to broaden our knowledge and to know the state of rice cultivation in Nagaland. Further study can also be done on comparing rice and other crops to get an idea and knowledge on production and productivity of other crops of the state. The study made an attempt to assess the production efficiency among the different farming systems in the state, and there is huge scope to carry out further research on cost minimizing and production increasing techniques to tackle the problem of import of rice from adjacent states.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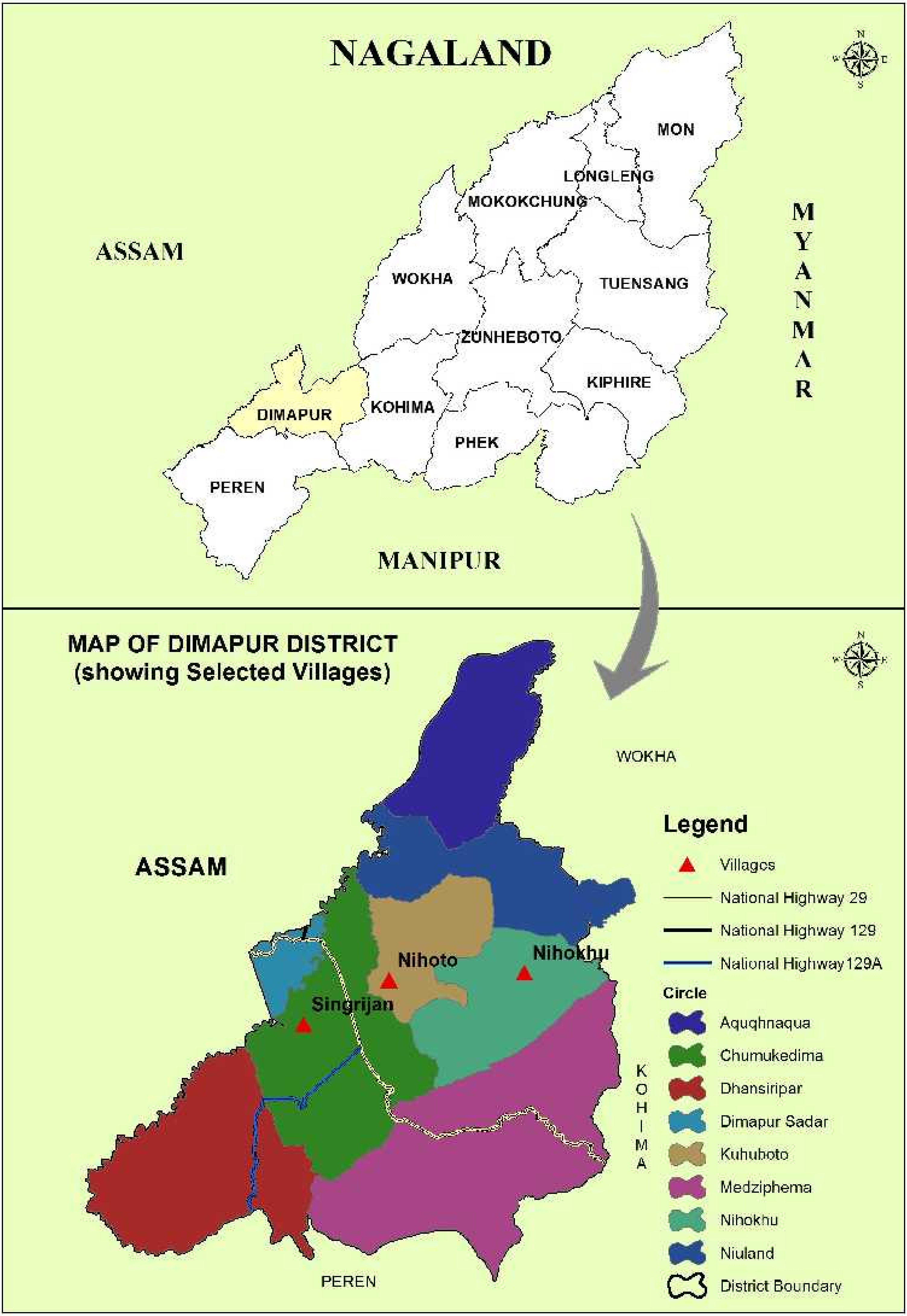
GOVERNMENT OF NAGALAND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TUENSANG
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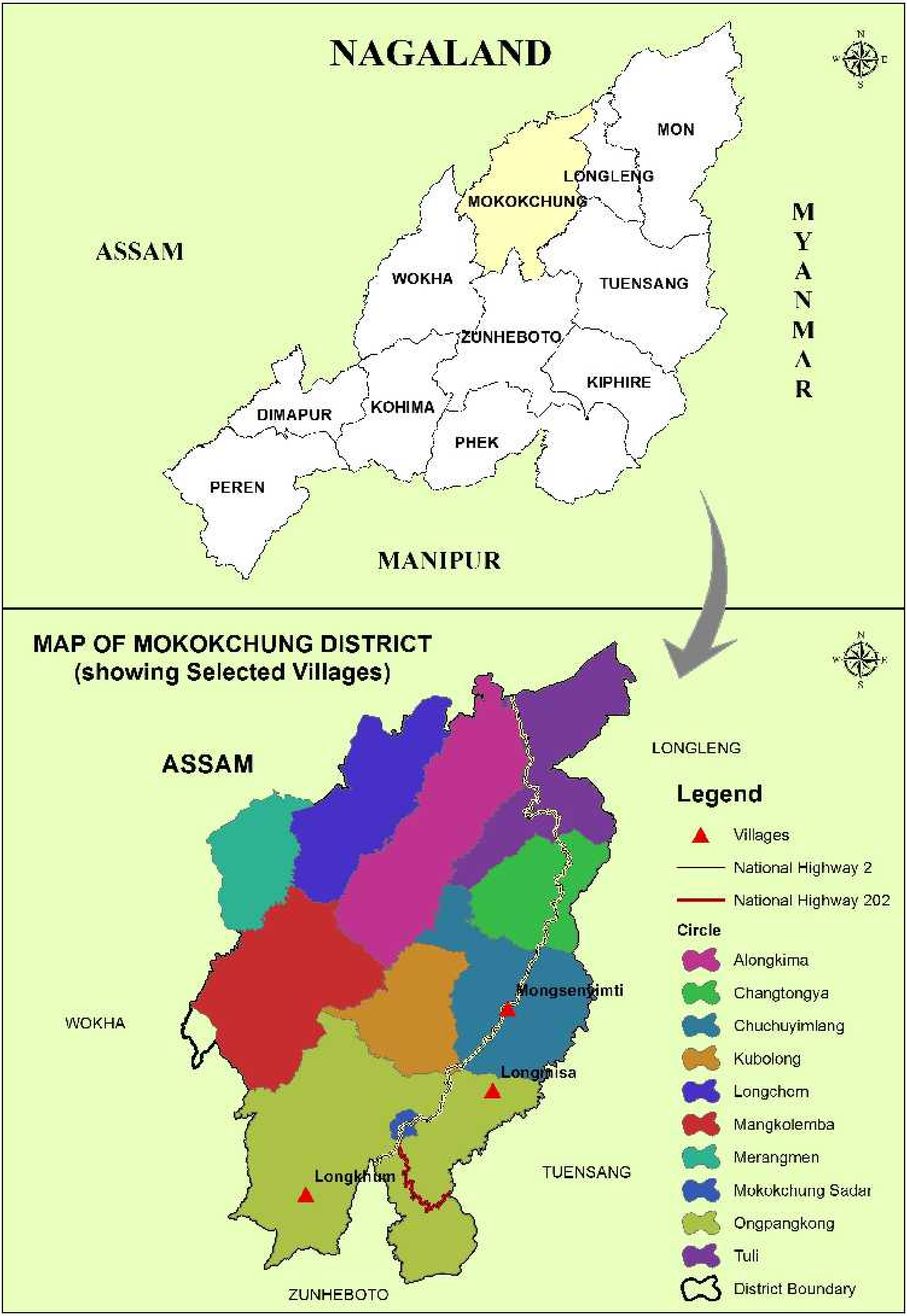
KOHIMA
PHEK
PEREN
MAP OF DIMAPUR DISTRICT
(showing Selected Villages)
WOKHA
ASSAM
KOHIMA
PEREN
Nihoto
Nihokhu
Singrijan
Legend
Villages
National Highway 29
National Highway 129
National Highway 129A
Circle
Aquqhnaqua
Chumukedima
Dhansiripar
Dimapur Sadar
Kuhuboto
Medziphema
Nihokhu
Niuland
District Boundary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DIMAPUR
KOHIMA
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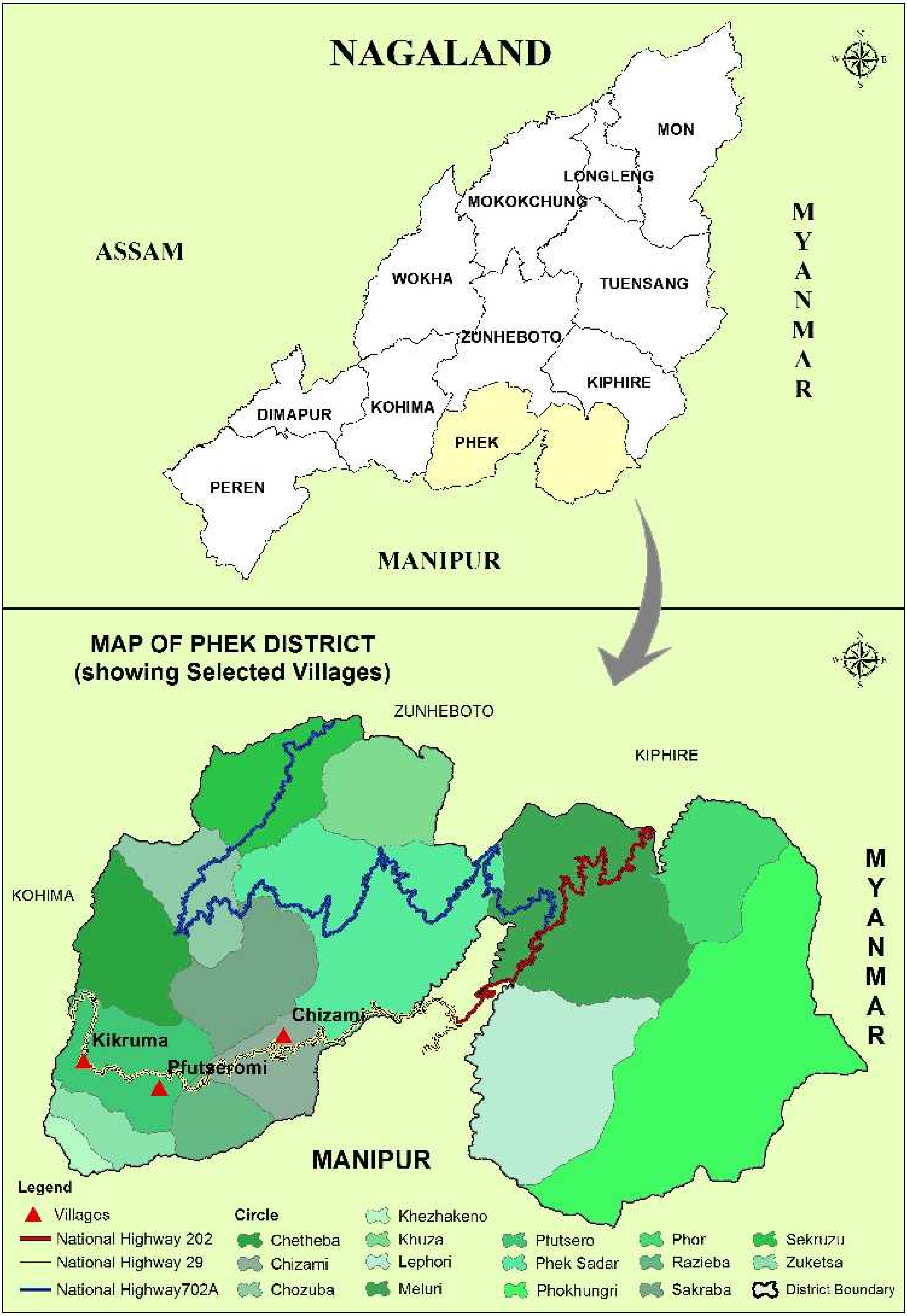
PHEK
PEREN
MANIPUR
MYANMAR
MAP OF MOKOKCHUNG DISTRICT
(showing Selected Villages)
ASSAM
LONGLENG
WOKHA
TUENSANG
ZUNHEBOTO
Mongsenyimti
Longmisa
Longkhum
Legend
Villages
National Highway 2
National Highway 202
Circle
Alongkima
Changtongya
Chuchuyimlang
Kubolong
Longchom
Mangkolemba
Merangmen
Mokokchung Sadar
Ongpangkong
Tuli
District Boundary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DIMAPUR
KOHIMA
PHEK
PEREN
MANIPUR
MYANMAR
MAP OF PHEK DISTRICT
(showing Selected Villages)
ZUNHEBOTO
KIPHIRE
KOHIMA
MYANMAR
Chizami
Kikruma
Pfutseromi
MANIPUR
Legend
Villages
National Highway 202
National Highway 29
National Highway702A
Circle
Chetheba
Chizami
Chozuba
Khezhakeno
Khuza
Lephori
Meluri
Pfutsero
Phek Sadar
Phokhungri
Phor
Razieba
Sakraba
Sekruzu
Zuketsa
District Boundary