A STUDY ON PROFITABILITY ANALYSIS OF BORO RICE CULTIVATION IN SOME SELECTED AREAS OF LAXMIPUR DISTRICT

MAISHA MUNA WOARUM

DEPARTMENT OF AGRICULTURAL STATISTICS

SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA-1207

JUNE, 2020

A STUDY ON PROFITABILITY ANALYSIS OF BORO RICE CULTIVATION IN SOME SELECTED AREA OF LAXMIPUR DISTRICT

BY

MAISHA MUNA WOARUM

Reg. No. 12-05199

A Thesis Submitted to
The Department of Agricultural Statistics, Faculty of Agribusiness Management
Sher-e-Bangla Agricultural University, Dhaka-1207
In partial fulfillment of the requirements
For the degree
Of

MASTER OF SCIENCE (MS)
IN
AGRICULTURAL STATISTICS
SEMESTER: JANUARY-JUNE, 2020

Approved by

Md. Zakir Hossain
Professor
Department of Agricultural Statistics
Sher-e-Bangla Agricultural University
Supervisor

Dr. Md. Mizanur Rahman Sarker
Professor
Department of Agricultural Statistics
Sher-e-Bangla Agricultural University
Co-Supervisor

Prof. Md. Zulfikar Ahmed Reza
Chairman
Department of Agricultural Statistics
Sher-e-Bangla Agricultural University

DEPARTMENT OF AGRICULTURAL STATISTICS

Sher-e-Bangla Agricultural University

Sher-e-Bangla Nagar, Dhaka-1207

CERTIFICATE

*This is to certify that the thesis entitled "**A Study On Profitability Analysis Of Boro Rice Cultivation In Some Selected Area Of Laxmipur District**" submitted to the Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in AGRICULTURAL STATISTICS**, embodies the result of a piece of bonafide research work carried out by **MAISHA MUNA WOARUM**, Registration No. **12-05199** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that such help or source of information, as has been availed during the course of this investigation has been duly acknowledged and style of this thesis have been approved and recommended for submission.

Dated: November, 2020
Place: Dhaka, Bangladesh

Md. Zakir Hossain
Professor
Department of Agricultural Statistics
Sher-e-Bangla Agricultural University
Supervisor

DEDICATED
TO
MY MOTHER

ACKNOWLEDGEMENT

Bismillahir Rahmanir Rahim. I would like to thank Almighty Allah, the most merciful and kind hearted, the most gracious and beneficent to Whom every praise is due and to His prophet Mohammad (SM) Who is forever a torch of knowledge and guidance for humanity as a whole with who's delighting the present and endeavour beautiful. All praises are due to the omnipotent, omnipresent and omniscient Allah, who enabled me to pursue my higher studies in Agricultural Statistics and to complete this thesis successfully for the degree of Master of Science in Agricultural Statistics.

Now, I would like to pay ineffable gratitude to my ***Supervisor Md. Zakir Hossain,*** *Professor, Department of Agricultural, Statistics, Sher-e-Bangla Agricultural University, Dhaka-1207, for his ever inspiring guidance, scholarly comments and constructive suggestions throughout the preparation of thesis. Without his valuable intellectual advice, precise constructive comments and help this work would never have come to life.*
I am especially grateful to my respected ***Co-supervisor, Dr. Md. Mizanur Rahman Sarker,*** *Professor, Department of, Agricultural, Statistics, Sher-e-Bangla Agricultural University, Dhaka, for his proper guidance, inspiring co-operation and encouragement during the research work and preparation of thesis.*

I would like to extend my appreciation to ***Md. Zulfikar Ahmed Reza Chairman,*** *Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka, for his sincere cooperation, valuable suggestions and encouragement at every stage of this thesis paper.*

I am highly grateful to all of teachers, for their valuable teaching, direct and indirect advice, encouragement and cooperation during the whole study period.
I would like to express my gratitude to 80 farmers who actively participate in this survey and most importantly help me to understand their initiatives and activities related to boro rice farming in general and in particular. They provided important data upon which different models were employed to evaluate the efficiency of farming activities. Their invaluable cooperation during my data collection process is highly acknowledged.
I would like to express my sincere appreciation to Md. Faruk Hossain, SDE, Laxmipur PWD Division, Laxmipur for his help during data collection process.

I found no words to thank my parents for their never-ending affection and continuous support, their sacrifices and untiring efforts to fulfil my dream of higher education. They were constant source of inspiration in the critical moments of my study.

June 2020
Maisha Muna Woarum

ABSTRACT

Bangladesh is an agro based country with an area of 148,460 square kilometers and a population about 162 million. Majority of the population of the country involves in agriculture. The study was undertaken to assess the profitability of Boro rice. A total of 80 farmers were selected by simple random sampling from the villages of Ramganj, Raipur and Ramgati upazila of Laxmipur district. Tabular technique and statistical analysis were done to achieve objectives. The Cobb-Douglas production function was used in this study to determine the effects of effects of individual inputs on Boro rice production. The major findings of the study were that the cultivation of Boro rice was profitable from the view point of farmers. The total return per hectare 111090.35 Tk. Gross Cost 78202.24 Tk. Total variable cost was 54451.90 Tk. Total fixed cost was 23750 Tk. Net return was 32888.11 Tk. The undiscounted BCR was 1.42. It is also observed that per hectare net returns were influenced by the factors included in model namely: human labor, insecticides, and irrigation. These factors were responsible for influencing per hectare net returns for Boro rice production. There were also some constrains and problems facing by the farmers during the production process as well as marketing of Boro rice. High price of inputs, high cost of irrigation, lack of quality seeds, lack of scientific knowledge about cultivation, inadequate extension service, lack of operating capital, natural calamities, low output price, high cost of transportations etc. were common problems faced by farmers. It can be concluded that the farmers should be encouraged to grow more Boro rice as a means of increasing their income. More HYV of Boro rice should be cultivated in the study area.

TABLE OF CONTENT

TITLE	PAGE

LIST OF FIGURE

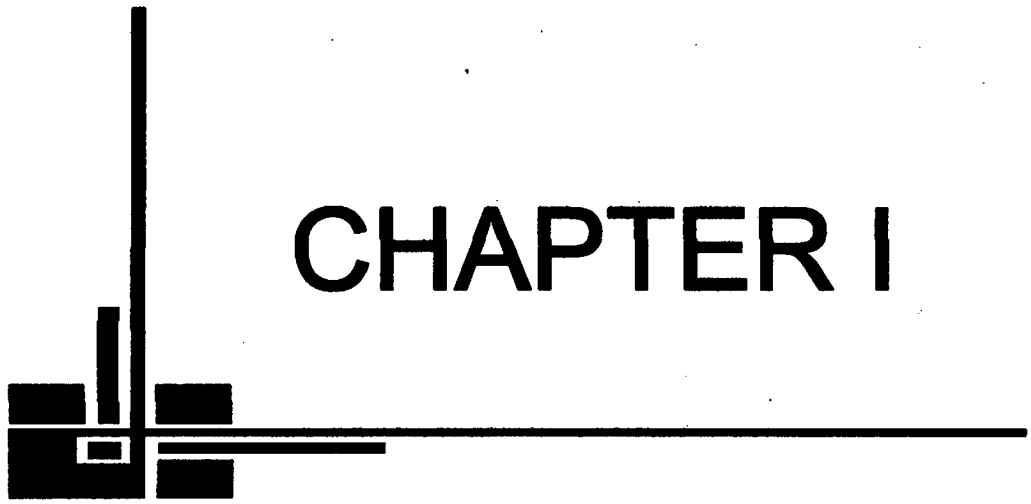
TITLE	PAGE

LIST OF TABLE

TITLE	PAGE

ABBREVIATION AND ACRONYMS

BARI : Bangladesh Agricultural Research Institute
BBS : Bangladesh Bureau of Statistics
BCR : Benefit Cost Ratio
BDT : Bangladeshi Taka
BER : Bangladesh Economic Review
CDP : Crop Diversification Program
DAP : Di ammonium Phosphet
DAE : Department of Agricultural Extension
FY : Financial Year
GM : Gross Margin
GDP : Gross Domestic Product
GAIN : Global Agricultural Information Report
GR : Gross Return
gm : Gram
ha : Hectare
HIES : Household Income and Expenditure Survey
HYV : High Yielding Varieties
IFPRI : International Food policy Research Institute
IOC : Interest on Operating Capital
Kg : Kilogram
MoP : Murate of Potash
MT : Metric Ton
NGO : Non-Governmental Organization
t : Ton
TC : Total Cost
TFC : Total Fixed Cost
TSP : Triple Super Phosphet
TR : Total Return
VC : Variable Cost
TVC : Total Variable Cost
US : United States
USDA : United States Department of Agriculture



CHAPTER I

CHAPTER I

INTRODUCTION

1.1 Background

The economy of Bangladesh is primarily dependent on agriculture .The predominance nature of agriculture in Bangladesh becomes obvious from its contribution to economic development and employment creation. Bangladesh is going to clinch third place in global rice production with an increased output of 36 million metric tons. A recent world Agricultural Production report of US Department of Agriculture USDA estimated that Bangladesh will have 36 million metric tons of rice while Indonesia 34.9 million metric tons, India 118 million metric tons, China 149 million metric tons 2020/ 21 period. Being dominant sector of Bangladesh economy the share of agricultural sector in Gross Domestic Product(GDP) at the beginning of eighties (1980-1981) was 33.07 percent which reduced gradually to 29.23 percent in 1990-91, 25.03 percent in 2000-01, 21.85 percent in 2005-06 and 20.24 percent in 2009-10 at constant prices. During 2011-12 the contribution of agricultural sector was 19.29 percent at current price. In 2019, the share of agriculture in GDP was 12.68 percent. Agricultural sector is comprised of four subsectors, e.g. crops, livestock, forestry and fisheries with crop subsector being the predominant one. The increasing rate of rice production is lessened slightly over the past few years compared to the rate of population increase. In Bangladesh rice is grown in three distinct seasons: Boro from January to June, Aus from April to August and Aman from August to December. Boro is the most important and single largest crop in Bangladesh in respect of volume of production. Boro rice alone contributes about 53.8% of total rice production while total rice production was 36.4 million metric tons estimated in fiscal 2018-2019 (IFPRI 2020). The development of more high-yielding, different maturity period, drought tolerant, disease-resistant and nutrient rich varieties will further boost rice production. Different crop management strategies and fertilizer application system will likewise enhance rice production. The Government should increase investment in rice research and extension programs to improve yield and reduce the cost of rice production in the long run.

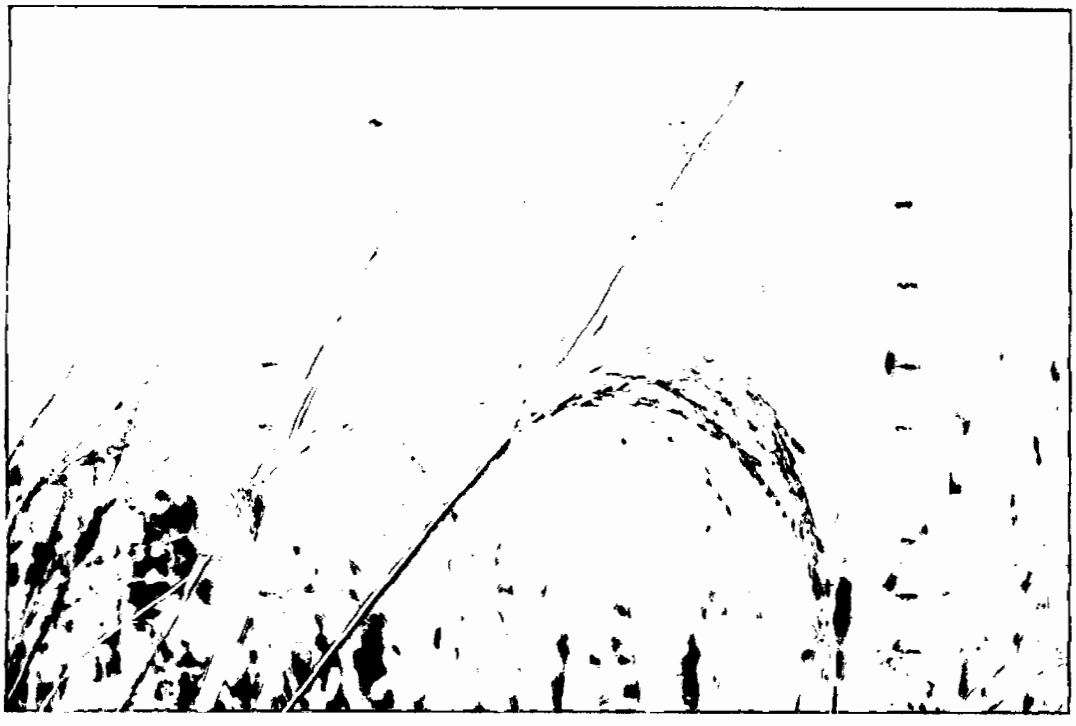


Figure 1.1: Picture of Boro rice

1.2 Status of Bangladesh Agriculture

Despite some diversification, most of the agricultural production is still concentrated on a limited number of crops and rice continuing to be the most important crop. While cash crops, like sugarcane and jute, have seen their production stagnating or declining over the past decades (BBS, 2020). Production of spices and tea has been increased. Production of fruits and vegetables has also improved. In non-crop sector, poultry, dairy and seafood have seen considerable growth. Bangladesh is an agro based country and most of the people directly or indirectly are involved in agricultural activities for their livelihood. Earlier more than 50% of GDP came from this sector. Due to industrialization, the activities of population got diversified towards different sectors. So the contribution of agricultural sector is slowly reducing and now declining to 13.35% of the GDP (BER, 2020). But still agriculture plays as the most prominent sector of the economy. Despite increase in the shares of fisheries, livestock, and forestry, Crop and Horticulture sub-sector alone accounts for 69.02% share of agricultural GDP in FY 2019-20, Livestock contributes 17.60% of Agricultural GDP, Forestry contributes 13.38 % of Agricultural GDP (BER, 2020).

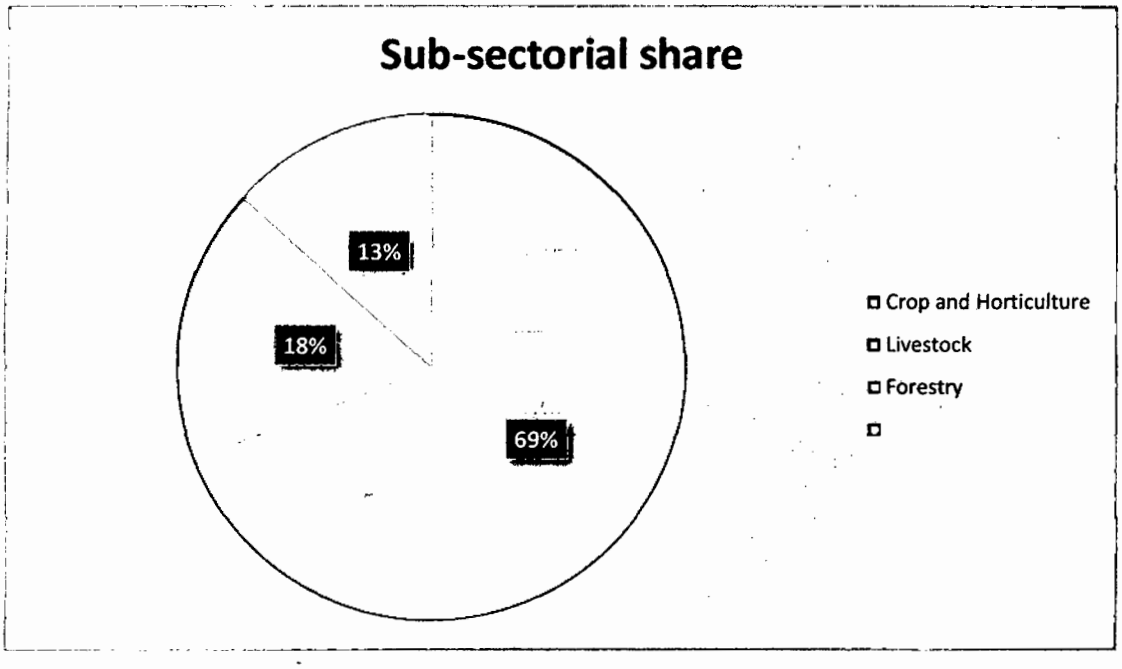


Figure 1.2: Sub-sectorial share of broader agricultural GDP in 2019-20

Source: BER, 2020

1.3 Importance of Boro rice

Rice as a complex carb, it is the primary source of energy for over half of the world's population. Depending on the strains of rice, it can contain decent amount of fiber, protein, vitamin B, iron and manganese. This means it can play a vital role against malnutrition. Rice is the staple food for entire 155.8 million people. Keeping this in mind, since the independence all the successive governments have given high priority for attaining self-sufficiency in food production. The development of high yielding modern varieties of rice which are highly responsive to inorganic fertilizer and insecticides, effective soil management and water control helped the country to meet the increasing food grain (Hayami and Ruttan, 1985). Boro is the most important and single largest crop in Bangladesh in respect of volume of production. It has been persistently contributing to higher rice production in last successive years. The demand for rice is constantly rising and 2.3 million people being added each year to its total population. Rice constitutes about 70 percent of total calorie intake for the people particularly for hard working people. For market year 2019/20 (May-April), total rice area and production levels are projected to increase slightly to 11.8 million hectares and 35.3 million metric tons assuming good weather and increased yield. Market year 2019/20 rice imports are expected to decrease

to 500,000 MT due to a higher level of domestic production that largely meets demand (GAIN Report, 2019).

The yield rate of rice, in particular for different years were shown in Table 1.1.

Table 1.1: Area and Production of rice and Boro rice by Different Years

Year	Production ('000' MT)	
	Rice	Boro rice
2003-04	26190	9745
2004-05	25157	10042
2005-06	26530	10047
2006-07	27319	10522
2007-08	28931	11386
2008-09	31317	11654
2009-10	31975	11631
2010-11	33542	11788
2011-12	33889	11886
2012-13	33833	111763
2013-14	34357	11838
2014-15	34710	11961
2015-16	34710	11794
2016-17	33804	11060
2017-18	36278	12008
2018-19	36391	11832

Source: BBS, 2020

1.4 Nutritive and medicinal value of this crop

Rice is the staple food of over half of the world's population. It is the predominant dietary source for 17 countries in Asia and Pacific, 9 countries in North and South America and 8 countries in Africa. Rice provides 20% of the world's dietary energy supply, while wheat supplies 19% and maize 5%. A detailed analysis of nutrient content of rice suggests that the nutrition value of rice, that is between white, brown, red and black varieties of rice, each prevalent in different parts of the world. It also depends on nutrient quality of the soil rice is grown in, whether or how the rice is polished or processed, manner it is enriched, and how it is prepared before consumption.

About 40% of the world's population derives most of their calories from rice. Almost 90% of the population of Bangladesh, Myanmar, Sri Lanka, Vietnam and Kampuchea are rice eaters. The food department of the government of Bangladesh recommends 410 gm of rice/head/day.

Table1.2: Nutrients from per 100 gm Rice

Composition	Rice
Calories (k . calorie)	325
Moisture content (percent)	13.3
Carbohydrate (percent)	79
Protein (gm)	6.4
Fat (gm)	0.4
B-carotine (µg)	0
Vitamin B (mg)	0
Thiamin	0.21
Riboflovine	0.09
Vitamin C (mg)	0
Calcium (Ca) (mg)	9
Iron (mg)	1

Source: Bose and Som, 1986; Wahed and Anjan, 2008

The opportunity cost of food imports may be high in terms of lower investment and consequently reduced rate of rate of economic growth (Ghatak and Ingersent, 1984). The overall performance of the economy is, therefore, yet intricately linked to the performance of the agricultural sector (Martin, 2004). Hence it is evident that Bangladesh should develop its agriculture sector to attain development.

The total area of Bangladesh is about 14.845 million hectares of which 53.89 percent is cultivable, 3.16 percent is current fallow, rest 42.95 percent is covered by homesteads, rivers, tidal creeks, lakes, ponds, roads, etc.(BER, 2015). So there is a little scope left to increase agricultural output by bringing new land new land under cultivation. Increase in agricultural output could be attained, however, by using High Yielding Varieties (HYV) and adopting improved cultural and management practices. In the past, growth of agriculture in Bangladesh has centered on food grain production rice alone comprises over 90 percent of that growth. Massive increase in rice production led to the decline in area of tubers, pulses, spices, oilseeds, roots, and other minor crops (Baset, 2003).

For the improvement of nutritional status of the people, the government has taken a Crop Diversification Plan (CDP) in the sixth Five year plan (2011-15). Under the CDP strategy, emphasis was placed to increase production and consumption of those nutrient rich foods. The diversification has not taken place adequately within the crop sector, which is still dominated by production of cereals. It is necessary to analyze the profitability of minor crops in order to reveal important information before farmers, researchers, planners and so on to take unique steps forward to increase both production and acreage of minor crops.

1.5 Justification of the study

Agriculture sector is playing very important role in the economy of Bangladesh. This sector attained modest growth and experienced slow transition during the two decades since independence. The goal of the sector was to replace the traditional and vulnerable agriculture by a modern agriculture capable of sustained growth. Thus it is essential to ensure easy availability of inputs, execution of agriculture extension principles, modernization of research techniques to improve the quality of agriculture product and steps should be taken to apply and extend the use of technologies obtained from research for sustainable agricultural development.

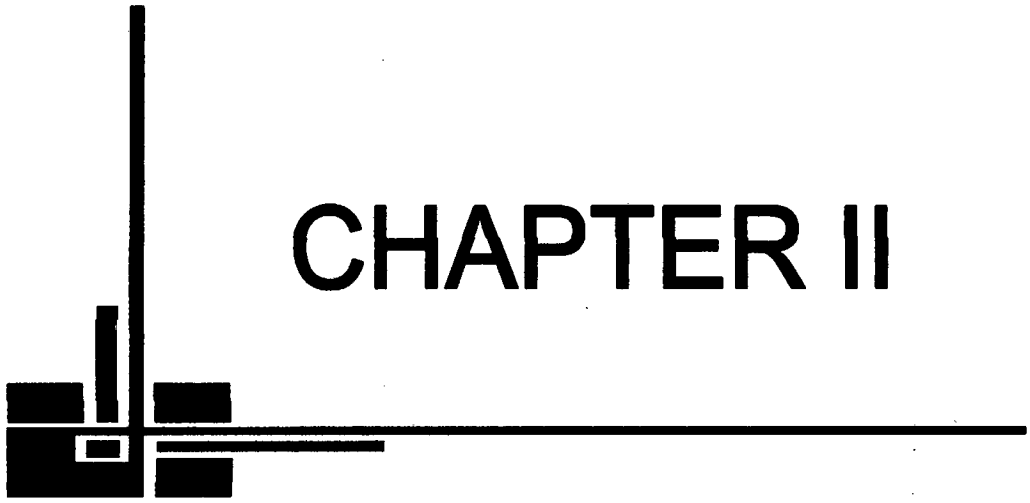
Profitability study on Boro rice is expected to reveal valuable information relating to farms and farmers growing this crop. With the importance of Boro rice cultivation in Bangladesh, it is also important to get maximum level of production per area of land with existing level of resources. Efficient use of resources can provide higher level of production. However a few financial investigations on Boro rice cultivation whether undertaken either by government or private organizations are not enough for farmers, workers, researchers to satisfy the demand. In this context, this study will help to diagnose the problems and prove our understanding on the interrelated problems of farmer's choice making in Boro rice production. The findings of the study will generate basic financial data on the production practices of Boro rice. The present study will provide valuable information to the farmers and researchers who will conduct studies of similar nature and encourage them in conducting them more comprehensive and detailed study in this particular field of study.

1.6 Objectives of the study

- To understand the present socio-economic characteristics of Boro rice growing farmers.
- To find out the profitability of Boro rice in the study area.
- To identify the major factors affecting the production.
- To suggest some policy actions for the improvement of Boro rice cultivation.

1.7 Organization of the study

The study consists of 9 chapters. Chapter 1 describes introduction of the study. Chapter 2 describes review of literature. Methodology, Description of the study area, socio-economic characteristics of the sample farmers, results and discussion, major factors affecting to the production process of Boro rice, problems of Boro rice growers and summery, conclusion and recommendations are presented in Chapter 3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 8, Chapter 9, respectively.



CHAPTER II

CHAPTER II

REVIEW OF LITURATURE

This chapter represents some related studies in connection with the present study. Some of these studies may not entirely relevant to present study, but their findings, methodology of analysis, suggestions have a great influence on the present study. Review of some literature work relevant to the present study are discussed below.

Khalique *et al.* (2019) attempted to examine the growth performance and profitability of rice production in Bangladesh using the time series data for the period 1981-82 to 2010-11. The study was based on secondary data. Growth rates of area, production, yield and nominal price of three seasons of rice were estimated by fitting the exponential trend function. Growth rates of an area which were significantly negative for Aus, Aman that were -4.6 percent and -0.3 percent and positive of Boro rice that was 4.5 percent.

Islam (2018) conducted a study to accomplish a comparative economic analysis on profitability of Boro rice and Jute production in Rajor Upazila of Madaripur. Data were collected from 80 farmers using a structural questionnaire. Cobb-Douglas production function was used for analyzing data. The result revealed that jute was more profitable than Boro rice in the study area. The result also revealed that power tiller, seed and fertilizer showed positive and significant effect on gross return of Boro rice. Additionally, jute seed and fertilizer showed positive and significant effect on gross return of jute production.

Masum *et al.* (2018) undertook a study on economics of Boro rice production in Rangpur district of Bangladesh which was a comparative assessment of Boro rice production using urea super granule (USG) and traditional urea in Rangpur district. Field survey was conducted of 60 farmers. Cobb-Douglas production function was used. Per hectare net return for USG users and traditional users was Tk. 40264.4 and Tk. 26740.2 respectively. BCR was higher for USG user. Power tiller cost, seed cost, TSP cost, Mop cost, manure cost irrigation cost has significant impact on gross return from Boro rice production for USG and traditional urea users.

Sujan *et al.* (2017) analyzed the profitability and resource use efficiency of Boro rice cultivation in Bogra district of Bangladesh using farm level survey data. The result was based on farm budgeting model showed that per hectare variable cost and total cost of production was BDT 57,583 and BDT 71,208 respectively. The Cobb-Douglas production function analysis showed that human labor, irrigation, insecticide, seed and fertilizer had statistically significant

effect on yield. MVP and MFC ratio analysis showed that growers allocated most of their resources in the rational stage of production.

Rahman *et al.* (2016) attempted to estimate the profitability and technical efficiency of Boro rice (BRRI dhan 29) in the northern part of Bangladesh. Primary data was collected from 60 farmers comprising Dinajpur (30 farmers) and from Bogra (30 farmers). Descriptive and inferential statistics as well as Cobb-Douglas production function were used to analyze the data. Benefit Cost Ratio implies that BRRI dhan 29 cultivation in Dinajpur was more profitable than Bogra. The empirical result indicated that the coefficients of human labor, seed, MoP, Gypsum, irrigation cost were positive and significant which implied that an increase in the magnitudes of these variables would results the positive impacts on rice production in Dinajpur region.

Hossain (2014) conducted a study on comparative economic analysis of garlic and Boro rice in some selected area of Natore district. Farmers were selected randomly from three villages namely: Jogendranagar, Durgapur and Khubjipur under Gurudaspur upazila in Natore district. Tabular technique and statistical analysis were done to achieve the objectives of the study. Cobb-Douglas production function was used. The revealed that the cultivation of garlic and boro rice were profitable. The total return per hectare for garlic and boro rice were Tk. 469056.23 and 195712.24 Tk. respectively. The undiscounted BCR was 1.69 and 1.34 for garlic and boro rice production respectively.

Nargis and Lee (2013) conducted a study on efficiency analysis of Boro rice in north-central region of Bangladesh. The study was conducted using field survey data of 199 farmers in north-central region. This paper estimated technical, allocative, economic and scale efficiency. It was revealed that on an average the farms technical, allocative, economic and scale efficiencies was 0.93, 0.82, 0.69 and 0.90 respectively.

Kazal *et al.* (2013) attempted a study to estimate financial profitability of Boro rice, Aman rice, Wheat, Maize, Lentil, Mustard and Jute based on net returns, gross margin and undiscounted BCR. Results showed that all the estimates of net returns, gross margins and undiscounted BCRs are positive. This means that the production of these crops is profitable for farmers at current market conditions. The study also estimated economic profitability of these crops through PAM analysis. It is evident that for majority of crops in different locations, revenue transfers were either positive or marginally negative, indicating that farmers were enjoying positive support as a result of combined effects of various government interventions.

Sarker *et al.* (2006) conducted a study on comparative economic analysis of HYV and Hybrid rice production in the selected areas of Gazipur district to describe the socio-economic profile of rice growers, productivity and profitability of HYV and Hybrid rice. Multistage sampling procedures were used for this study. It was revealed that, on an average the surveyed families consisted the larger family size than national average. The findings lead to the conclusion that HYV rice is more profitable than hybrid rice.

Sarker *et al.* (2004) attempted a study to resource exploitation for irrigated Boro rice cultivation under favourable production environments according to farm category. Simple random sampling method was used for this study. It was found that the small farmers used their resource more efficiently than others in the study area.

Khan (2004) conducted a study on productivity and resource use efficiency of Boro rice in some selected area of Kishoreganj district to describe the socio-economic profile of Boro rice growers, productivity and profitability of Boro rice. Stratified sample were used. It was revealed that, on an average the surveyed families consisted of 7 members, highest portions of farmers were within the age group of 36-50 years. The findings lead to the conclusion that seed, fertilizer and irrigation significantly affected the returns from Boro rice. Considering all the farmers the mean efficiency in Boro rice cultivation was 87.73%.

Zaman (2002) conducted a study to accomplish a comparative analysis of resource productivity and adoption of modern technology under owner and tenant farms. It was found that gross cost for producing HYV Boro rice were the highest in owner farms and the lowest in tenant farms. Owner operators used more hired labour where tenant operators used more family labour. The maximum return over total cost per hectare was obtained by owner operators and minimum by tenant operators. It was also observed that owner operators were more efficient than tenant operators. It was also observed that owner operators were more efficient than tenant operators; it was also found that the degrees of adequacy level in the application of modern farm inputs were higher in owner farms than in tenant farms.

Rahman *et al.* (2002) attempted to measure the technical efficiencies obtained by owner operated farming and share cropping for Boro, Aus and Aman rice were 86 percent, 93 percent and 80 percent, respectively whereas mean technical efficiencies obtained by sharecroppers for Boro, Aus and Aman rice were respectively 73 percent, 76 percent and 72 percent. The study reveals that owner operators were technically more efficient than sharecroppers in the

production of all the rice crops. To reduce the difference of technical efficiencies between owner operator and sharecropper a perfect leasing system is inevitable.

Akter (2001) conducted a study on relative profitability of alternate cropping patterns under irrigation condition in some selected area of Barguna district. The relative profitability of 5 dominant cropping patterns in two villages of Barguna district Bangladesh was assessed. The cropping patterns considered were (1) T. Aus Rice-T. Aman rice-HYV Boro rice; (2) T. Aus rice-T. Aman rice-wheat; (3) T. Aman rice-Jute-HYV Boro rice; (4) T. Aman rice -chilli-fallow; and (5) T. Aman Rice-Jute-potato. Data were obtained through interviews with 60 farmers 10 farmers from each cropping pattern during June-August 2000. Cropping pattern 1 had the highest per hectare gross margin (Tk. 43312) and net return (Tk. 27643). While cropping pattern 4 had the lowest gross margin (Tk. 29575) and net return (Tk. 19000). The inclusion of HYV Boro rice as a third crop in the cropping pattern increased income and employment.

Ali (2000) attempted to measure and compare resource use and land productivity within tenure groups. Total gross cost for producing Aman, Boro and Aus were the highest in owner farms and the lowest in tenant farms. It observed that owner operators used higher level of inputs than owner-cum-tenant and tenant operators. Rice owner-cum-tenant operators obtained higher yield in Aman and Aus production then owner and tenant operators. In Boro paddy production tenant operators obtained maximum net return than owner operators and owner-cum- tenant operators in owner land. Finally, it was concluded that tenancy affects positively on resource use and production in a predictable fashion even in small scale peasant agriculture. Hasan (2000) studied on the economic potential of alok hybrid rice and found that per hectare total cost for hybrid alok was Tk. 36,276.33 per hectare variable cost was calculated as Tk. 2,927.05 and per hectare yield was 6,557.07 kg. The price of alok paddy was Tk. 7.81/kg. Taking the by product into account the gross return of hybrid alok per hectare was Tk. 5,465.02. The net return per hectare was Tk. 18,375.50 and the gross margin was Tk.26, 409.97.

CHAPTER III

CHAPTER III

METHODOLOGY

3.1 Introduction

Methodology is an integral part of any study. Appropriate methodology is a necessity of a good research. The scheme of any survey is predominantly determined by the nature, aims, and objectives of the study. It also depends on the availability of necessary resources, materials and time. Improper methodology very often leads to misleading results. Therefore author must be careful to follow a scientific and logical methodology for carrying out the study. The study area, the sources of data, the analyses and interpretations all are need to be described clearly by the author. This study was carried out by using a primary data collection from selected Boro rice producers in selected areas of Laxmipur, Bangladesh for estimation of profitability of Boro rice production. The methodological framework is presented in this chapter, which consists of three main sub-sections. The first section describes sampling procedures, sampling frame, sample size and survey design. Second section describes data collection procedures, formal and informal survey, and primary and secondary data. Data analysis techniques are described in detail in the third section.

3.2 Sampling procedure

In the case of empirical investigation it is not possible to collect information from the whole population. Therefore, researchers are often forced to make inferences based on information derived from a representative sample of population. The quantity and quality of the survey is affected by the size of the sample, and amount of variation. Using appropriate sampling methods, both factors can be controlled. The aim is to devise a sampling scheme, which is economical and easy to operate, and provides unbiased estimates with small variance. The main characteristics of sampling theory applied in this study are discussed below.

3.3 Selection of the study region

"The area in which a farm business survey is to be carried out depends on the particular purpose of the survey and possible cooperation from the farmers" (Yang, 1965). Selection of study region is that's why important. A preliminary survey in Ramganj Upazila, Raipur Upazila and Ramgoti Upazila of Laxmipur district was conducted to achieve the objective of the present

study. Upazila is an administrative region in Bangladesh. They function as sub-units of districts. On the basis of preliminary information were selected purposively because a large number of farmers grow Boro rice in these Upazilas. Other reasons for selecting the study region were as follows:

i. The area represented the same agro ecological characteristics
ii. From the view point of time and available resources these areas are suitable for the study
iii. Easy accessibility and good communication system existed in the selected villages
iv. Cooperation from the respondents were expected to be high since the researcher was inhabitant of the area and familiar with the local dialect, living experience, beliefs and socioeconomic characteristics of the area and
v. No socio-economic study of this type was conducted before in this area.

3.4 Sampling technique

In selecting sample for a study two factors need to be taken into consideration. The sample size should be large as to allow for adequate degrees of freedom in the statistical analysis. Secondly, administration of field research, processing and analysis of data should be manageable within the limitation imposed by physical, human and financial resources. But there is diversity in the technical and human environment, so it is needed to sample several numbers of the population before any conclusion can be drawn. Therefore the purpose of sampling is to select a sub-set of the population that is representative of the population. Due to the limitations of time, money, and personnel it was not possible to include all the farmers in the area studied. A simple random sampling technique was followed in the study for minimizing cost, time and to achieve ultimate objectives of the study. Ten villages of Ramganj upazila, Raipur upazila and Ramgoti upazila were selected. A list of farmers who cultivated Boro rice at that time was collected with the help of agricultural extension personnel and elderly framers of the study area. A total number of 80 farmers were simple randomly selected from this list. Thus the selected farmers were interviewed to achieve ultimate objectives of the study.

3.5 Period of study

Agricultural farming is seasonal, so a farm business survey should cover a whole crop year in order to have a complete sequence of crops. The researcher must determine to what extent the

information for a particular year represents normal or average conditions, particularly for crop yields, annual production and price level. BRRI dhan 28 of Boro rice were prevailing in the study area which cultivation begins at mid to late Novembers and ends in mid-April-May. The data collection period was November to December 2019. Secondary data were collected from different published and un-published sources to fulfill of the objectives of the study.

3.6 Preparation of survey questionnaire

Survey questionnaire was important to collect necessary information from the farmers. A set of comprehensive survey questionnaire was followed in such a way so that all the factors in the production of Boro rice could be included. Survey mainly depends on the preparation of the survey questionnaire, it was, therefore, pretested to verify the relevancy of the question and nature of response of the respondents. The schedules were finalized in logical sequences after proper correction, modification and adjustments.

The questionnaire included the following information:

i. Identification of the sample farmers
ii. Farm size and tenurial status of the respondents
iii. Family size and consumption, availability and use of family labor income and occupation
iv. Use of materials inputs for the cultivation of Boro rice
v. Yield, output, cost and return of Boro rice

3.7 Data collection

For the purpose of this study primary data has been collected by conducting survey of Boro rice producers from the selected area. The field work also involved gathering data on Boro rice production practices, input use, labor utilization, natural and socio-economic constrains, prices and market activities. The data collection consists of field survey, review of previous studies, and interviews with knowledgeable Boro rice producers and also direct observation by the researchers. Management practices, input use and marketing system of Boro rice producers were given emphasis.

3.8 Accuracy of the data

During the period of data collection necessary measures were taken to minimize the possible errors. The measures taken were:

- Built-in-check in the interview schedule
- Field checking and
- Independent re-interviewing of the respondents.

3.9 Processing, editing and tabulating of data

The collected data was checked and verified for the sake of consistency and completeness. Editing and coding were done before putting the data in computer. To eliminate all possible errors, all the collected data were summarized and scrutinized carefully. Data were presented mostly in the tabular form to easily understand. Besides, functional analysis was done using the concerned software Microsoft Excel and STATA.

3.10 Analytical technique

Several analytical methods were employed in the present study. Tabular method was used for a substantial part of data analysis. This technique is intensively used for its inherent quality of purporting the true picture of the farm economy in the simplest form. Percentage and arithmetic mean or average were employed to analyze data and to describe socioeconomic characteristics of Boro rice growers, input use, costs and returns of Boro rice production and to calculate undiscounted Benefit Cost Ratio (BCR).

3.10.1 Gross margin

Gross margin has given an estimate of the difference between total revenue and variable cost.

That is,

GM =TR-VC

Where,

GM = Gross margin

TR = Total return

VC = Variable cost

Gross margin is widely used in short run analysis and farm planning. This analysis is easily understandable for its simplicity. Per hectare total return was calculated by multiplying per hectare total amount of product by annual average farm gate price.

3.10.2 Net return

Net return analysis considered fixed cost; cost of land rent; interest on operating capital etc. So, per hectare net return was determined by subtracting per hectare total cost (variable cost and fixed cost) of production from per hectare total return. To determine the net returns of Boro rice production the following equation was used in the present study:

$\Pi = P_r Q_r + P_b Q_b - \sum (Px_i . X_i) - TFC$

Where,

Π= Net return (Tk. /ha)

P_r=per unit price of the product (Tk. /ha)

Q_r= Quantity of the product (kg/ha)

P_b=per unit price of by- products (Tk. /kg)

Q_b=Quantity of by-product (kg/ha)

Px_i=per unit price of the ith (variable) inputs (TK. /Kg)

X_i=quantity of the ith inputs (kg/ha)

i = 1, 2, 3.....n (number of inputs)

TFC = Total Fixed Cost

3.10.3 Functional analysis

Apart from the tabular analysis, the functional technique was also followed in this study. Cobb-Douglas production function model was used to estimate the effects of key variables. This model was proved the best-fit and more reliable on theoretical and econometric aspects in real world situation.

For Boro rice the model specification was:

$Y_i = \beta_0 X_{1i}^{\beta 1} X_{2i}^{\beta 2} X_{3i}^{\beta 3} X_{4i}^{\beta 4} X_{5i}^{\beta 5} X_{6i}^{\beta 6} X_{7i}^{\beta 7} e^{u}_{i}$

By taking log in both sides the Cobb-Douglas production function was transformed into the following logarithmic form

$\text{Ln } Y_i = \ln \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + \beta_6 \ln X_{6i} + \beta_7 \ln X_{7i} + u_i$

Where,

Y= Gross return (Tk. / ha)

β_0= Constant or intercept of the function

X_1= Human labor (Tk. /ha)

X_2= Seed Cost (Tk. /ha)

X_3= Urea (Tk. /ha)

X_4= TSP (Tk. /ha)

X_5= MoP (Tk. /ha)

X_6= Insecticide (Tk. /ha)

X_7=Irrigation (Tk. /ha)

i = 1, 2, 3.....n (n=80)

e = base of natural logarithm

u_i = error term

$\beta_1, \beta_2 \ldots\ldots \beta_7$= coefficient of respective variables.

3.11 Major cost items

In this section an attempt has been made to estimate the cost and returns of Boro rice production. To estimate the net returns of Boro rice production, it is essential to estimate the actual costs and returns in appropriate procedures. Input used in the study area were both purchased and family supplied. Thus, the total production costs consisted of cash and non-cash expenses farmers had to pay cash for the purchased inputs like hired labor, seeds, fertilizers, insecticides, irrigation etc. It was easy to calculate the cost of these items. No cash was paid for home supplied inputs like family labor, tools, and equipment, manure etc. In this case family

supplied labor costs were estimated by applying the opportunity cost principle. Opportunity cost of an item was is defined as an alternative employment in or outside the farm (Bishop and Toussaint, 1958). The input items were valued at the existing market price in the area during survey period or the prices at which the farmers really bought the inputs.

A list of cost items and their estimation procedure has been discussed under following heads:

(a) Land use cost
(b) Human labor cost
(c) Seed cost
(d) Fertilizer cost
(e) Manure cost
(f) Insecticides and pesticides cost
(g) Tillage cost
(h) Irrigation cost
(i) Interest on operating capital

3.11.1 Land use cost

Land use cost varied from village to village depending upon the soil type, topography, location and security of the particular crop field. Land use cost may be calculated using one of the following concepts:

(a) Interest on the value of land
(b) Valuation of land at its cash rental price per year and
(c) Forgoing income from the alternative.

The second method is the most popular. So, it was used in the study.

3.11.2 Cost of human labor

Human labor is the most essential input in all kinds of production. Boro rice cultivation is labor intensive. Human labor was required for different operations like seed bed preparation, seedling preparation, land preparation, manuring, weeding, irrigation, harvesting and so on. It was classified into two categories, family labor and hired labor. Family labor consists of the farm operator himself and other family members. In determining family labor cost, actual man days devoted by the workers were taken into account. Eight hours of work were equivalent to

one-man-day. Family labor cost was calculated by applying the principle of opportunity cost. The average wage of the hired labor was taken as the opportunity cost of the family labor.

3.11.3 Cost of seed

The farmers used both family supplied and purchased seed and seedlings of Boro rice. Family supplied seed were priced at the prevailing market price and the cost of the purchased seed were priced on the basis of price paid by the farmers in the study area.

3.11.4 Fertilizer cost

In the selected study region farmers used different kinds of fertilizers for higher yield of Boro rice. They used Urea, Triple Super Phosphet (TSP), Murate of Potash (MoP), Di-Amonium Phosphet (DAP) and Gypsum. Fertilizer costs represented the actual prices paid by the farmers including all incidental charges.

3.11.5 Cost of manure

Farmers used cow-dung as manure in their Boro rice production. A large quantity manure was supplied from their home. While some farmers bought cow-dung from the milk producers. The cost of cow-dung was priced at the prevailing market price.

3.11.6 Cost of irrigation

In the study region, most of the farmers used irrigation water for their Boro rice production. Shallow tube well was widely applied. Some farmers has their own shallow tube well to irrigate the field others bought irrigation water from the shallow tube well owners. In the study area, only one payment system was practiced; under this system farmers had to pay cash taka for irrigation water charge per unit of land. Irrigation cost was estimated as the actual amount of money paid by the farmers.

3.11.7 Cost of insecticides and pesticides

Most of the farmers of the study region used insecticides and pesticides for cultivation of Boro rice. Commonly used insecticides and pesticides were Thiovot, Furadan, Heptachlor, Dimecrone, Nogos etc. This cost represented the amount of money the farmers actually paid to buy the items.

3.11.8 Tillage cost

In the study region, all the sample farmers used power tiller for land preparation. They mainly used hired power tiller. A power tiller owner supplied fuel as well as drive for land preparation and laddering. Farmers used to pay a fixed rate as service charges for using power tiller. Generally, farmers used five to six passage for preparation of Boro rice land. The wage rate of power tiller was considered as the actual amount of money paid by the farmers in cash.

3.11.9 Interest on operating capital (IOC)

Interest on operating capital was determined by taking all costs incurred on various operations in the process of cultivation of Boro rice excluding those for which interest was already calculated. Interest on operating capital was charged at the rate of 9 percent per annum and was estimated for the duration of six month for Boro rice. It was assumed that farmers borrowed the money from a bank, they had to pay interest at the same rate. It was estimated by using the following formula:

Interest on operating capital = AIiT

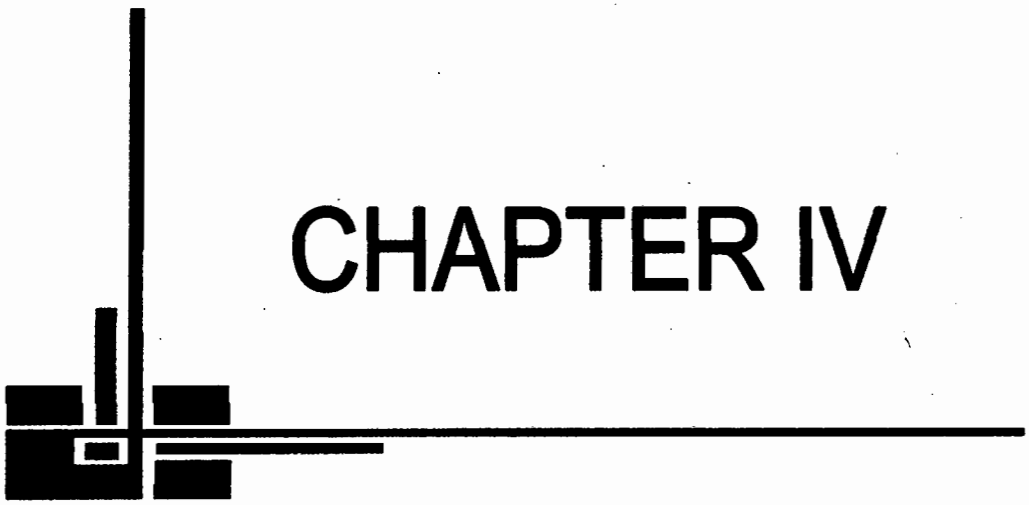
Where,

AI = (Total Investment)/ 2

i = Rate of interest

T = Total time period of a cycle

The period of crop cultivation was considered from the time of land preparation to harvest. The interest actually means the average operating costs over the period as all the costs were not incurred at the same time, rather these were used throughout the production period from beginning to the end.



CHAPTER IV

CHAPTER IV

DESCRIPTION OF THE STUDY AREA

4.1 Introduction

In this chapter the study area has been described. It is necessary to know about the study area to understand the location, physical features and topography, soil type, temperature, rainfall, agricultural and economic condition, population, education and other socio economic infrastructure available in the area.

4.2 Location

The study was conducted on some villages of three Upazila namely Ramganj Upazila, Raipur Upazila, Ramgati Upazila of Laxmipur district. The district is bordered by Chandpur district to the north, Bhola and Noakhali district to the south, Noakhali district to the east, and Barisal and Bhola district to the west. It lies between 22°30' and 23°10' north latitudes and in between 90°38' and 90°01' east longitude. The total area of the District is 1367.59 square km. The location of the study area is shown in map 4.1.

4.3 Physical features, topography and soil type

Laxmipur District is under the AEZ (Agro-ecological zone) of Lower Meghna River Floodplain. This area occupies the transitional area between the Middle Meghna River Floodplain and the Young Meghna River Floodplain. The banks of the river are constantly eroding. The land is mainly moderately deeply flooded. Soils of this area are relatively uniform: silt loams occupy relatively higher areas and silty clay loam occupy the depressions. Five general soil types occur in the region. Non-calcareous dark grey floodplain and calcareous grey floodplain soils are major components of general soil types. Top soils are moderately acidic and sub soils neutral in reaction. The general fertility level is medium to high with low to medium organic matter content.

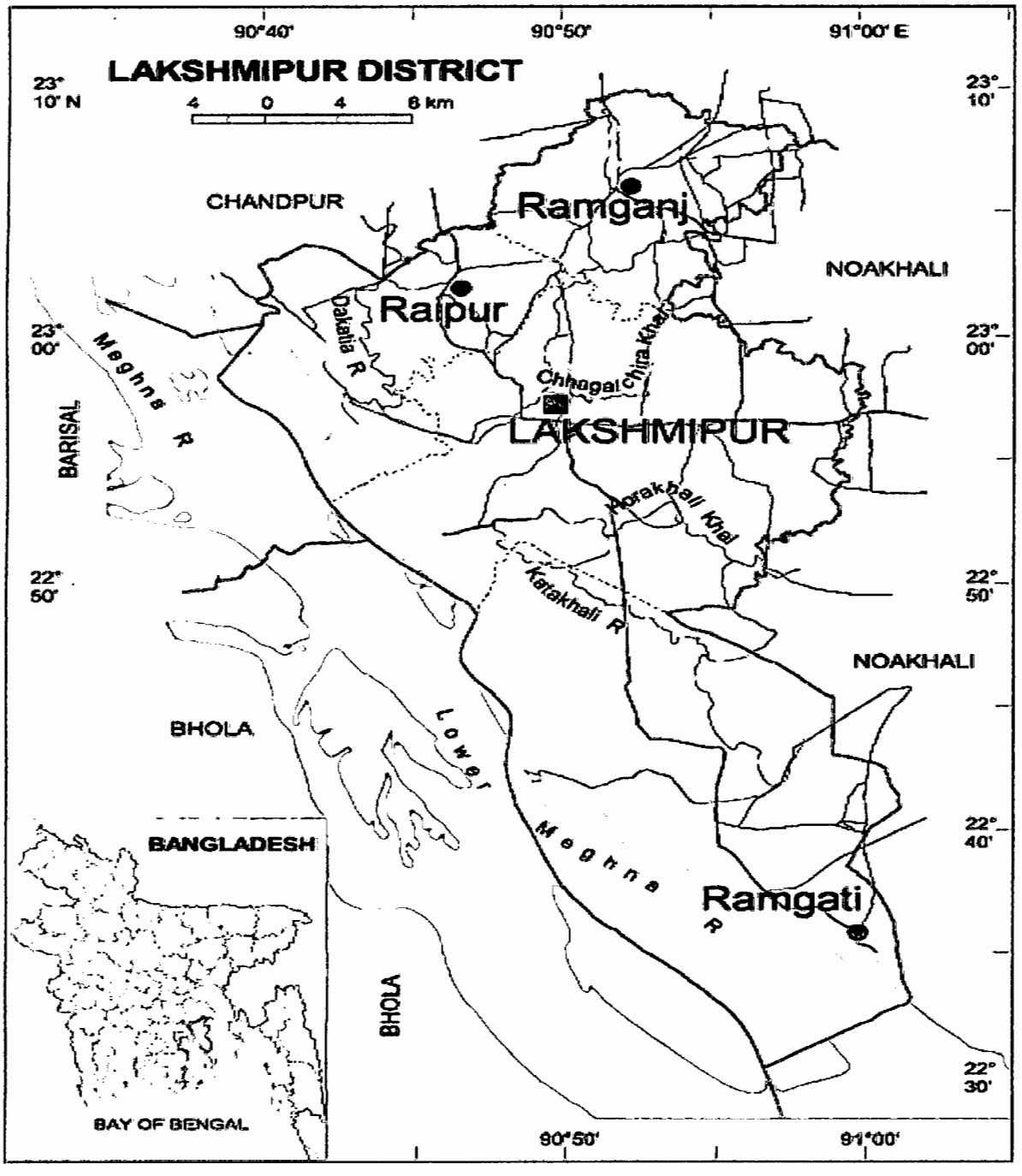


Figure 4.1: Map of Laxmipur

4.4 Area, population and household

Laxmipur district is bordered by Chandpur district to the north, Bhola and Noakhali district to the south, Noakhali district to the east, and Barisal and Bhola district to the west. The total area of the District is 1367.59 square km (556.14 square miles). Laxmipur was established in 1984. The upazilas under this district are: Laxmipur Sadar Upazila, Ramganj Upazila, Raipur Upazila, Ramgati Upazila, Kamalnagar Upazila. The district of Laxmipur consists of 4

municipalities, 58 union, 514 villages. It also comprises 4 paurashava, 39 paura wards, and 66 mahallas, 3539 mosques, 45 temple and 1 church.

Table 4.1: Area, Population and Household of study area

Study Area	*Area (sq. km)*	*Population(000)*
Ramgang	169.31	342.027
Raipur	201.32	275,160
Ramgati	570.55	335,243

Source: Wikipedia

4.5 Climate

Laxmipur has the moderate climate prevailing. There is a lot of rainfall in the summer, and in the winter it is quite dry again. The average annual temperature for Laxmipur is 32° degrees and there is about 507 mm of rain in a year. It is dry for 201 days a year with an average humidity of 67% and an UV-index of 7.

4.6 Agriculture and economic condition

Laxmipur is one of the costal district at the fringe of the Bay of Bengal with vast sandy land of recent origin in the south. In the farmlands, varieties of crops namely local and HYV rice, jute, vegetables, spices, pulses, oilseeds, etc. are produced. Rice covers most of the gross temporary cropped area. Most of the trees grown in homestead forests are fruit bearing. Mangoes, although poor in quality, grow in abundance. Almond is usually common, other common trees are gab, black berry, Tamarind, jackfruit, olive, wood apple, chalta, boroi or kul, guava etc. Banana is seen almost everywhere but their quality is rather poor. Litchi, kamranga, custard apple, haritaki, amlaki etc. also grow abundantly. Indigenous timber trees including koroy, sheel koroy, garjan, jarul, shimul, mahgoni, sissoon etc. are grown in wayside as well as in farm. Mandar, a thorny tree mostly used as fuel and fencing, isseen in almost every at the household. Shimul and kadam trees are very common and are preferred for manufacturing match stick. The shimul or karpas is used for stuffing mattresses and pillows and has a silky appearance. Eucalyptus and pine also planted in the district. The luxuriant growth of palms is

the most characteristic feature of the vegetation. Cocoanut and betel nut are grown abundantly throughout the district. Toddy palms or tal and date palms are also very common. Date palm is a valuable tree. Betel-nut and coconut are good source of income for the household. Shady trees include banyan, pipa and neem. There are several varieties of cane, a good deal of bamboo of different varieties and thatching grass or chhan although their plantations are gradually decreasing steadily. Use of bamboo is widespread such as post and fencing of houses, making of baskets and trays of various kinds. Cane is used for making baskets, binding and thatching. In the marshes, sola and marta are found, which is extensively used making various types of mats and baskets. The economy of Laxmipur is predominantly agricultural. Most of the households are engaged in the production of varieties of crops namely local and HIY rice, vegetables, spices, cash crops, pulses, oilseeds, betel leaves and other. Various fruits like banana, guava, coconut etc. are grown. Fishes of different varieties abound in this district. Varieties of fishes are caught from rivers, tributary channels, and creeks and even from paddy fields during season.

4.7 Occupation

Laxmipur is famous for trade and business. Various consumable goods and agricultural product related businesses are prevailed. Various agribusiness farms, processing factories, rice mills, timber business, fish and dried fish business are popular. Non- farm economic activities has also significant impact in this district. The following table shows total establishments and persons engaged by sex and activities.

Table 4.1 Number of establishment and population engaged by activity other than agriculture

Economic Activities	Establishments	Total person engaged		
		Total	Men	Female
Mining and Quarrying	4	15	15	0
Manufacture	27300	72744	46360	26384
Electricity, gas, steam, air conditioning supply	67	408	377	31

Water supply, sewerage, waste management and remediation activities	7	39	38	1
Construction	187	697	635	62
Wholesale and retail trade, repair of motor vehicles and motorcycles	38910	73440	70455	2985
Transportation and storage	12174	18456	16725	1731
Accommodation and food service activities	11611	26889	26622	267
Information and communication	102	419	361	58
Financial and Insurance activities	576	4209	3326	883
Real estate activities	145	655	581	74
Professional, scientific and technical activities	567	1087	1065	22
Administrative activities	435	1210	1145	65
Public Administration and defence, compulsory social security	186	3198	2737	461
Education	2310	15936	13003	2933
Human health and social work	646	3239	233	900
Art, entertainment and recreation	128	269	256	13

Source: Economic Census 2013, District report, Laxmipur

Ac no- 43382

4.8 NGO Activities

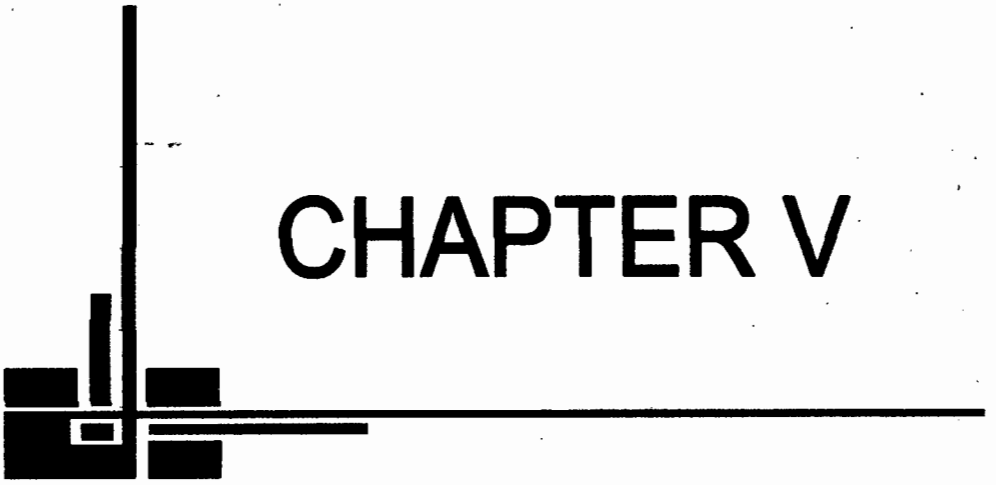
Operationally important NGOs are BRAC, ASA, COAST; Laxmipur, VOICE, CWDA, SWDA, SURGE, FRINDSHIP, TWSDA etc.

4.9 Transport, communication, and marketing facilities

The communication facilities of Laxmipur district is well enough that all upazilas are well connected with the district headquarters. Bus, minibus, cart, van, CNG, truck, pick-ups are all over the roads. Farmers carry their products mainly by van and by hackneyed carriage. They use mainly trucks to supply their products to the different parts of the country. Local bazars and big huts are very common.

4.10 Conclusion Remarks

From the above discussion it is clear that the study area is near to the district. Physical features, topology and soil type, temperature and rain fall are favourable for cultivation Boro rice. Therefore, various types of agricultural crops were cultivated in the study area. Communication systems are good for marketing of agricultural crops.



CHAPTER V

CHAPTER V

SOCIO-ECONOMIC PROFILE OF HOUSEHOLD POPULATION

5.1 Introduction

The point of this part is to present a brief description of the socio-economic characteristics of the growers delivering Boro rice. Socioeconomic parts of the growers can be viewed from various perspectives relying on various factors identified with their degree of living, the financial condition where they live and the nature and the degree of the growers support in national advancement exercises. It was impractical to gather all the data with respect to the financial attributes of the example growers because of confinement of time and assets. Financial state of the example growers is significant in the event of research arranging in light of the fact that there are various interrelated and constituent qualities describes an individual and significantly impacts advancement of his/her conduct and character. Individuals contrast from each other for the variety of financial perspectives. Nonetheless, for the present research, a couple of the financial qualities have been contemplated for exchange.

5.2 Composition of the Family Size

Family size is significant in connection to generation of enough nourishment grain for ranch family. In this study family has been characterized as the all-out number of people living respectively and taking meals from a similar kitchen under the influence of one leader of the family. The relatives considered as spouse, children, unmarried little girl, father, mother, sibling and different relatives who live for all time in the family.

Table 5.1: Distribution of household members according to sex of the sample farmers

Particulars	Ramganj Upazila		Raipur Upazila		Ramgati Upazila		Average of all three upazilla		National Average Family Size
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Male	3.00	58.25	2.80	57.73	2.95	58.42	2.92	58.14	
Female	2.15	41.75	2.05	42.27	2.10	41.58	2.10	41.86	4.06
Total	5.15	100.00	4.85	100.00	5.05	100.00	5.02	100.00	

Source: Field Survey, 2020

5.2 Age

There are 40, 20, 20 samples are collected from three upazila named respectively Ramganj, Raipur and Ramgoti represented the total population. In Ramganj upazila, 35 percent of the sample populations were 20-40 years, 30 percent were 40-60 years and 20 percent were above 60 years old. In Raipur upazila, 43.33 percent of the sample population were 20-40 years, 20 percent were 40-60 years and have 13.33 percent found sample were above 60 years old. In Ramgati upazila, 33.33 percent of the sample populations were 20-40 years, 43.33 percent were 40-60 years and 3.33 percent sample found who were above 60 (Figure 5.1). In this figure we saw most of the people age between 20 to 40 years in every upazila.

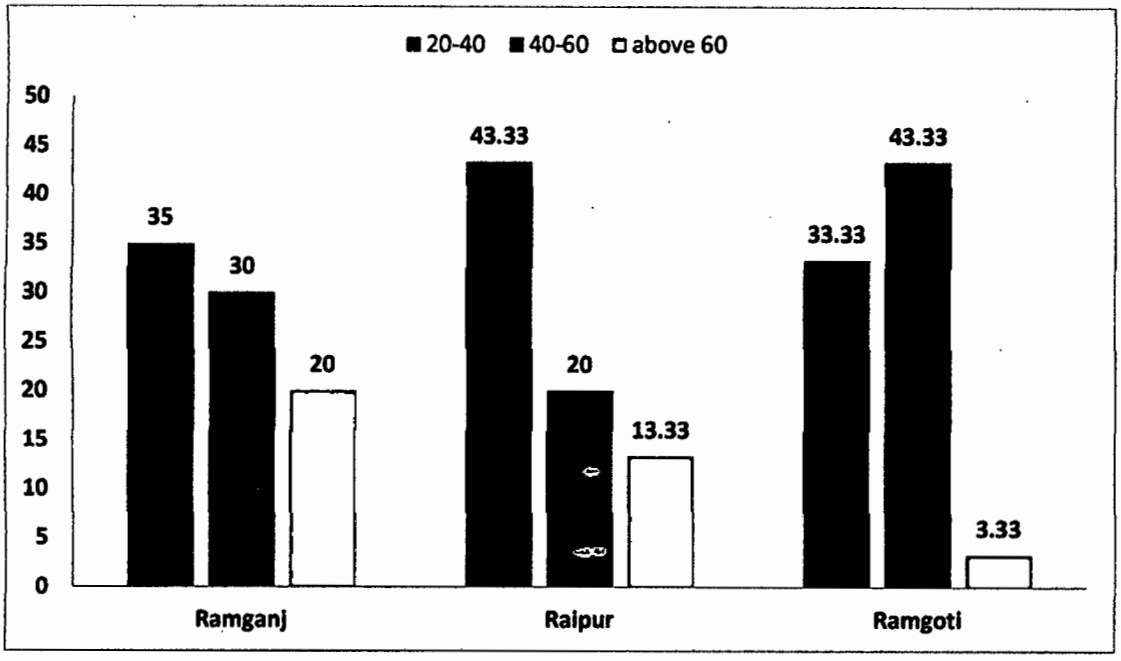


Figure 5.1: Age of the respondent by Study area;

Source: Field survey, 2020

5.3 Education

Figure 5.2 showed that, in Ramganj upazila, about 15 percent of the study population aged have no education and/or read/write, about 25 percent were found to have primary level education, about 40 percent were found to have secondary and/or higher secondary level education and 10 percent people were found to have attained/completed graduation level of education. In Raipur upazila, about 12 percent of the study population were found to have no education and/or read/write, about 26 percent were found to have primary level education, about 45 percent were found to have secondary and/or higher secondary level education and 5 percent people were found to have attained/completed graduation level of education. In Ramgoti upazila, about 10 percent of the study population were found to have no education and/or read/write, about 23 percent were found to have primary level education, about 45 percent were found to have secondary and/or higher secondary level education and 07 percent people were found to have attained/completed graduation level of education.

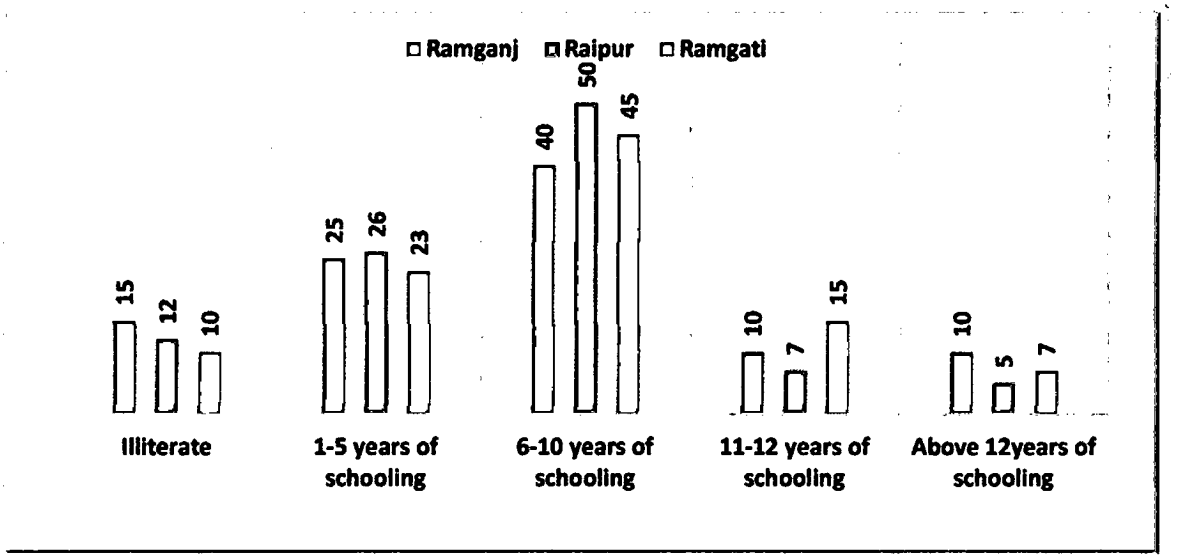


Figure 5.2: Education of the Household Members by Study Area

Source: Field survey, 2020

5.4. Annual Family income

Table 5.2: Average annual family income

Sector		Average annual income (Tk)
Agricultural work	Crops	45000
	Coconut and Betel nut	48000
	Poultry	14500
	Livestock	15000
	Fisheries	50000
	Total	172500
Non-agricultural work		20000
Foreign remittance		100000
Total		292500

a) Agricultural work

Crops, poultry, livestock and fisheries are the main agricultural income source of the sample and every household have coconut and betel nut garden which have their another source of income. In data collection average monthly income was about 4000 Tk. by sell coconut and betel nut. Most of the framers generate income by agriculture and fisheries sector. Some family fisheries were the main source of income among them average yearly income from fisheries sector found TK 50000. Now a day's poultry and dairy farm have been developed in the study area. The mean value of annual family income by agriculture was Tk. **172500.**

b) Non-agricultural work

Main non agriculture was found day labor, Auto driver, Truck driver, domestic worker, small business, and services. Annual average income by non-agriculture source was found Tk 20000.

c) Foreign remittance

Remittances are funds transferred from migrants to their home country. They are the private savings of workers and families that are spent in the home country for food, clothing and other expenditures, and which drive the home economy. Remittances are becoming a key source of funding for Laxmipur district. Average yearly Tk. 100000 has been generated form remittance in study area.

5.5. Annual Family Expenditure

Sample farmer, annual average expenditure was found Tk. 210000. Main family expenditure was use for food consumption. Others main cost were child's education cost, clothing cost, medicine cost transportation, festival cost, entrainment cost etc. Average annual family savings was found Tk 82500.

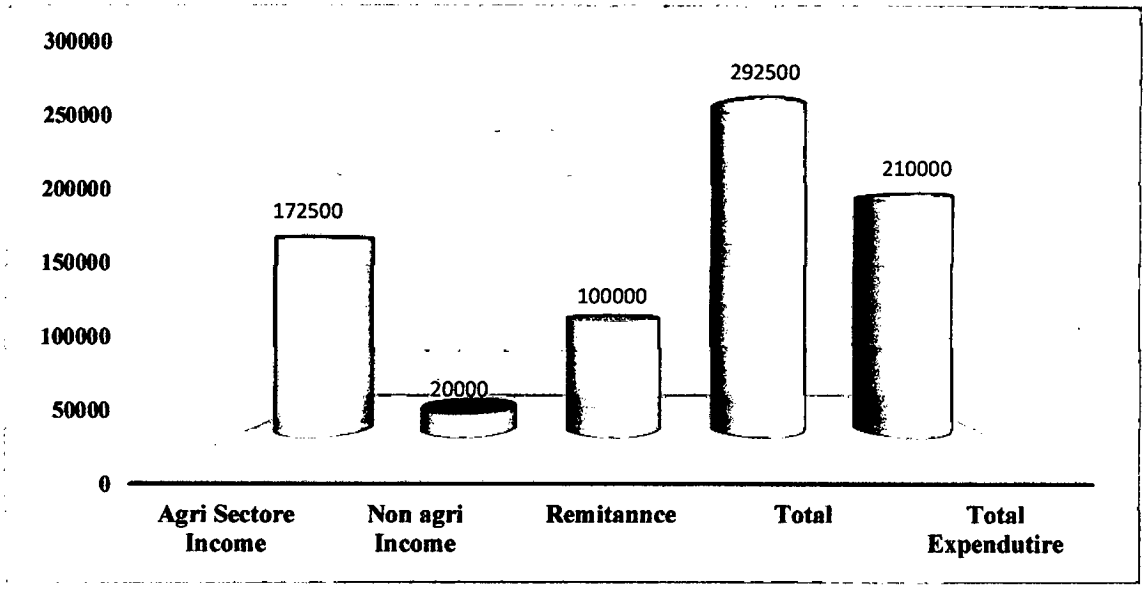


Figure 5.3: Annual Family Income and Expenditure by Study Area
Source: Field survey, 2020

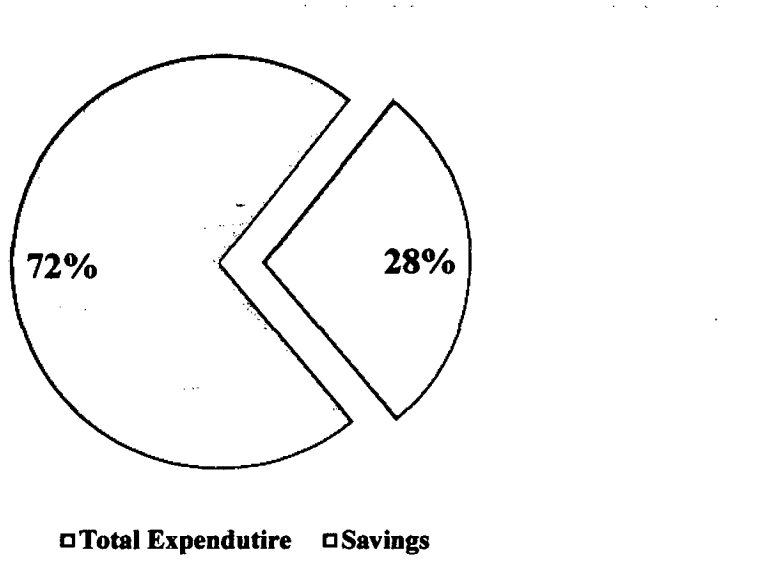


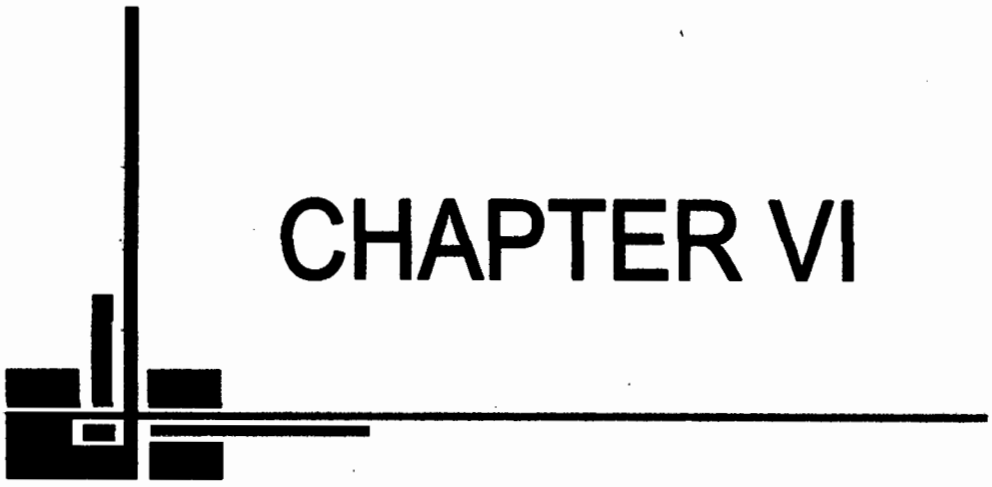
Figure 5.4: Annual Family Expenditure and Savings by Study Area

Source: Field survey, 2020

5.6 Concluding Remarks

From the above discussions it is clear that there are some variations in socioeconomic characteristics between the Ramganj Upazila, Raipur Upazila, Ramgoti Upazila boro rice growers. But the magnitude of the variations was not large. Most of the people of the study area are engaged in mainly agriculture. They also involved in other occupation also like day

labor, Auto driver, Truck driver, domestic worker, small business, and services. A significant amount of income generates from remittance of the study area. As a large number of farmers are engaged in crop production activities, the farmers of these areas can increase their income and socio-economic condition by Boro rice production.



CHAPTER VI

CHAPTER VI

PROFITABILITY OF BORO PRODUCTION

6.1 Introduction

The main purpose of this chapter is to assess the costs, returns and profitability of growing Boro. Profitability is a major criterion to make decision for producing any crop at farm level. It can be measured based on net return, gross margin and ratio of return to total cost. The costs of all items were calculated to identify the total cost of production. The returns from the crops have been estimated based on the value of main products and by-products.

6.2 Profitability of Boro production

6.2.1 Variable costs

6.2.1.1 Cost of land preparation

Land preparation is the most important components in the production process. Land preparation included ploughing, laddering and other activities needed to make the soil suitable for Boro cultivation. For land preparation in Boro production, tiller was required 2 times with average Tk. 1573 per tiller. Thus, the average land preparation cost of Boro production was found to be Tk. 33146 per hectare, which was 4.02 percent of total cost (Table 6.1).

6.2.1.2 Cost of hired human labour

Human labour cost is one of the major cost components in the production process. It is one of the most important and largely used inputs for producing Boro. It is generally required for different operations such as land preparation, sowing, weeding, fertilizer and insecticides application, irrigation, harvesting and carrying, threshing, cleaning, drying, storing etc. The quantity of average hired human labour used in Boro production was found to be about 65 man-days per hectare and average price of human labour was Tk. 400 per man-day. Therefore, the total cost of hired human labour was found to be Tk. 26000 representing 33.25 percent of total cost (Table 6.1).

6.2.1.3 Cost of seed

Cost of seed varied widely depending on its quality and availability. Per hectare total cost of seed for Boro production were estimated to be Tk. 3838.70, which constituted 4.91 percent of the total cost (Table 6.1).

6.2.1.5 Cost of urea

In the study area, farmers used different types of fertilizers. On an average, farmers used urea 252.5 kg per hectare. Per hectare cost of urea was Tk. 4545.00, which represents 5.81 percent of the total cost (Table 6.1).

6.2.1.6 Cost of TSP

Among the different kinds of fertilizers used, the rate of application of TSP (108.00 kg). The average cost of TSP was Tk. 2700.00 which representing 3.45 percent of the total cost (Table 6.1).

6.2.1.7 Cost of MoP

The application of MoP per hectare (120.8 kg). Per hectare cost of MoP was found Tk. 2053.60, which represents 2.63 percent of the total cost (Table 6.1).

6.2.1.8 Cost of gypsum

Among the different kinds of fertilizers used, the rate of application of Gypsum (122.5 kg). The average cost of Gypsum was found Tk. 1470.00 which representing 1.88 percent of the total cost (Table 6.1).

6.2.1.9 Cost of insecticides

Farmers used different kinds of insecticides to keep their crop free from pests and diseases. The average cost of insecticides for Boro production was found to be Tk. 2298.60 which was 2.94 percent of the total cost (Table 6.1).

6.2.1.10 Cost of irrigation

Cost of irrigation is one of the most important costs for Boro production. Production of Boro largely depends on irrigation. Right doses application of irrigation water help to increase bulb diameter, number of cloves, and number of leaves and plant height. As a result yield per hectare is being increased. The average cost of irrigation about 7-10 times and the average irrigation was found 8 times in survey area and Tk 800 to be per hectare, which was found Tk. 6400 per heater that represents 8.18 percent of the total cost (Table 6.1).

6.2.1.11 Cost of manure

It was observed in the present study area that farmers used cow dung for producing their enterprises. They bought a large portion of cow dung from the milk producers. It was found about Tk. 2000 per hectare.

Table 6.1: Per hectare costs of Boro

Cost Items	Quantity	Price Per Unit (Tk.)	Costs/Returns (Tk ha-1)	% of total
A. Gross Return				
Main product (Rice)	6725.56	16.25	109290.35	98.38
By-product (Straw)			1800.00	1.62
Total return			111090.35	100.00
B. Gross Cost				
C. Variable Cost				
Seedlings			3838.70	4.91
Irrigation	8	800	6400.00	8.18
Power tiller	2	1573	3146.00	4.02
Hired labour	65	400	26000.00	33.25
Urea	252.5	18	4545.00	5.81
TSP	108	25	2700.00	3.45
MOP	120.8	17	2053.60	2.63
Gypsum	122.5	12	1470.00	1.88
Fertilizers cost			10768.60	13.77
Manure	250	8	2000.00	2.56
Insecticides			2298.60	2.94
Total variable cost (TVC)			54451.90	69.63
D. Fixed Cost				
Land use cost			6500.00	8.31
Family labour	37	400	14800.00	18.93
Interest on operating capital @ 9% interest rate			2450.34	3.13
Total Fixed cost (TFC)			23750.34	30.37
E. Total costs			78202.24	100.00

Source: Field survey, 2020

6.2.1.12 Total Variable Cost

Therefore, from the above different cost items it was clear that the total variable cost of Boro production was Tk. **54451.90** per hectare, which was **69.63** percent of the total cost (Table 6.1).

6.2.2 Fixed cost

6.2.2.1 Rental value of land

Rental value of land was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of four months. Cash rental value of land has been used as cost of land use. On the basis of the data collected from the Boro farmers the land use cost was found to be Tk. 6500.00 per hectare, and it was 8.31 percent of the total cost (Table 6.1).

6.2.2.2 Cost of family labour

Human labour cost is one of the major cost components in the production process. It is one of the most important and largely used inputs for producing Boro. It is generally required for different operations such as land preparation, sowing, weeding, fertilizer and insecticides application, irrigation, harvesting and carrying, threshing, cleaning, drying, storing etc. The quantity of average family supply labour (Without hired labour)used in Boro production was found to be about 37 man-days per hectare and average price of human labour was Tk. 400 per man-day. If we pay those labour it was found to be Tk. 14800.00 representing 18.93 percent of total cost (Table 6.1).

6.2.2.3 Interest on operating capital

It may be noted that the interest on operating capital was calculated by taking in to account all the operating costs incurred during the production period of Boro. Interest on operating capital for Boro production was estimated @ 9% as bank rate and calculated Tk. 2450.34 per hectare, which represents 3.13 percent of the total cost (Table 6.1).

6.2.3 Total cost (TC) of Boro production

Total cost was calculated by adding all the cost of variable and fixed inputs. In the present study per hectare total cost of producing Boro was found to be Tk. **78202.24** (Table 6.1).

Table 6.2: Per hectare cost and return of Boro production

	Cost/returns (Tk/ha)
A. Gross Return	**111090.35**
B. Gross Cost	
C. Total Variable Cost (TVC)	**54451.90**
D. Total Fixed Cost (TFC)	**23750.34**
E. Total costs (TC)	**78202.24**
F. Gross Margin (A-C)	**56638.45**
G. Net Return (A-E)	**32888.11**
H. Undiscounted BCR (A/E)	**1.42**

6.2.4 Return of Boro production

6.2.4.1 Gross return

Return per hectare of Boro cultivation is shown in table 6.2. Per hectare gross return was calculated by multiplying the total amount of product with respective per unit price. It is evident from table that the average yield of Boro per hectare was 6725.56 kg and the average price of Boro was Tk. 16.25. Therefore, the gross return was found to be Tk. 109290.35 per hectare (Table 6.2). And remain by product (straw) estimated value Tk 1800 for per hectare Boro Cultivation. Total return or Gross margin was found Tk. 111090.35 for per hectare.

6.2.4.2 Gross margin

Gross margin is the gross return over variable cost. Gross margin was calculated by deducting the total variable cost from the gross return. On the basis of the data, gross margin was found to be Tk. 56638.45 per hectare (Table 6.2).

6.2.4.3 Net return

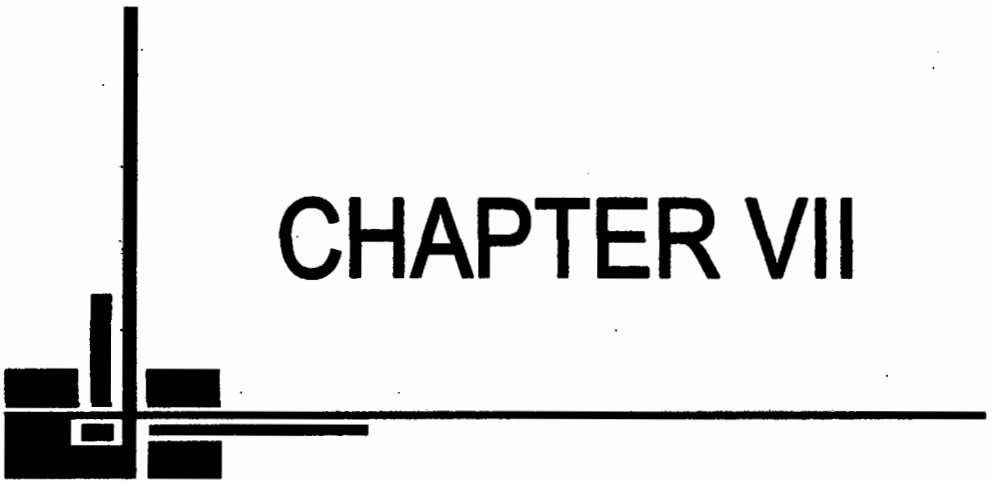
Net return or profit was calculated by deducting the total production cost from the gross return. On the basis of the data the net return was estimated as Tk. 32888.11 per hectare (Table 6.2).

6.2.5 Benefit Cost Ratio (Undiscounted)

Benefit Cost Ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. Benefit Cost Ratio (BCR) was found to be 1.42 which implies that one taka investment in Boro production generated Tk. 1.42 (Table 6.2). From the above calculation it was found that Boro cultivation is profitable in the study area.

6.3 Concluding remarks

From the above discussion it is easy to understand about the different cost items and their application doses of farmers, yields and returns per hectare of Boro cultivation. Boro production is a labour intensive enterprise. It is most essential to use modern inputs such as seeds, fertilizers, human labour, power tiller, pesticides and irrigation efficiently. Timely and efficient use of these inputs are the most important to increase production and profitability. On the basis of above discussions it could cautiously be concluded here that cultivation of Boro is a profitable. Cultivation of Boro would help farmers to increase their income earnings.



CHAPTER VII

CHAPTER VII

MAJOR FACTORS AFFECTING OF BORO PRODUCTION

7.1 Introduction

The estimation of efficiency with the help of production function has been a popular area of applied econometrics. Technical efficiency reflects the ability of a farmer to obtain the maximum possible output from a given level of inputs and production technology. It is a relative concept, since each farmers production performance is compared to a best-practice input-output relationship or production frontier. A farmer is technically inefficient in the sense that if it fails to produce maximum output from a given level of inputs. Technical inefficiency is then measured as the deviation of a farmer from the best-practice frontier. The main objective of this chapter is to estimate the technical inefficiency as well as frequency distribution of Boro farmers through technical efficiency analysis. The technical efficiency in production was estimated by using the stochastic frontier production. The primary advantage of a stochastic frontier production function is that it enables one to estimate U, (non-negative random variable which is under the control of the farmers).

Since the pioneering work on technical efficiency by Farrell in 1957, which drew upon the works of Debreu (1951) and Koopmans (1951), considerable effort has been directed at refining the measurement of technical efficiency. Empirical studies suggest that farmers in developing countries fail to exploit the potential of technology perhaps due to inefficient decision making due to various reasons of which management capacity is important one.

7.2 Interpretation of estimates of the production function:

Maximum likelihood estimation begins with writing a mathematical expression known as the Likelihood Function of the sample data. The likelihood of a set of data is the probability of obtaining that particular set of data, given the chosen probability distribution model. This expression contains the unknown model parameters. The values of these parameters that maximize the sample likelihood are known as the Maximum Likelihood Estimates or MLE's. The maximum likelihood estimates for parameters of the Cobb-Douglas production function for Boro production for all farmers are presented in Table 7.1.

Table 7.1: Estimated values of coefficients of Cobb-Douglas Production Function Model for Boro Farmers.

Variables	Parameter	Coefficients	T-ratio
Stochastic Frontier:			
Constant (X_0)	β_0	6.07	7.68
Human Labour (X_1)	β_1	-.1430***	-5.13
Seed (X_2)	β_2	-.0338	-0.39
Urea(X_3)	β_3	-.07460	-1.56
TSP(X_4)	β_4	.03808	1.15
MoP(X_5)	B_5	-.0407	-1.17
Insecticide (X_6)	β_6	.9279***	80.32
Irrigation (X_7)	β_7	-.01699**	-2.41
R^2		0.70	

Note: *, ** and * indicates significant at 1, 5 and 10 percent level respectively.**

Source: Field survey, 2020.

Human labor (X_1)

The regression coefficient of labour cost (X_1) of Boro production was negative and significant at 1 percent level of significance, which implied that if the expenditure on labour was increased by 1 percent then the yield of Boro would be decreased by 0.1430 percent, other factors remaining constant (Table 7.1).

Seed (X_2)

The regression coefficients of Seed cost (X_2) was negative and non-significant which indicates that seed has no effect on Boro production.

Urea (X_3)

The regression coefficient of Urea cost (X_3) of Boro production was negative and not significance, which implied that if the expenditure on urea was increased there would be no significant effect on Boro production.

TSP (X_4)

The regression coefficient of TSP cost (X_4) of Boro production was not significant which implies that TSP has no significant effect on Boro production.

Cost MoP (X_5)

The regression coefficients of MoP cost (X_5) was not significant. (Table 7.1) which indicate that MoP has no effect on Boro production.

Cost of insecticide (X_6)

The regression coefficient of insecticide cost (X_6) of Boro production was positive and significant at 1 percent level of significance, which implied that if the expenditure on insecticide cost was increased by 1 percent then the yield of Boro would be increased by 0.9279 percent, other factors remaining constant (Table 7.1).

Cost of Irrigation (X_7)

The regression coefficient of irrigation cost (X_7) of Boro production was negative and significant at 5% level of significance, which implies that if the expenditure on irrigation was increased by 1 percent then the yield of Boro would be 0.0169 percent, other factors remaining constant.

7.3 Concluding Remarks

From the above discussion it is easy to understand about the different cost items and their application doses of farmers, yields and returns per hectare of Boro cultivation. Boro production is a seed, irrigation and labour intensive enterprise. It is most essential to use modern inputs such as seeds, fertilizers, human labour, power tiller, pesticides and irrigation efficiently. Timely and efficient use of these inputs are the most important to increase production and profitability. It is noticed that Human labour, insecticides and irrigation have significant effect on Boro rice production in the study area. On the basis of above discussions it could cautiously be concluded here that cultivation of Boro is a profitable. Cultivation of Boro would help farmers to increase their income earnings.

CHAPTER VIII

CHAPTER VIII

PROBLEMS AND CONSTRAINTS TO BORO RICE PRODUCTION

8.1 Introduction

The focus of this chapter is to identify the extent of problems encountered by the Boro farmers. Farmers faced a lot of problems in producing Boro. The problems were social and cultural, financial and technical. This chapter aims at represent some socioeconomic problems and constraints to producing Boro. The problems and constraints faced by the farmers were identified according to opinions given by them. The major problems and constraints related to Boro cultivation are discussed below:

8.2 Low price of output

Most of the farmers had to sell a large portion of their product at the harvesting period to meet various obligations like, household's expenditure and repayment of loan. But harvest time price of Boro remained low because of ample supply. So they could not get reasonable return for their products. It can be seen from Table 8.1 that 91.25 percent Boro growers reported this as high problem.

8.3 High cost of irrigation water

Irrigation is the leading input for crop production. Yield of Boro varies with the application of irrigation water. Most of the farmers had no shallow tube well or deep tube well of their own in the study areas and for this they had to pay a higher amount of money to the water supplier. But farmers reported that they had to pay higher charge for irrigation water. Table 8.1 shows that about 88.75 percent Boro growers reported this as high problem. (Table 8.1).

8.4 High price of quality seed

High price of quality seed was also one of the most important limitations of producing Boro in the study area. From Table 8.1 it is evident that about 85.00 percent Boro growers reported this as high problem.

8.5 Lack of quality seed

Lack of quality seed was one of the most important limitations of producing Boro in the study area. From Table 8.1 it is evident that about 81.25 percent Boro growers reported this as high problem. Farmers in both Upazilas told that they were cheated by buying so called hybrid seeds from the local markets and from the seed dealers.

8.6 Attack of pest and disease

The growers of Boro were also affected by the problem of attack of pests and diseases. Pests and diseases attack reduce crop yield and increase cost of production. About 75 percent Boro growers reported this as high problem (Table 8.1).

8.7 Inadequate extension service

During the investigation some farmers complained that they did not get any extension services regarding improved method of Boro cultivation from the relevant officials of the Department of Agricultural Extension (DAE). As an agricultural extension personnel block supervisor, the main advisor of technical knowledge to the farmers about their farming problems. About 70.00 percent Boro growers reported this as high problem (Table 8.1). Farmers of both areas marked that they hardly ever got help from the block supervisor and Agricultural Extension Officer.

8.8 Lack of operating capital

The farmers of the study area had capital constraints. For cultivation of Boro, a huge amount of cash money was needed to purchase various inputs like, human labour, seed, fertilizers, pesticides, etc. About 68.75 percent Boro farmers reported that they did not have sufficient amount of money for purchasing the required quantity of inputs for the relevant enterprises and marked this as high problem. (Table 8.1).

8.9 Natural calamities

It was found that Boro growers faced some acute problems relating to the nature in their production process. Natural calamities like drought, hailstorm, excessive rainfall, caused

substantial damage to the crop in the field. Farmers said that excessive rainfall during the harvesting period reduces both the quantity and storability of Boro. Table 8.1 shows that almost 68.75 percent Boro growers in reported this as high problem.

8.10 Shortage of human labour

Most of the human labour is being used during seed/seedling plantation and harvesting period of Boro. Boro are labour intensive spices. Non-availability of human labour was found in different stages of production such as planting, intercultural operations and harvesting. Table 8.1 shows that near 62.50 percent of Boro growers reported this as high problem.

8.11 Lack of scientific knowledge of farming

Although modern agricultural technologies have been using in the study area, a large number of farmers have no adequate knowledge of right doses and methods of using modern inputs and technologies of producing their enterprises. Near 62.50 percent Boro growers were encountered this problem. (Table 8.1).

8.12 Adulteration of fertilizer, insecticide, and pesticide

Chemical fertilizers, insecticides and pesticides are the most important inputs of Boro production. They were being intensively used in Boro production in the study area. Many farmers reported to have been cheated by applying adulterate fertilizers and pesticides in their crop field. It can be seen from Table 8.1 that near 56.25 percent Boro growers faced this problem highly.

8.13 High price of fertilizers

Farmers claimed that non-availability of fertilizers at fair price was a problem in the way of producing enterprise. It appears from the table 8.1 that about 55 percent Boro growers reported this as high problem.

8.14 Poor storage facilities in house

Usually most of the fanners used to store their Boro in their house. Lack of trained manpower was a great deal of spoilage of Boro in the harvest and the post-harvest period. For this, they

had to face some losses like losing weight and rotten of Boro. It appears from Table 8.1 that only 50 percent of sample farmers faced the problem of poor storage facilities highly.

Table 8.1 Problems and Constraints of Boro Production by no. of Farmers

Type of Problems	No. of farmers	Percentage of farmers	Rank
Low price of output	73	91.25	1
High cost of irrigation water	71	88.75	2
High price of quality seed	68	85.00	3
Lack of quality seed	65	81.25	4
Attack of pest and disease	60	75.00	5
Inadequate extension service	56	70.00	6
Lack of operating capital	55	68.75	7
Natural calamities	55	68.75	8
Shortage of human labour	50	62.50	9
Lack of scientific knowledge of farming	50	62.50	10
Adulteration of fertilizer, insecticide, and pesticide	45	56.25	11
High price of fertilizers	44	55.00	12
Poor storage facilities in house	40	50.00	13
Lack of quality tillage	30	37.50	14

Source: Field survey, 2020

8.15 Lack of quality tillage

Deeply ploughing is essential for successful crop production. Most of the farmers, who use hired power tiller, reported that hired power tiller owners did not till deeply. Never the less, they did not use all the tines when they till others land. Table 8.1 shows that 37.50 percent Boro growers reported this as high problem.

8.16 Concluding remarks

The above mentioned discussions as well as the results presented in Table 8.1 indicates that Boro growers in the study area have currently been facing some major problems in conducting their Boro farming. These are the major constraints for the producers of Boro in the study area.

Public and private initiatives should be taken to reduce or eliminate these problems for the sake of better production of Boro.

CHAPTER IX

CHAPTER IX

SUMMARY, CONCLUSION AND RECOMMENDATION

9.1 Introduction

The key findings of the study are summarized in this chapter. Section 9.2 presents a summary of the major findings of the study. Conclusion, policy recommendations, limitations of the study and scope for further study are given in Section 9.3, 9.4, 9.5 and 9.6 respectively.

9.2 Summary

Agriculture is the main source of income and employment of Bangladesh. The country is characterized by high population growth rate, unfavourable land-man ratio and low growth rate in agricultural production. To meet these challenges, the country has to enhance agricultural production through following intensive method of cultivation and diversifying the production of crops. Agriculture sector continues to play a very important role in the economy of Bangladesh. Agriculture contributes about 13.35 percent of the GDP and provides 40.6 percent employment for its labour force. Total area of Bangladesh is about 14.845 million hectares of which 53.89 percent is cultivated, 3.16 percent is current fallow land, rest 42.95 percent is covered by homesteads, rivers, tidal creeks, lakes, ponds, roads, etc. Climatic condition of Bangladesh is friendly for agricultural crops.

Agriculture of Bangladesh is still dominated by rice production. According to the BBS (2020), in 2018-19 rice was produced in 28456 thousand acres of land among which Aman was cultivated in 13892 thousand acres of land which production was 14055 thousand MT, Aus was cultivated in 2731000 acres of land which production was 2775 thousand MT. and Boro was cultivated in 11832 thousand acres which production was 19561 thousand MT.

Despite having large population, there is a large gap between demand and supply, every year for meeting deficit, Bangladesh has to import a large volume of rice at the cost of hard earned foreign currency. Rice production is labour intensive, so cultivation of this crop can create

more employment opportunity to rural people of Bangladesh. In order to find out the problems, potentials and possibilities of expansion in both the acreage and production of Boro rice the present study is conducted with the following objectives:

- To assess the present socio-economic condition of Boro rice growing farmers.
- To find out the profitability of Boro rice in the study area.
- To identify major factors affecting the production.
- To suggest some guidelines for the improvement of Boro rice cultivation.

Villages of Ramganj upazila, Ramgoti upazila, Raipur upazila of Laxmipur district were selected for the study. In total of 80 farmers were selected by simple random sampling. Data were collected by comprehensive interview schedules. Simple statistical techniques as well as Cobb-Douglas production function were used to process and analyze data to achieve objective of the study.

In case of socioeconomic characteristics, it was found that average family size of Boro rice growers was 5.02 and sex ratio was 1.38. The highest percentage of people was in the age group of 15-59. Literacy rate of Boro rice growing families were 73.33 percent. Average annual income from crops 45000 Tk. from poultry 14500 Tk. From coconut and betel nut 48000 Tk. Average annual income from non-agricultural sector is 172500 Tk. Annually average 1000000 Tk. have been generated from foreign remittance. Profitability analysis was done to evaluate costs and returns of Boro rice production. It was observed that the quantity of hired human labour use per hectare was 65 man-days and average price of human labour was 400 per man day. Therefore, the cost of total hired labour to be Tk .26000 representing 33.25 percent of total cost. Per hectare total cost of seed for Boro production were estimated to be Tk. 3838.70, which constituted 4.91 percent of the total cost. . On an average, farmers used urea 252.5 kg per hectare. Per hectare cost of urea was Tk. 4545.00, which represents 5.81 percent of the total cost. Per hectare use of TSP, MoP, Gypsum for Boro rice production were 108.00kg, 120.8kg, 122.5 kg respectively whose costs were estimated at Tk. 2700, Tk. 2053.60, Tk. 1470 respectively. Per hectare cost of manure for Boro rice production was Tk. 2000. Per hectare irrigation cost 6400 Tk. covering 8.18 percent of the total cost. The average cost of insecticides of Boro rice cultivation was estimated Tk. 2298.60 which was 2.94 percent of the total cost.

For land preparation in Boro production, no. of tiller was required 2 times with average Tk. 1573 per tiller. Thus, the average land preparation cost of Boro production was found to be Tk. 3000 per hectare, which was 4.02 percent of total cost. Interest on operating capital for Boro production was estimated @ 9% as bank rate and calculated Tk. 2450.34 per hectare, which represents 3.13 percent of the total. Per hectare fixed cost of Boro rice production was Tk. 23750.34. Per hectare gross cost of Boro rice production was Tk. 78202.24. Per hectare gross margin of Boro rice growers was Tk.56638.45. Per hectare net return of Boro rice production was calculated Tk. 32888.11. Undiscounted benefit cost ratio of Boro rice production was 1.42. Cobb-Douglas Production Function model was applied on the basis of the best-fit and significant effects of resources on gross returns. Seven explanatory variables was taken into account to explain variations in production. The coefficient of multiple determination, R^2, was 0.70indicates that 70 percent of variation of output was explained by the explanatory variables included in the model. The present study also identified some problems of Boro rice production. The major problems faced by the farmers were low price of output, high price of input, lack of quality seed, lack of operating capital, shortage of human labour, inadequate extension service etc.

9.3 Conclusion

The results of the present study shows that considerable scope apparently exists in the study area to increase the productivity of Boro rice to increase income of the growers. Boro rice is extensively cultivated food grain in Ramganj, Raipur, Ramgoti upazila of Laxmipur district. Cultivation of more HYVs of Boro rice can help farmers in increasing farm income, employment and nutritive status of farmers. Farmers were not known about the application of inputs in right time with right doses. Therefore, they made over or under use of some inputs. Thus well planned management training in accordance with their problems, needs, goals and resource base can lead to viable production practices and sustainable income from Boro rice cultivation.

9.4 Policy Recommendation

On the basis of the findings of the study it was manifest that Boro rice was profitable enterprises and can generate income earnings and employment opportunity to the rural people of Bangladesh. But some problems and constraints revealed to attain the above mentioned

objectives. The policy makers should, therefore, take necessary actions according to the findings of the study some policy recommendations may be advanced which are likely to be useful for policy formulation:

1. Quality seeds of improved varieties in appropriate quantity are recognized to be one of the prime elements for enhancing agricultural production. Emphasis should be given on creating facilities and infrastructure support for hybrid garlic and Boro rice seed production, marketing and development.

2. Lack of operational capital is a problem for poor farmers. Favourable institutional credit programs should be launched aiming at particularly the small and medium farmers. Specialized and commercial banks should be encouraged to provide loans at a low interest rate to enable farmers to operate their farming on commercial basis.

3. Farmers could not get reasonable prices for Boro rice. Marketing costs are high because of inadequate information, infrastructure, high price risks etc. So appropriate steps should be taken to ensure fair price, quality products stability of production.

4. Shortage of human labour was a major problem for the farmers. Authorities should take this in concerns. Adequate training on recommended use of quality seed, fertilizer dose, insecticides.

5. Water management practices, etc., should be provided to the garlic and Boro rice farmers which will enhance production as well as resource use efficiency by improving the technical knowledge.

9.5 Limitations of the study

The study is suffered from a number of limitations. So, the findings of the study should be considered with a note of a caution. The limitations of the study are:

i. Maximum of the farmers did not keep any written documents of their farm activities. So that, information gathered mostly through their memories of the farmers which were not always accurate.

ii. In the resource and time constraints, broad and in-depth study got hampered to some extent. Therefore, the findings of this study should be interpreted cautiously to generalize for the country as a whole.

9.6 Scope for further study

Although the present study is intended to provide some valuable information for the guidance of farmers, extension workers, policy makers etc., it is not free from criticisms. Due to limitation of time and resources this study could not cover some important areas.

The weaknesses of the present study, of course, open roads for further research which are given below:

- The study could not cover all the area, a broad based study of this line may be under taken not only to understand profitability of Boro rice but also compare the profitability with other crops through relative profitability analysis.
- A further study can be undertaken by taking into account different farm sizes to assess the impact of profitability of Boro rice on income and employment opportunity.
- The study of other varieties of Boro rice may be conducted.
- Acreage response, growth and instability of Boro rice production can be studied with respect to Bangladesh

REFERENCES

CHAPTER X

REFERENCE

Akter, F. (2001). An Economic Study of Relative Profitability of Alternate Cropping Patterns Under Irrigation in Some Selected Areas of Barguna District. M. S. Thesis. Department of Agricultural Economics, BAU, Mymensingh.

Ali, H. (2000). Impact of Land Tenurial Arrangements on Costs, Returns and Household Income of Paddy Growing Farmers of Sadar Upazila in Mymensingh District. M. S. Thesis, Department of Agricultural Economics, BAU, Mymensingh.

BBS (2020). District Statistics, Bangladesh Bureau of Statistics, Statistics and Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh.

BER (2020). Bangladesh Economic Review, Department of Finance, Ministry of Finance, Government of the People's Republic of Bangladesh, Dhaka.

Economic Census 2013. District Report, Laxmipur.

Hasan, A. A. (2000). An Investigation in Economic Potentialities of Alok Hybrid Rice in a Selected Area of Mymensingh District. M. S. Thesis, Department of Agricultural Economics, BAU, Mymensingh.

Hossain, S. (2014). A Comparative Economic Analysis of Garlic and Boro Rice Cultivation in Some Selected Area of Natore District. M. S. Thesis, Department of Agribusiness Management, SAU, Dhaka.

Islam, T. (2018). A Comparative Economic Analysis on Profitability of Boro Rice and Jute Production in Rajoir Upazila of Madaripur. M. S. Thesis, Department of Agribusiness and Marketing, SAU, Dhaka.

Kazal, M. M. H., Rahman, S., Alam, M. J. and Hossain, S.T. (2013). Financial and Economic Profitability of Selected Agricultural Crops in Bangladesh. Department of Management and Finance, SAU, Dhaka.

Khalique, F. B., Sarker, T., Islam, S. and Murmu, H. (2019). Economic Analysis of Rice Production in Bangladesh. *United International Journal for Research and Technology, Volume 01, Issue 02, 2019.*

Khan, M. A. K. (2004). Productivity and Resource Use Efficiency of Boro Rice Cultivation in Some Selected Haor Areas of Bangladesh. M. S. Thesis, Department of Agricultural Economics, SAU, Dhaka.

Masum, F., Islam, M., Jannat, A. and Dhar, A. R. (2018). Economic of Boro Production in Rangpur District of Bangladesh: Comparative Assessment of Urea Super Granule and Traditional Urea Application. Agricultural Research and Technology Open Access *Journal, Volume 18, Issue 3- October 2018*

Sarker M. M. R., Quayum, M. A., Hossain, M. Z. and Main M. R. U. 2006. Comparative Economic Analysis of HYV and Hybrid Rice Production in the Selected Areas of Gazipur District. *Journal of the Bangladesh Society for Agricultural Science and Technology, 3 (1&2), pp. 25-28.*

Sarker, M. M. R., Alam, M. S., S. Islam and Alam M. M. 2004. Resource Exploitation for Irrigated Boro Rice Cultivation UnderFavourable Production Environments. *Bangladesh Journal of Agricultural Sciences, 31 (1), pp. 1-7*

Nargis, F. and Lee, S. H. (2013). Efficiency Analysis of Boro Rice Production in North-central Region of Bangladesh. *The Journal of Animal & Plant Sciences, 23(2): 2013, Page: 527-53. Department of Agricultural Economics, Sunchon National University, Suncheon, Jeonnam 540-950, South Korea.*

Rahman, K. M. M., Schmitz, P.M. and Wronka, T. C. (2002). Comparison of Technical Efficiencies for Rice Production in Bangladesh Under Two Alternative Tenurial Systems. *Bangladesh Developments Studies, 28 (1&2), pp.136-160.*

Rahman, K. T., Bari, M. R. and Kamruzzaman, M. (2016). Profitability and Technical Efficiency of Boro Rice (BRRI dhan29) Cultivation in Dinajpur and Bogra of Bangladesh. *International Journal of Natural and Social Sciences, 2016, 3(2): 04-11.*

Sujan, H. K., Islam, F., Azad, J. and Rayhan, S. J. (2017). Financial Profitability and Resource Use Efficiency of Boro Rice Cultivation in Some Selected Area of Bangladesh. *African journal of agricultural research, July 2017.*

Zaman, M. (2002). Resource Productivity and Adoption of Modern Technology by Tenancy: A Study of HYV Boro Rice Production in a Selected Area of Dinajpur District. M. S. Thesis, Department of Agricultural Economics, BAU, Mymensingh.