ECONOMIC ANALYSIS OF BORO RICE CULTIVATION OF BURICHANG UPAZILLA OF CUMILLA DISTRICT IN BANGLADESH

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BY

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CERTIFICATE

This is to certify that the thesis entitled ***Economic Analysis Of Boro Rice Cultivation Of BurichangUpazilla Of Cumilla District In Bangladesh*** *ubmitted to the Department of Agricultural Statistics, Sher-e-BanglaAgricultural 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 ofbonafide research work carried out by* ***HALEMA KHAN*** *Registration No.* ***13-05510*** *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

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DEDICATED TO MY BELOVED PARENTS

ABSTRACT

This study was conducted to assess the economic analysis of Boro rice production. In total 60 farmers were selected randomly from three villages namely Ghobindopur, Jatrapur and Nowapara under Burichang Upazila in Cumilla district of Bangladesh. Tabular technique and statistical analysis were done to achieve the objectives of the study. The Cobb-Douglas production function was used in this study to determine the effects of individual inputs on boro rice. Per hectare gross cost of Boro farmers was Tk99052.62669 and per hectare gross return was Tk139556.63.It was observed that per hectare net return was Tk. 40504.01.The undiscounted BCR were 1.41.The results indicated that Boro production was profitable .It was also evident from the study that per hectare net returns were influenced by most of the factors included in model namely: human labor, seed, fertilizer and manure, insecticides and pesticides, power tiller, and irrigation. These factors were directly or jointly responsible for influencing per hectare net returns for boro rice production. The study also showed that farmers producing boro rice faced some problems, mainly related to production and marketing of the crops.

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First of all, 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.

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ACRONYMS AND ABBREVIATION

BAU	:	Bangladesh Agricultural University
BBS	:	Bangladesh Bureau of Statistics
BDT	:	Bangladeshi Taka
BER	:	Bangladesh Economic Review
Cal.	:	Calories
CDP	:	Crop Diversification Programme
al.	:	and others (at elli)
FAO	:	Food and Agriculture Organization
FY	:	FiscalYear
g	:	gram
ha	:	Hectare
HIES	:	Household Income and Expenditure Survey
HYV	:	High Yielding Varieties
IOC	:	Interest on Operating Capital
k. Cal.	:	Kilo Calories
kg	:	Kilogram
mg	:	Milligram
mm	:	Millimeter
MoP	:	Murate of Potash
MT	:	Metric Tons
Rs.	:	Rupee symbol
SFYP	:	Sixth Five-Year Plan
SPSS	:	Statistical Package for SocialScience
Sq. km	:	Square Kilometer
Tk.	:	Taka
TSP	:	Triple Super Phosphate
GDP	:	Gross Domestic Product
AD	:	Agriculture Diary
NAS	:	National Accounts Statistics
BFSR	:	Bangladesh Food Situation Report

CHAPTER 1

INTRODUCTION

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INTRODUCTION

1.1 The Bangladesh Economy

Agriculture is the mainstay of the economy of Bangladesh. As a developing country, it has been striving for rapid development of its economy. The country has a population of 164.6 million encompassing an area of 147570 sq. km (BER, 2018).The population density per km2 is 1,115.55people (BBS, 2018).

About 80 percent of its population lives in rural areas, where agriculture is the major occupation and 40.6 % (BBS, 2018) labor force are engaged in agriculture. At present the contribution of agriculture to the total GDP is 13.32% in which 7.12% comes from crops, 1.35% from forestry, 1.79% from livestock and 3.07% from fisheries (BBS, 2018).In the year (2017-18), Bangladesh earned $687.53 million by exporting agricultural products which is 4.24 percent of total export earnings (BBS, 2018). So agriculture plays vital roles for poverty alleviation and food security by increasing income level of rural population.

The economic development of the country is mainly based on agriculture. The total cultivable area in Bangladesh isabout8.58Mha and net cultivable area is7.95Mha and 0.22 Mha are cultivablewaste (AD, 2018). The contribution of agriculture sector in GDP is 14.23 percent in 2017-18. The crop sub-sector dominates with 7.51% of total GDP at constant market price fromwhich rice contributes46% (NAS,2018). Of all crops, rice plays the leading role by contributing 96% of total food grain production (BFSR, 2018).

1.2 Background Information

1.2.1 Importance of Agriculture Sector

Bangladesh is predominantly an agrarian country. Due to its very fertile land and favorable weather, varieties of crop grow abundantly in this country. Agriculture sector contributes about 14.23 percentto the country`s Gross Domestic Product (GDP) and

employsaround40.60 percentof total labour force.Food grains production is 413.25 lakh MT. in FY2017-18. (BER 2018).

Agriculture is the major dominating sector of the country. Out of total land area of 14.84 million hectares, the net cropped area of the country is 8.002 million hectares and its cropping intensity is 196 per cent (BER 2018).

Table 1.1 shows agricultural sector growth rates in GDP of Bangladesh. The share of agriculture in GDP has fallen in recent years but it is still largest economic sector in our country.

Table 1.1 Agricultural Sector Growth Rates of GDP of Bangladesh at current Market Price

(Growth rate in % per year)

Year	Agriculture	Crop	Forestry	Livestock	Fisheries
2013-14	11.50	11.01	8.96	15.55	10.19
2014-15	12.48	12.03	10.43	15.83	11.08
2015-16	12.92	13.14	9.35	13.88	11.45
2016-17	10.71	9.88	10.14	14.88	14.84
2017-18	7.12	7.14	1.35	1.79	3.07

Source:BBS 2018

1.2 .2 Area and Production of Rice in Bangladesh

Bangladesh was the fourth largest rice producer in the world, but its productivity was low compared with other Asian countries. It is currently theworld's sixth-largest producer. High yield varieties of seed, application of fertilizer, and irrigation have increased yields, although these inputs also raise the cost of production and chiefly benefit the richer cultivators. Bangladesh inherited an agricultural sector dominated by rice production. Rice nearly three fourths of the crop land and is dominant source of supply of food and the major source of income and employment that helps finance development activities.

Table 1.2: Area and Production of Boro Rice by Different Years

Division	2016-17		2017-18	
	Area (ha)	Production (mt)	Area (ha)	Production (mt)
Dhaka	713641	3044422	769377	3311552
Mymensingh	619406	2495197	676562	2769727
Khulna	573572	2391068	600157	2477058
Barisal	130188	485567	131068	493378
Rajshahi	809725	3301628	490032	201189
Rangpur	600387	493386	788892	309987
Chittagong	567780	489976	339860	776890
Sylhet	589540	389210	487294	278806
Total	11890765	1288906	1178056	1288905

Source:BBS 2018

Rice is vital for the nutrition of many of the people in Asia, as well as in Latin America, and the Caribbean and in Africa. Developing countries account for 95% of the total production, with China and India alone responsible for nearly half of the world production. . Total rice production in Bangladesh was about 10.59 million tons in 2000 when the country's population was about 70.88 millions. However, the country is now producing about 33.2 million tons to feed about 166.59 millions people of this country. This indicates that the growth of rice production was much faster than the population growth. This increased rice production was possible largely due to the adoption of modern *Boro*rice varieties.

Table 1.3. Area and Production of Aus, Aman and Boro Rice in Bangladesh

(000 acres) (000 m. tons)

Year	Aus		Aman		Boro	
	Area	Production	Area	Production	Area	Production
2013-14	36	84	97	164	304	486
2014-15	32	84	97	164	307	490
2015-16	34	82	98	170	304	484
2016-17	32	77	125	204	284	460
2017-18	37	97	127	209	309	501

Source:BBS 2018

1.2.3 Importance of BoroRice.

Rice, the staple food crop in Bangladesh about 80% of the cultivable lands are occupied by rice. Rice production systems make a vital contribution to the reduction of hunger and poverty in Bangladesh. It grows in three seasons namely; Aus, Aman and Boro. It covers 8.80%, 37.37%and55.55% of land respectively and total production of rice was estimated to be 33833 metric ton (BBS, 2018).About 100% population of the country depend on rice as their major food. 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 weather condition for Boro cultivationwas favoruable in the growing stageof this year.

Figure 1.1:Picture of Boro rice

Source:Field Survey,2019.

1.3.Justification of the Study

Agriculture plays a vital role through employment generation, poverty alleviation, food security enhance, standard of living by increasing income level of the rural people. About 80 percent of the people of Bangladesh live in the rural areas and they depend on agricultural activity. for their livelihoods. As almost 65 percent of the total population (and above 80 percent of the rural population depend on agriculture. The development of agriculture sector is very much urgent for poverty reduction and sustainable development of the country

In order to meet the demand of food grain for the increasing population and to achieveself-sufficiency in food grain, the government of Bangladesh has given much emphasis on riceproduction. Significant compositional changes occurred within rice production. This has definitely changed the cost structure of rice production.

So these study attempts to measure economic analysis and resource use efficiency of Boro rice. It also attempts to measure socioeconomic characteristics of the farmers in the study area. Moreover, this type of study has not conducted before in the study area. So, further investigations are necessary to help the policy makers in coming to right conclusion, and formulating appropriate policies. Study of such nature will definitely help

the policy makers, researchers and Government officials (dealing with food policy) in formulating future strategies for rice production in Bangladesh.

1.4 Objectives of the study

The specific objectives of the study are as follows-

i. To identify the socio-economic profile of Boro rice farmers.
ii. To determine the costs, returns & profitability of Boro rice.
iii. To identify the problems faced by the farmers in practicing improved rice farming.

1.5 Organization of the Study

The study has been organized into eight chapters. Chapter 1 describes the introduction of the study along with the objectives and justification. In chapter 2 a review of literature is presented and methodology is described in chapter3,Chapter 4 represents the socioeconomic characteristics of the farmers of the study area. Economic analysis of Boro paddy is shown in Chapter 5and Chapter 6provides Factors affecting the returns of Boro rice farmers and Problems and constraints of Boro farmers is shown in Chapter 7.Finally Chapter 8 presents summary, conclusion and policy recommendations of the study.

CHAPTER 2

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

For any research,review of literature is essential because it provides a scope for reviewing the stock of knowledge and information relevant to the proposed research. Although a lot of studies have been done on costs and returns of rice production in Bangladesh, only a few studies have so far conducted related to economic analysis and resource use efficiency ofBororice.This study highlights only a few of the studies, which are considered recent and very relevant for this research. Again, some of these studies may not entirely relevant to the present study, but their findings, methodology of analysis and suggestions have a great influence on the present study and all of these study have been conducted on Bangladesh, so it have great influence on the present study.So,,some of the literatures related to the present analysis are briefly discussed below:

2.2 Boro rice production Related Studies

On measuring the costs of production,**Rahman**et al. (2007)conducted a study, based on sizes of farm operation on rice farmers in Jessore district ofBangladesh.The objectives of the study were to measure the differences in the cost of production of Boro rice farmers on the basis of land. They included three types of rice farmers small, medium &large. They found that although there were no significant differences in the quantity of inputs used for all categories of farmers, the unit cost of some inputs significantly varied between small-large medium-large, thus affecting the cost of production. The reason is that most of the small medium farmers purchased inputs on credit, spending comparatively more than cash &they paid higher interest on borrowed money. They showed that for that reasonrice production increased regardless of the land operation size but small &medium farmers still have a serious problem especially the increasing cost involved in the production.

Mustafi and Azad(2000) conducted a study on adoption of modern rice varieties in Bangladesh. They examined the comparative profitability of BR-28 and BR-29 and found that the average yields 5,980 kg and 6,670 kg per hectare respectively. The gross margin was higher for BR-29 which was Tk. 27,717.02 per hectare. The farm level data also showed that the unit cost of BR-29 and BR-28 were Tk. 4.70 and Tk. 5.12 per kg. They also compared to BR-28 return from BR-29 is higher by Tk. 3,759 per hectare.

During Boro Period in Bangladesh**Chowdhury**et al. (2013) investigated the Efficiency of Rice Farms: An Econometric Approach .They was focusing to achieve the target by improving the efficiency of the farmers. Modern econometric tools, like Stochastic Frontier Approach (SFA) were used for measuring the efficiencies of the farmers. Empirical results of this study shows that average technical, allocative and economic efficiency of the farmers during Boro period were 86 per cent, 75 per cent and 64 per cent respectively.

Sarkeret al. (2010)conducted a study on comparative economic analysis of borrower & non borrower Boro rice farmers in some selected sites of Mymensingh district. They selected one hundred samples from four villages under Trishallupazila. This study has been conducted to examine the differences in input use, costs &returns of the borrower & non borrower rice farmers. They were found that borrower farmers used more inputs &attained more returns through higher yield than their counterparts. The yields of rice per hector were 5260.80kg &422177.34kg for the borrower and non borrower farmers respectively. They also found that borrower farmer's net return and gross return are higher than non borrower farmers.

The Wadudet al.(2011)conducted a study on Profit Efficiency and Farm Characteristics Evidence from the Rice Farmers in Bangladesh. They examine profit efficiency of rice farmers in some selected district of Bangladesh. From the study they found that estimated profit frontier revealed negative elasticity of price of fertilizers and positive elasticity of wage rates, price of seeds and area of land cultivated. The mean profit efficiency was 69%.

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 boro income and employment.

Quazi and Paul (2002) conducted a study on comparative advantages of crop production in Bangladesh. In their study, the economic profitability analysis demonstrates that Bangladesh has a comparative advantage in domestic production of rice for import157.81/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.

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. 157.81/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.

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.

Rahmanet 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 16 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.

Zaman(2002)conducted a study to accomplish a comparative analysis of resource productivity and adoption of modern technologyunder 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 and 80 percent, respectively whereas mean technical efficienciesobtained 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.

Islamet al.(2007) carried out a study to examine the income and price elasticities of demand for different types of rice in Bangladesh. The total budget for cereal field allocated to aromatic, fine, course rice and wheat was 4.0%, 23.3%, 65.2% and 7.5% respectively.The estimated expenditure elasticities of demand for those types ofcereal were 0.85, 0.79, 0.29 and 0.55 respectively.

Mondal(2005) attempted to measure and compare resource use, efficiency and relative productivity of farming under different tenurial conditions. It is found that total cash expenses as well as total gross cost producing HYV boro rice was highest in owner-cum-tenants owned land than in rented in land. When individual inputs were concerned it was

observed that expenses on human labour shared a major portion of expenses in the production of HYV boro rice under all tenure groups. The fertilizer cost in owner's own land was significantly different from that of tenant's rented land. It was found that owner farmers were more efficient than owner-cum-tenant and tenant farmers. Again, owner-cum-tenants were more efficient in production in the case of his owned land than in rented in land.

Ahmed(2009) conducted a comparative economic analysis of boro rice and potato production in some selected areas of Mymensingh district. Both boro rice and potato were profitable. Potato cultivation was more profitable than boro rice cultivation. Per hectare average yield of boro rice and potato were 6000 kg and 16302 kg, respectively. Per hectare total cost of production, gross margin and net margin of boro rice were Tk. 58202.74, Tk. 39402.2 and Tk. 24117.26, respectively. On the other hand, the corresponding figures for producing potato were Tk. 120221.71, Tk. 155436.23 and Tk. 142403.51, respectively.

Majid and Haque (2007)conducted a study on Monga mitigation for employment and food security increase through early aman rice production and crop diversification in greater Rangpur region of Bangladesh.Introducing of cash crop in potato growing time (early to late November) contributed more productivity (32.4-39.3 MT/ha) than Rice-Non-Rice system as Rice-Rice (13.2 MT/ha). The highest rice equivalent yield associated with early Aman Rice-Potato-Mungbean(37.4 MT/ha) and Early Aman Rice-Potato-Rice (Bolan/older seedling of BRRI Dhan-33) (32.4-32.6 MT/ha). However, early Aman Rice-Potato-Mungbean gave lower productivity than Rice-Potato-Relay Maize/Maize but Mungbean added some biomass in the soil for soil health.

2.3 Research Gap

From the summary of the above studies it is clear that many of the previous studies conducted in Bangladesh focused on economic analysis of Boro rice, but no studies were accomplished in this study area. A number of researchers explained their opinions on their own viewpoint. The present study is designed to measure the economic analysis of Boro rice in a less developed area of Bangladesh.

CHAPTER 3
METHODOLOGY

CHAPTER 3

METHODOLOGY

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. The scheme of the survey for the present study involved the following steps.

3.1 Selection of the Study Area

Selection of the study region is an important phase for the farm management research. A preliminary survey in BurichangUpazila of Cumilladistrict was conducted to achieve the objectives of the present study. On the basis of preliminary information, Gobindopur,Nowapara and Pirjatrapurvillages were selected purposively because a large number of farmers grow boro rice in these villages.The other reasons for selecting the study region were as follows:

i.The area represented the same agro-ecological characteristics

ii.These were typical boro rice growing villages with representative soil condition, topography and patterns

iii.Easy accessibility and good communication system existed in theselected villages

v.Co-operation 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 andother socioeconomic characteristics of the area.No socioeconomic study of this type was conducted previously in this area.

3.2 Sample Size and Sampling procedure

Selecting samples for a study two factors need to be taken into consideration. The sample size should be as large as to allow for adequate degrees of freedom in the statistical analysis. On the other hand, administration of field research, processing and analysis of data should be manageable within the limitation imposed by physical, human and financial resources (Mannan, 2001)..A simple random sampling technique was followed in the present study for minimizing cost, time and to achieve the ultimate objectives of the study.Three villages of BurichangUpazila in Cumilla district were selected. To lists of farmers, who cultivatedboro rice, was collected with the help of agricultural extension

personnel and elderly farmers of the study area. A total number of 60 farmers,were selected from the study areas.

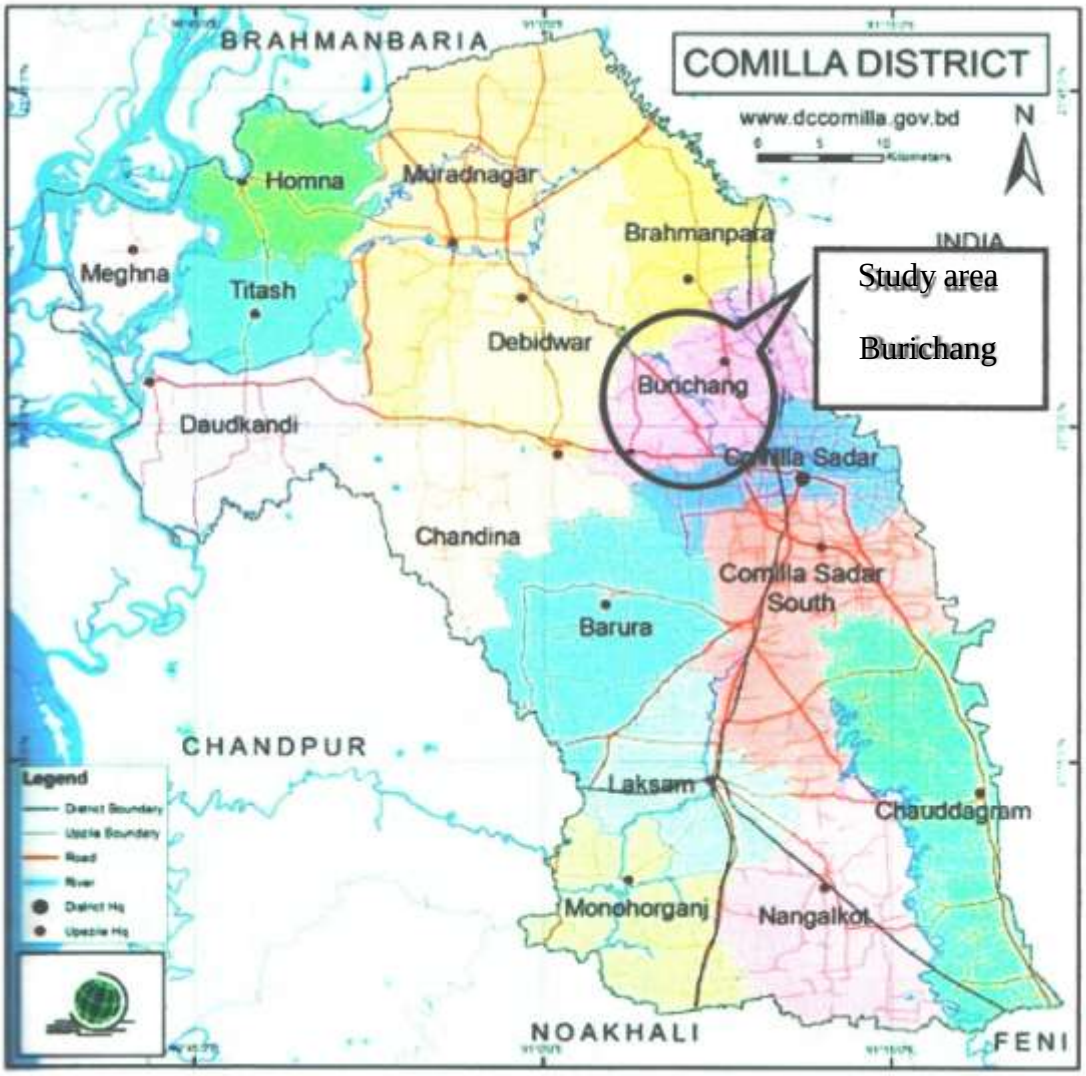

Figure: Map of Cumilla district

Source: Internet Search Engine Google

Figure: Map of Burichangupazilla

Source:Internet Search Engine Google

3.3 Preparation of the Survey Schedule

One of the most important part of this study was preparation of survey schedules. A comprehensive survey schedule was prepared to collect necessary information from the concerned respondent in such a way that all relevant information needed for Boro rice production could be easily obtained within the shortest possible time. The interview schedule was pretested for judging their suitability. The final survey schedule was prepared on the basis of the results of the pre-test survey.

3.4 Data Collection

Primary data were collected through structured interview schedule which were filled up by the researcher. Asimplerandom sampling technique was used to collect data fromrespondent farmer.Data was collected from August to October 2019.Additionally, secondary data were also collected from various sources like Bangladesh Bureau of Statistics (BBS) and Ministry of Agriculture.

3.5 Data Processing and Analytical technique

In this study, a statistical tool and technique both descriptive and functional was used to analyze the data.Besides, a descriptive tool and technique tabulation was also used in the study.Primary data were recorded into Statistical Package for Social Science (SPSS) and economic analysis was carried out for determining costs and returns. In this study, cost and return analysis were done on total cost basis. To achieve the objective of the study a simple tabular analysis was completed. Profit equation was developed to assess the profitability of Boro rice production.

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3.5.1 Descriptive Analysis

Descriptive analysis was generally used to find the socio-economic status of the respondents. The tabular technique of analysis was used for determining the cost, returns and profitability of Boro rice production and to assess and forecast the social tension. This technique is simple in calculation, widely used and easy to understand. It was used to get the simple measures- like average, percentage and ratio.

3.5.2 Functional Analysis

The production function represents the technological relationship between output and factor inputs. To estimate the production function, one requires development of its properties leading to specification of an explicit functional form. One of the most widely used production function for empirical estimation is the Cobb Douglas production function. This function was used to analyze the input-output relationship in Boro rice production. To determine the contribution of the most important variables in the production process ofBoro rice, the following specification of the model will be used-

$$Y=aX_{1i}^{b1}X_{2i}^{b2}X_{3i}^{b3}X_{4i}^{b4}X_{5i}^{b5}X_{6i}^{b6}X_{7i}^{b7}e^{u_i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

The Cobb-Douglas production function was transformed into following logarithmic form so that it could be solved through ordinary least squares (OLS) method.

$lnY = lna + b_1 lnX_{1+} b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_{4+} b_{5l} nX^5 + b_6 lnX_6 + b_7 lnX_7 + U$……..(3.2)

Where, Y= Gross income from year round Bororice(Tk/ha);

X_1= Human labor cost (Tk./ha);

X_2= Tillering cost(Tk /ha);

X_3=Land preparation cost(Tk /ha);

X_4=Seedling cost(Tk /ha);

X_5=Fertilizer and manure(Tk /ha);

X_6=Pesticides (Tk /ha);

X_7= Irrigation(Tk /ha);

a= Intercept;

b_1…..b_7= Coefficient of the respective variable;

U_i= Error Term;

i= 1, 2…7.

3.6 Profitability Analysis

The ultimate or primary goal of a farm is profit maximization. Profit or net return is the difference between the total revenue (gross return) i.e. total value product (TVP) and the total factor cost (TFC). Cost and return analysis is the most common method of determining and comparing the profitability of different farm household. In the present study, the profitability of boro rice cultivation is calculated by the following way-

3.6.1 Calculation of Gross Return

Per hectare gross return was calculated by multiplying the total amount of product and average price of the product and addition to the value of by product.

Gross Return (GR) = Quantity of the product × Average price of the product + Value of by-product.

3.6.2 Calculation of Gross Margin

Gross margin is defined as the difference between gross return and variable costs. Generally, farmers want maximum return over variable cost of production. The argument for using the gross margin analysis is that the farmers are interested to get returns over variable cost. Gross margin was calculated on total variable cost (TVC) basis. Per hectare gross margin was obtained by subtracting variable costs from gross return. That is,

Gross margin (GM) = Gross return (GR) – Total variable cost (TVC).

3.6.3 Calculation of Net Return

Net return or profit was calculated by deducting the total production cost from the total return or gross return. That is,

Net return (NR) = Total return (TR) – Total production cost (TPC).

The following conventional profit equation was applied to examine farmer's profitability level of the Boroproduction in the study areas.

Net profit, $\pi = \Sigma P_b Q_b + \Sigma P_b Q_b - \Sigma (P_{xi} X_i) – TFC.$

Where, π = Net profit/Net return Boroproduction(Tk/ha);

P_b = Per unit price of Boro rice (Tk/kg);

Q_b= Total quantity of the Boro production (kg/ha);

$P_{b=}$Per unit price of by product of rice (Tk/kg);

Q_b= Total quantity ofby product of rice (kg/ha);

P_{xi}= Per unit price of i-th inputs (Tk);

X_i= Quantity of the i-th inputs (kg/ha);

TFC =Total fixed cost (Tk); and

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

3.6.4 Undiscounted Benefit Cost Ratio (BCR)

Average return to each taka spent on production is an important criterion for measuring profitability. Undiscounted BCR was estimated as the ratio of total return to total cost per hectare.

BCR= Total Return /Total Cost

3.6.5 Problem Encountered in Collecting Data

During collecting data from the field, the researcher faced the following problems.

- Generally most of the farmers did not keep their written records on annual, monthly or daily transaction and activities.The researcher had to rely solely on the memory of the farmer;

- The farmers were afraid of imposition of taxes and they always tried to avoid providing true information relating to the actual size of holding and income;
- Most farmers initially hesitated to answer the questions since the author was unknown to them;

- The farmers were usually busy with their filed works. So, the researcher sometimes also had to pay extra visits to meet the farmer;
- Most of the farmers felt disturbed to answer questions and had fear since they thought that the researcher might use the information against their interest. To earn the confidence of the farmers a great deal of time was spent.

CHAPTER 4

SOCIO-ECONOMIC CHARACTERISTICS OF THE BORO FARMERS

CHAPTER 4
SOCIO-ECONOMIC CHARACTERISTICS OF THE BORO FARMERS

In the use of research planning, Socio-economic condition of the sample farmers is very important because there are numerous interrelated and constituent attributes characterizes an individual and profoundly influences development of his/her behaviors and personality. People differ from one another for the variation of socio-economic aspects. For the present research a few of the socio-economic characteristics have been taken into consideration for discussion.

4.1 Age and Sex Distribution of the Respondents

The age structure of the sample farmers was examined by classifying into three age groups that were Young age (<35 years), Middle age (35-50 years), and Old age (>50 years). The different age groups ofthe farmer are shown in Figure 4.1.1.There are three groups because almost all respondent cover these three categories.It was found that the highest number of the respondents (54.8%) belongs to the middle age (35-50) followed by the Old age (>50 years) 22.7% and 22.5% respondents are in the young age (<35years). It is evident from the table that 91.7percent male and 8.3 percent female were Boro rice farmers in the study area.

Figure 4.1.1 Level of Age of the Respondents

Category	Frequency	Percentage
Young age(<35)	14	22.5
Middle age(35-50)	34	54.8
Old age(>50)	12	22.7
Total	60	100

Source: Field survey, 2019.

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4.2 Level of Education of the Respondents

On the basis of education the respondents were classified into six categories as shown in Figure5.2. It was revealed that highest portion of therespondents (35.5%) has achieved

secondary level of education followed by illiterate (6.5%), signature only (16.7%) higher secondary level (11.3%) and higher education (3.2%). It is clear from the study that all the respondents who are involved in Boro production were much educated in the study area.

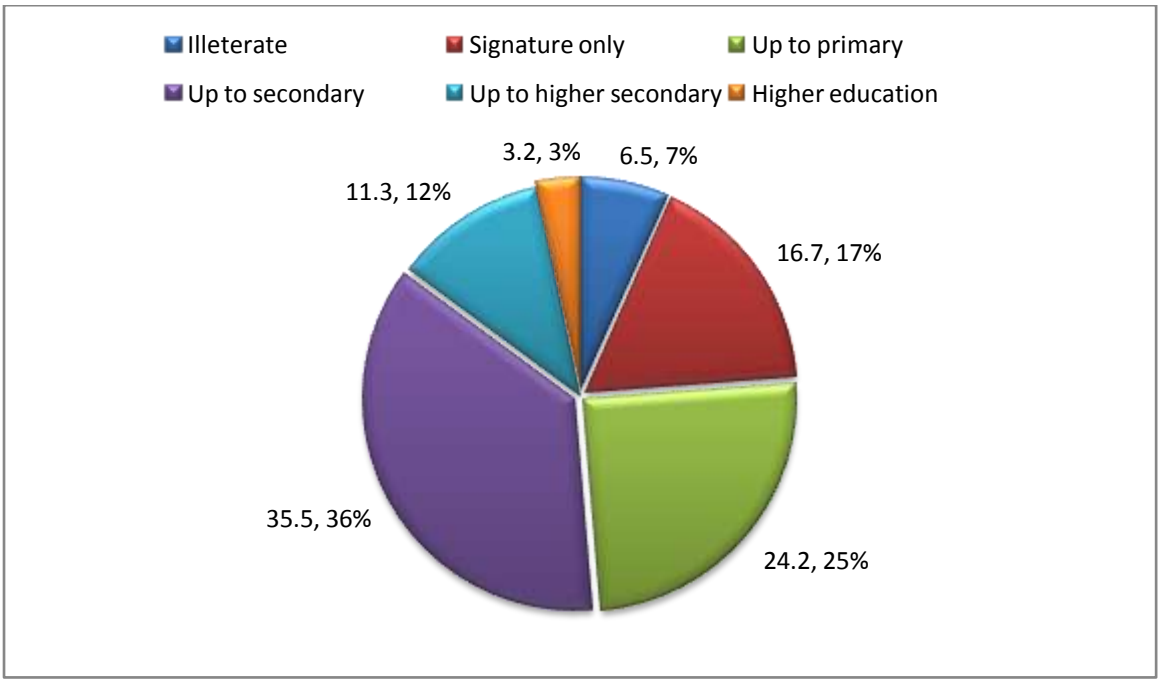

Figure 4.2:Level of Education of the Respondents

Source: Field survey, 2019.

4.3Average Family Size and Composition

Data presentd in Table 4.3 indicate that most of the respondents family (50%) belonged to medium size family,categories followed by medium size family (41.67%) while only about 8.33% of the respondents belonged to large family size category.

Table 4.3 Average family size of Boro rice farmers

Category	Frequency	Percentage
Small size	25	43.3
Medium size	30	48.4
Large size	5	8
Total	60	100

Source: Field survey, 2019.

4.4Occupational Status of Respondents:

The work in which a man is engaged for more or less throughout the year is known as the occupation of that person. Selected farmers of the study area were engaged in various other occupations along with Boro rice cultivation. The main and subsidiary occupations of selected farmers are presented in Table 4.4.

Table 4.4 Occupational Status of Boro rice farmers

Category	Frequency	Percentage
No work	4	6.5
Agriculture	26	41.9
Agriculture labor	1	1.6
Non-agriculture Labor	7	11.3
Service	10	16.1
Student	6	9.7
Business	4	9.7
Others	2	3.2
Total	60	100

Source: Field survey, 2019.

4.5 Income Distribution of the Respondent

The yearly income of Boro farmers differs from one another. In the present study, the incomes ofBoro farmers were categorized as follows: less than 50000,50000-100000 from 110000 - 150000 and 150000- 200000.

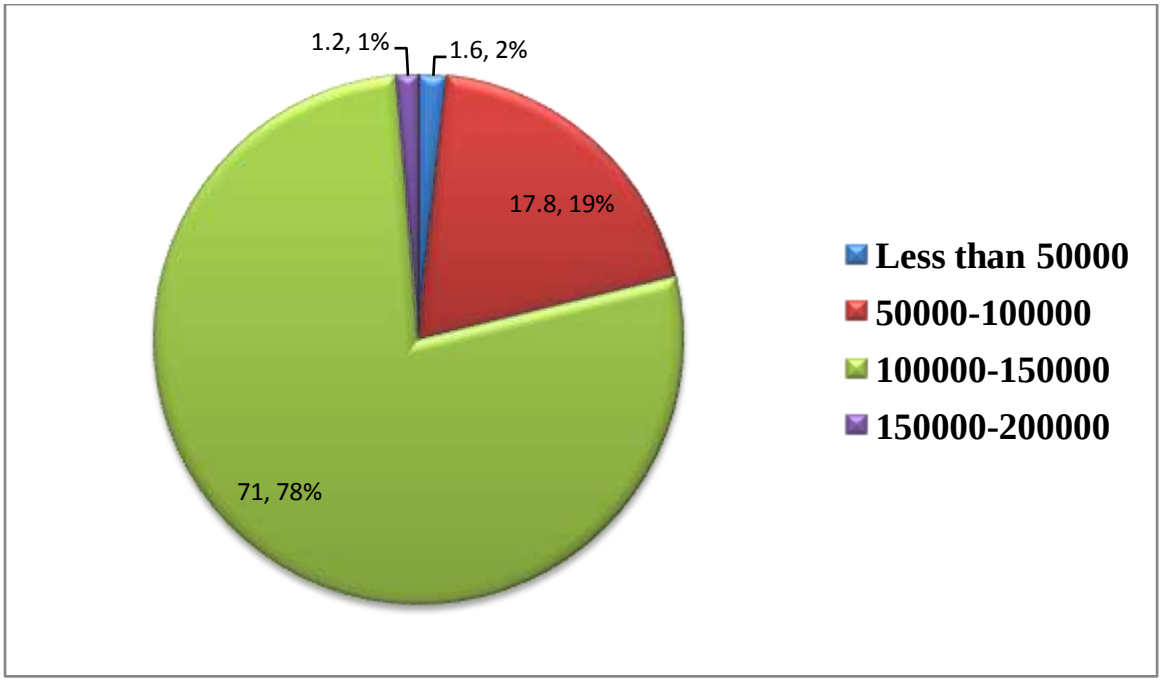

Figure 4.5:Income distribution of the respondents

Source: Field survey, 2019

4.6Size of land holdings:

The land holding of the respondents are categorized into several categories such as homestead land, own land in cultivation, rented in, mortgage in, fellow land, pond, rented out and mortgage out.

Table 4.6 Size of Land Holding of the respondents

Types of land	Average area (Decimal)	Percent (%) of area
Homestead	15.27	2.75
Own cultivable land	70.42	8.03
Leased in	60.10	10.84
Leased out	187.31	33.79
Mortgaged in	125.05	22.56
Mortgaged out	48.48	8.75
Pond	7.15	1.25
Fellow land	18.70	8.05
Total	554.32	100

Source: Field survey, 2019

4.7 Concluding Remarks

The socioeconomic attributes of the sample farmers has analyzed. The findings of analysis clearly indicate the socioeconomic characteristics from each other in respect of age and sex distribution, education, occupation, land size and income etc.

CHAPTER 5

COST AND RETURNS OF BORO RICE PRODUCTION

CHAPTER 5
COSTS AND RETURNS OF BORO RICE PRODUCTION

5.1. Introduction

Every production process, cost plays a vital role for making right decision of the farmers. This chapter mainly deals with the estimation and analysis of costs of Boro rice production. The costs were classified into variable costs and fixed costs. Most of the inputs were valued at the current market rate and sometimes governments' rates in the study area during the survey period or the prices at which farmers bought the inputs. But, for some unpaid inputs such as family labor, non-cash price was actually paid and pricing was very difficult in such cases. In these cases, the rule of opportunity cost was followed. In this chapter, in terms of Boro production per hectare yield, gross return, gross margin, net return and undiscounted benefit-cost ratio are discussed.

Table 5.1 : Variable and fixed cost of Boro rice production in the study area:

Particulars	**Quantity**	**Rate (Tk/unit)**	**Cost (Tk/ha)**	**% of Total Cost**
Variable Cost				
Seedlings			3220.40	3.25
Irrigation			10853.75	10.96
Power tiller/ mechanical cost	4	1645	6580	6.64
Hired labor	75.00	450	33746.03913	34.07
Urea	294.14	16	4706.191463	4.75
TSP	168.22	22	3700.867166	3.74
MOP	114.61	15	1719.198571	1.74
Gypsum	40.59	12	487.1237077	0.49
Zinc Sulphur	5.32	8	42.52370766	0.04
Total Fertilizers cost			10655.90461	10.76
Manure	210	10	1235	1.25
Insecticides			1720.74	1.74
Total variable cost			**68011.84**	**68.66**
Fixed Cost				
Land use cost			18668.83	18.85
Family labour cost	25	450	11250	11.36
Interest on operating capital @ 10%			1121.96	1.13
Total Fixed cost			**31040.79**	**31.34**
Total costs			**99052.63**	**100**

5.2 Variable cost

5.2.1Human labor cost

It varied from 450 0 to 550 Tk. per man-days in the study area. Thus the computed average rate was Tk. 500 per man-days for Boro production.

Use of human labor and its relevant cost incurred were shown in table 5.1. The labor cost was 33746.03913Tk/ha which constituted34.07%of total variable cost.Table 5.1 also shows that the amount of human labor for Boro production was 75 mandays per hectre.

5.2.2 Cost of Power Tiller

In the study area, power tiller was mainly used for land preparation. Power tiller was used on contact basis .Most of the farmer used power tiller for leveling their land in this area. By adding power tiller cost total mechanical cost was found. Table 5.1 indicates that the power tiller cost for producing Bororice was 6580Tk/hec and 6.64% total variable cost.

5.2.3 Cost of Seed

Farmers used both homesupplied and purchased seed,

in the study area.. The costs of home supplied seed were determined at the ongoing market rate and costs of purchased seed were calculated on the basis of actual prices paid by the farmers in the study area. Cost of seedlings of Boro rice was3220.40Tk/hec and 3.25% of total variable cost.

5.2.4 Cost of Fertilizer

In the study area farmers used five types of chemical fertilizer namely, Urea, Triple Supper Phosphate (TSP), Muriate of Potash (MP), Gypsum and ZincSulphate (ZnSo4). These chemical fertilizers were charged at the rate of price paid by the farmers. Table 5.1 shows per hectare costs of chemical fertilizers. Costs of Urea were4706.191463Tk/ha and thepercentage of total cost of production was 4.75%, .Costs of TSP was 3700.867166Tk/ha and the percentage of total cost of production was 3.74%.Per hectare costs of MOP was 1719.198571 and the percentage of total costof production was 1.74%.Cost of Gypsum 487.1237077Tk/ha and percentage is 0.49%.Cost of $ZnSO_4$42.52370766Tk/ha& percentage was 0.04%.Cost of Manure:1235Tk/ha,percentage 1.25%. Cost of Pesticide 1720.74Tk/ha, and percentage was 1.74%. Cost of Irrigation 10853.75Tk/ha and percentage 10.96% .The respondent farmers used 210 kg of manures

per hectare. Boro rice farmers also used chemical fertilizers like urea, TSP, MOP, Zipsum , Zinc sulphate at the rate of 294.14 kg,168.22kg,40.59 kg,5.32 kg .Table 5.1 : Variable and fixed cost of Boro rice production in the study area.

5.3 Fixed cost

Fixed cost is also an important part for economic analysis. Here land use cost is 18668.83Tk,which contributes 18.85% of total cost. Family labor cost is.11250Tk. which contributes 11.36 % of total cost. Interest on operating capital is1121.96Tkwhich contributes 1.13% of total cost(Table 5.2).5.2.Total cost is calculated on the basis of variable cost and fixed cost. Total variable cost is68011.84Tk/hecand total fixed cost is31040.79Tk/hec.So the total cost is 99052.63Tk/hec(Table 5.2).

Table 5.2 Cost and Return of Boro rice production in Study Area

Particulars	**Cost/Returns (Tk/ha)**
Gross Return	139556.63
Variable Cost	68011.83539
Fixed Cost	31040.7913
Total costs	99052.62669
Gross Margin (GR-VC)	**71544.80**
Net Return (GR-TC)	**40504.01**
Undiscounted BCR (GR/TC)	**1.408913996**

5.4 Gross return

Gross return is calculated on the multiplication of yield per hectare with average price of Boro rice and then addition to the by product value. The yield of Boro riceis6914.27kg/hec, market price.18.93Tk and by product value is8669.43 kg/hec.So the gross return is139556.63Tk/hec(Table 5.2).

5.5 Gross margin

Gross margin is calculated by the subtraction from gross return to variable cost.The variable cost is68011.83539Tk/hec.So the gross margin is Tk. 71544.80(Table 5.1).

5.6 Net return

Net return is calculated by the subtraction from gross return to total cost. Gross return is Tk139556.63and total cost is Tk99052.62669.So the net return is Tk40504.01

5.7 Benefit cost ratio (undiscounted)

Benefit cost ratio is calculated from the table 5.21by the division of gross return and total cost on the full cost basis. Gross return is Tk139556.63 and total cost is Tk99052.62669/hec. So the Benefit cost ratio (BCR) on full cost basis is 1.41. Here variable cost is Tk68011.83539/hec. So the benefit cost ratio on variable cost basis isTk 2.05(Table 5.2)

5.8 Concluding Remarks

Fromthe above discussion andthe results presented in Table 5.2 it is clear thatBoro rice production is a profitable business for the farmers of study area.

CHAPTER 6

FACTORS AFFECTING THE RETUNS OF BORO PRODUCTION

CHAPTER 6

Factors Affecting the Returns of Boro Production

6.1 Introduction

Objective of this chapter is to identify and assess the effects of some important variables of production on gross return of bororice in the framework of production function analysis. For the purpose Cobb-Douglas production function model, as stated in Sub-section 3.5.2, has been chosen to determine the effects of selected variables on boro rice production.

6.2 Functional Analysis

Production function is a relation (or mathematical function) specifying the maximum output that can be produced with given inputs for a given level of technology. Considering the effects of explanatory variables on yield of boro rice, six explanatory variables namely, seed cost (X_1), human labour (X_2), fertilizer and manure cost (X_3), irrigation cost (X_4), insecticides and pesticides cost (X_5), tillage cost (X_6), were chosen as key independent factors to estimate the quantitative effect of inputs on yield of boro rice. All these variables have been estimated as per hectare monetary values.To explore the input output relationships production function were fitted in allthe locations of possible statistical forms, Cobb-Douglas production function, most popular in farm management analysis.In fact, it is widely used by many researchers in their economic studies. The advantages of the model are that it is simple to calculate and the elasticity of production can directly be obtained from the coefficient.The following Cobb-Douglas production function was used in the present study:

$Y=aX_{1i}^{b1}X_{2i}^{b2}X_{3i}^{b3}X_{4i}^{b4}X_{5i}^{b5}X_{6i}^{b6}X_{7i}^{b7}e^{u}{}_{i}$……(3.1)

By taking log in both sides the Cobb-Douglas production function was transformed into the following logarithmic form because it could be solved by the ordinary least square (OLS)

$lnY= lna + b_1 lnX_{1+} b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_{4+} b_{5l} nX^5 + b_6 lnX_6 + b_7 lnX_7 + Uiln$e……..(3.2)

Where, Y= Gross income from year round Bororice(Tk/ha);

X_1= Human labor cost (Tk./ha);

X_2= Tillering cost(Tk /ha);

X_3=Land preparation cost(Tk /ha);

X_4=Seedling cost(Tk /ha);

X_5=Fertilizer and manure(Tk /ha);

X_6=Pesticides (Tk /ha);

X_7=Irrigation(Tk /ha);

a= Intercept;

b_1…..b_7= Coefficient of the respective variable;

U_i= Error Term;

i= 1, 2…7.

6.3 Estimated Value of the Production Function Analysis

Estimated values of the coefficients and related statistics of the Cobb-Douglas production functions of garlic and boro rice are presented in the Table 6.3.

Table 6.3 Estimated Values of Coefficientsand Related Statistics of Cobb-Douglas Production function model

Explanatory variables	**Estimated co-efficient**	**t-value**	**p-value**
Constant	-8.26466	-0.808	0.422
Human labor cost(X_1)	0.105 NS	0.593	0.555
Tillage cost(X_2)	0.013 NS	0.097	0.922
Seed cost(X_3)	0.046 **	2.2826	0.026
Urea cost(X_4)	0.980***	2.994	0.004
TSP cost(X_5)	0.865 NS	0.737	0.464
MOP cost(X_6)	0.366 NS	0.677	0.501
Irrigation cost(X_7)	0.036**	2.218	0.030
pesticide cost(X_8)	0.011*	2.218	0.081
R^2	0.561	-	-
F-value	8.166	-	-
Return to scale($\sum\beta i$)	2.43	-	-

Source: Field Survey, 2019

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

6.4 Interpretation of the Results

6.4.1 Effect of Human labor (X_1)

From the value of coefficient of the use of human labor is not significant.. Because here, the family labor cost is 11% of total fixed cost.

6.4.2 Effect of Power tiller(X_2)

It can be seen that the value of coefficient of the use of power tilleris 0.013,which is not significant.

6.4.3Effect of seed (X_3)

It was observed from the regression that the coefficient of seed waspositive and significant at five percent level of significance. Five percent level of significant indicates that the onepercent increase in the cost of seed keeping others factor remaining constant would increase the yield of Boro rice by 0.04 percent.

6.4.4Effect of Urea(X_4)

From the table the value of coefficient of urea was positive and significant at onepercent level of significance. One percent level of significant indicates that the onepercent increase in the cost of urea keeping other factor remaining constant would increase the yield of Boro by 0.98 percent.

6.4.5 Effect of TSP (X_5)

It can be seen that the value of coefficient of the use of TSPis 0.86,which is not significant.

6.4.6 Effect of MOP (X_6)

It was observed from the regression that the coefficient of the use of MOP is 0.366,which is not significant.

6.4.7 Effect of Irrigation(X_7)

From the table, the value of coefficient of the use of irrigationwas positive and significant at five percent level of significance. Fivepercent level of significant indicates that the fivepercent increase in the use of irrigation keeping other factor remaining constant would increase the yield of Boro rice by 0.036 percent.

6.4.8 Effect of Pesticides (X_8)

It was observed from the regression that the coefficient of the use of pesticides was positive and significant at ten percent level of significance.Tenpercent level of significant indicates that the tenpercent increase in the use of pesticides keeping others factor remaining constant would increase the yield of Boro rice by 0.011 percent.

6.4.9 Value of R square

The multiple co-efficient of determination (R^2) is a summary measure which tells how the sample regression line fits with the data (Gujarati, 1995). In this table the value of R^2 was0.56 ,that means the variables considered in the models can explain 56 percent of the variation in yield explained by independent variables include in the model.

6.4.10 Value of F

In the table the F value was found 8.16 which is significant at onepercent level implying that the variation of yield mainly depends on the explanatory variables include in the model.

6.4.11 Returns to Scale [$\sum\beta i$]

The summation of all the production coefficients indicates returns to scale. For Boro paddy production the summation of the coefficients was 2.43. This indicated that, if all the variables specified in the production function were increased by one percent, gross return would increase by 2.43 percent.

6.5 Concluding Remarks

Cobb-Douglas production function model revealed that the key variables included in the model were individually or jointly responsible for variation in gross return of garlic and boro rice. Boro rice growers allocated their resources in the zone of decreasing returns, which indicates that they were operating boro rice farming in the rational zone of production.

CHAPTER 7

PROBLEMS AND CONSTRAINTS OF BORO PRORDUCTION

CHAPTER 7

PROBLEMS AND CONSTRAINTS OF BORO PRORDUCTION

7.1 Introduction

Farmers faced a lot of problems in producing Bororice. The problems were social, cultural, financial and technical. This chapter aims at represent some socioeconomic problems of producing garlic and boro rice. The problems faced by the farmers were identified according to opinions given by them. The major problems and constraints related toBoro rice cultivation are discussed below

7.2High Price of Inputs

In the way of producing enterprises non-availability of inputs like seeds, fertilizers, insecticides, human labour etc. at fair price was a problem. During the production period price of some inputs tend to rise due to their scarcity.From Table8.1,it appears that 96.66 percent boro growers reported that they had to purchase some inputs at a high price during the production period.

7.3High Cost of Irrigation

Irrigation is the leading input for crop production. Yield of Boro rice varies with the application of irrigation water. Availability of irrigation water was not a problem in the study area because of portable irrigation devices. But farmers reported that they had to pay higher charge for irrigation water. Table 8.1 shows that 33.33 percent rice growers reported this problem.

7.4 Natural Calamities

It was found that Boro rice growers faced some acute problems relating to the nature in their production process. Natural calamities like drought hail storm, 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 Bro rice. Table 8.1 shows that 20 percent Boro growers reported this problem.

7.5 Lack of Operating Capital

The capital constraintshad farmers of the study area. For cultivation of Boro rice a huge amount of cash money was needed to purchase various inputs like, human labour, seed, fertilizers, pesticides, etc. In the study area 43.33 percent 58 boro farmers reported that

they did not have sufficient amount of money for purchasing the required quantity of inputs (Table 7.1).

7.6 Lack of Quality Seed

One of the most important limitations,lack of quality seed was of producing Boro rice in the study area. From Table 7.1 it is evident that about 30 percent Boro growers reported this problem. Farmers told that they were cheated by the local markets and from the seed dealers in the time of buying so called hybrid seeds.

Table 7.6 Major Problems Faced by the Sample Farmers

Name of the problems	Boro rice farmers		
	Frequencies	Percentage	Rank
High Price of Inputs	29	96.67	1
High Cost of Irrigation	10	33.33	5
Natural calamities	6	20.00	8
Lack ofOperating Capital	13	43.33	3
Lack of Quality Seed	9	30.00	6
Lack of Scientific Knowledge of Farming	5	16.67	9
Lack of Quality Tillage	12	40.00	4
Adulteration of Fertilizers	6	20.00	7
Low Price of Output	25	83.33	2
Inadequate Extension Service	3	10.00	10

7.7 Lack of Scientific Knowledge of Farming

A large number of fanners have no adequate knowledge of right doses and methods of using modern inputs although modem agricultural technologies have been using in the study area and technologies of producing their Boro rice. In the study area 16.67 percent boro growers were encountered this problem (Table 7.1).

7.8 Lack of Quality Tillage

For successful crop production deeply ploughing isessential.Most of the farmers, who use hired power tiller, reported that hired power tiller owners did not till deeply. Nevertheless,

they did not use all the times when they till others land. Table 7.1 shows that 40 percent Boro growers reported this problem.

7.9 Adulteration of Fertilizers

Insecticidesand pesticides are the most important inputs of Boro rice production. They were being intensively used in Boro rice production in the study area. Many farmers reported to have been cheated by applying adulterate fertilizers in their crop field. It can be seen from Table 7.1 that 20 percent rice growers faced this problem.

7.10 Low Price of Output

Most of the farmers had to sell a large portion of their product at the harvest period to meet various obligations like, household's expenditure and repayment of loan. But harvest time price of Boro rice remained low because of ample supply. So they could not get reasonable return for their products. From Table 7.1,it can be seen that 83.33 percent Boro growers reported this problem.

7.11Inadequate Extension Service

During the investigation some farmers complained that they did not get any extension services regarding improved method of Boro rice cultivation from the relevant officials of the Department of Agricultural Extension (DAE). As an agricultural extension personnel block supervisor's the mam advisor of technical knowledge to the farmers about their farming problems. But in the study area about 10 percent boro growers (Table 7.1) reported that they hardly ever got help from the block.

7.12 Concluding Remarks

Discussions,the above mentioned as well as the results presented in Table 7.1 indicates that boro rice growers in the study area have currently been facing some major problems in conducting their boro rice farming. These are the major constraints for the producers of boro rice in the study area. Public and private initiative should be taken to reduce or eliminate these problems for the sake of better production of Boro rice.

CHAPTER 8

SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

CHAPTER 8
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

8.1 Introduction

The key points 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 8.2, 8.3, 8.4 and 8.5, respectively.

8.2 Summary

Bangladesh is predominantly an agricultural country.Agriculture is the main source of income and employment in this country. The country is characterized by high population growth rate, unfavorable 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 14.23 percent of the GDP and provides 47.30 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.The area under boro rice was 4812150 hectares and production was 18759000 MT with an average yield rate of 3.91 MT/ha. Agriculture of Bangladesh is still dominated by rice production. According to the BBS final estimate, the volume of food grains production in FY 2017-18 stood at 372.66 lakh MT of which aus accounted for 21.58 lakh MT, aman 128.97 lakh MT, boro 187.78 lakh MT, wheat 12.55 lakh MT and maize 21.78 lakh MT. In FY 2013-14 food grains production stood 381.73 lakh MT of which aus accounted for 23.26 lakh MT, aman 130.23 lakh MT, boro 190.06 lakh MT, wheat 13.02 lakh MT and maize 25.16 lakh MT. In FY 2011-12(BBS, 2017). According to Bangladesh Bureau of Statistics 2017, in FY 2017-18, annual production of boro rice were 2.34 and 187.59 lakh metric tons,respectively.Boro rice production is labour intensive, so cultivation of these two

crops can create more employment opportunity to rural people of Bangladesh. In order to find out the problems, potentials and possibilities of expansion boro rice the present study is conducted with the following objectives:

i.To identify the socio economic characteristics of boro rice growing farmers

ii.To estimate the cost and returns of producing boro rice

iii.To identify the problems faced by the farmers producing boro rice.

Three villages of BurichangUpazila in Comilla district were selected for the study. In total 60 farmers, for boro rice were randomly selected. Data were collected by comprehensive interview schedules. Simple statistical techniques as well as Cobb-Douglas production function were used to process and analyze the data to achieve the objectives of the study.In case of socioeconomic characteristics, it was found that average family size of boro rice growers was 3.87 and sex ratio was 1.63 boro rice. The highest percentage of people was in the age group of 25-59. Literacy rate of boro rice growing families were 89.66 percent. Percentage of above secondary education was 11.3. In the study area, 32.20 percent of boro rice grower's sole occupation was agriculture and average farm size of boro growers 1.63 hectare, respectively.

Profitability analysis was done to computecosts and returns of boro production. It was observed that human labour use per hectare was 75 man-days for boroproduction. Per hectare cost of human labour for garlic and boro rice production were Tk. 450which represented 34.07percent of the total cost. Per hectare tillage cost of boro rice production was Tk. 6580covering 6.64 percent of the total cost. Per hectare cost of seed was estimated Tk. 3220.40covering 3.25 percent of the total cost of producing boro rice, respectively.Per hectare use of Urea, TSP, MoP, Gypsum and ZnSO4for Boroproduction were 294.14kg, 168.22kg, 114.61kg, 40.59 kg and 5.32kg whose costs were estimated at Tk. 4706.191463, Tk. 3700.867166, Tk. 1719.198571, Tk. 42.52370766, respectively.Per hectare manure cost wasTk1235, Per hectare irrigation water charge of garlic and boro rice cultivation was calculated Tk10853. covering 10.96 percent of the total cost. Per hectare insecticides and pesticides costs of boro rice cultivation was estimated Tk1720.74, which constituted 1.74 percent of the total cost.Land use cost per hectare was Tk. 18668.83 for boro rice cultivation. It constituted 18.85 percent the total cost of boro rice production.Interest on operating capital of boro rice cultivation was Tk. 1121.96 covering 1.13 percent of the total cost.Per hectare fixed cost of boro rice production was

Tk. 31040.79. Per hectare gross cost of boro rice production was Tk. 99052.63. Per hectare gross margin of boro rice growers was Tk. 71544.80.Per hectare net return of boro rice production was calculated Tk. 40504.01.Undiscounted benefit cost ratio of boro rice production was 1.41.

Cobb-Douglas Production Function model was applied on the basis of the best-fit and significant effects of resources on gross returns. For boro production eight explanatory variables was taken into account to explain variations in production.The coefficient of multiple determination, R2, was 0.56 in case of boro production function.The F-value (8.166) of the equation was highly significant, which indicates good fit of the model. The summation of the estimated coefficients was 2.43, which implies increasing returns to scale. The major problems faced by the farmers were low price ofoutput, high price of input, lack of quality seed, lack of operating capital,shortage of human labour,inadequate extension service etc.

8.3 Conclusion

From the results of the present study, it can be concluded 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 BurichangUpazila of Comilladistrict.Boro rice is labour intensive production.Riceis nutritive also. So cultivation of the Boro rice can help in increasing farm income, employment and nutritional status of farmers. The controlling practices of boro rice production in the study area were not found efficient enough. 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.

8.4 Policy Recommendations

Depending on the findings of the study it was manifest that boro rice was profitable production and it 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.

i.Quality seeds of improved varieties inappropriate quantity are recognized to be one of the prime elements for enhancing agricultural production.

ii.Lack of operating capital is a problem for the resource poor farmers of the study areas. Favourable institutional credit program 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.

iii.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

iv.Ensuring quality tillage for Boro farmers.

v.Reasonable price of production inputs should be ensured.

vi.Adequate training on recommended use of quality seed, fertilizer dose, insecticides, water management practices, etc., should be provided to the boro rice farmers which will enhance production as well as resource use efficiency by improving the technical knowledge of the farmers.

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APPENDIX

APPENDIX

Interview Schedule for Field Survey

Interview Schedule

On

ECONOMIC ANALYSIS OF BORO RICE CULTIVATION OF BURICHANG UPAZILLA OF CUMILLA DISTRICT IN BANGLADESH

Respondent no:

1. Identification Of Respondent:

Name: Union: Mobile:

Village: Upazila:

Age	Education (years of schooling)	Occupation	Household size	Type of Household	Sex	Marital Status	Annual Income (Tk)

2. Family Composition:

Sl. no	Relation to House hold head	Sex	Age	Education (years of schooling)	Farming Experience (year)	Occupation	Marital status	Annual income from off-farm/ non-farm
1								
2								
3								
4								

5								
6								

Type of Household : 1 = Kachaghor, 2 = Khorerghor, 3= Tinshed, 4= Semipakaghor, 5=Pakaghor

Marital status :1=Married,2=Unmarried

Sex code: 1= Male, 2= Female
Occupation code:0=No work, 1=Agriculture, 2=Agricultural labor, 3=Non-agricultural labor, 4=Service,5= Student,6=Business,7=Other.

3.Land information:

Area in Bigha (1 bigha= 0.33 decimal)
(1kani=.35 dec; 1 bigha= 3.00 kani)

Category	Area(decimal)	Category	Area(decimal)
Home & homestead area		Rented out	
Own land under own cultivation		Pond	
Mortgage in		Land taken from other on lease	
Mortgage out		Fellow land	
Rented in			
Total (Tk)		Total (Tk)	

4. Amount of income:

a) Agricultural sources:

Sources	Income(Tk/year)
Rice	
Spices/Pulses/Oil seed crops	
Fruits & vegetables	
Livestock & Poultry	
Fisheries	
Others (if any)	
Total (Tk)	

b)Non-agricultural sources:

Sources	Income(Tk/year)
Service	
Business	

Pension	
Foreign remittance	
Labor	
Rickshaw puller	
Total (Tk)	

5. Value of assets:

Items	Quantity	Market value(Tk)	Total(Tk)
Refrigerator			
TV			
Radio			
Cell phone			
Motor cycle			
Cycle			
Furniture			
Power tiller			
Irrigation pump			
Tractor			
Boat			
Others			
Total (Tk)			

6. Monthly Expenditure:

Items	**Monthly Expenditure (Taka)**
Food	
Crop farming	
Children education	
Health care	
Clothing	
House making/repairing	
Festivals	
Livestock rearing	
Poultry keeping	
Others	
Total (Tk)	

7. Primary disposal pattern of Boro rice:

Total production of Boro (Kg)	Paid as kind (Harvesting and threshing) (kg)	Used for family consumption (kg)	Used as seed(Kg)	Sold (Kg)

Selling Pattern of Boro rice of farm households

Items	Sale before harvest	Sale within a month of harvest	Sale within 2- 3 months of harvest	Stored for sale after 3 months
Amount (Kg)				
Price Tk/Kg				

8. Availability of cash capital for farming operation: Yes/No

10.Sources of credit facilities of the sample farmers:

Items no.	Tick the option	Amount (Tk)
Bank		
NGOs		
Relatives		
Own		
Total(Tk)		

11. Plot-wise information about varieties grown:

Sl. No.	Name of variety	Plot area(decimals)	Plot yield(Kg)	Yield(ton/hactre)	Straw value(Tk/plot)
1					
2					
3					
4					
5					

12. Varieties grown during last five years in Boro season:

Sl. No.	Name of the previously grown variety	Name of the currently grown variety
1	-	
2		
3		
4		
5		

13. Reasons for cultivating existing 5 major varieties:

1	
2	
3	
4	
5	

14. Reasons for not cultivating existing 5 major varieties :

1	
2	
3	
4	
5	

15. Cost and Return:

Input use pattern of rice cultivation:

a) Human Labor Requirement (man-days):

Size of plot:____ decimals

Sl. No.	Items	Family labor	Hired labor(man-days)	Labor wage(Tk/man-days)	Total cost(Tk)
1	Seed bed preparation and sowing				
2	Mainland preparation (Ploughing and laddering				
3	Uprooting and transplanting				
4	Fertilizer and top dressing				
5	Manuing				
6	Weeding				
7	Pest management				
8	Irrigation				
9	Harvesting				
10	Carrying & Threshing				
11	Winnowing, Sunning				
12	drying and storing				
	Total (Tk)				

b) Animal/ mechanical power used:

Operation	Machine (Tk)		Total (Tk)	Animal (Tk)		Total (Tk)
	Own	Hired		Own	Hired	
Ploughing/Laddering						
Weeding						

Spraying						
Threshing						
Total (Tk)						

c) Material input used:

Inputs	Amount (Kg/unit)	Price (Tk/kg)	Cost (Tk)
Seeds/seedling (kg)			
Urea: Basal (kg)			
1st dose (Kg/plot)			
2nd dose (Kg/plot)			
3rd dose (Kg/plot)			
TSP(Kg)			
SSP(Kg)			
DAP(Kg)			
MOP(Kg)			
Gypsum(Kg)			
$ZnSO_4$ (Kg)			
Manure (md) : a. Home			
b. Bought			
Ashes (md)			
Pesticides:			
1st dose (ml/plot)or (Kg/plot)			
2nd dose (ml/plot)or (Kg/plot)			
3rddose (ml/plot)or (Kg/plot)			
4th dose (ml/plot)or (Kg/plot)			
Other			
Irrigation/ Supplementary Irrigation			
Other			
Total (Tk)			

16. Please mention the Problem faced by you in Boro rice cultivation

a)
b)
c)
d)
e)

17. What are your suggestions to overcome the above problem?

a)
b)
c)
d)
e)

Thank for your cooperation