PROFITABILITY ANALYSIS OF BORO RICE CULTIVATION IN SOME SELECTED HAOR AREAS OF KISHOREGONJ DISTRICT

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CERTIFICATE

*This is to certify that the thesis entitled "**PROITABILITY ANALYSIS OF BORO RICE CULTIVATION IN SOME SELECTED HAOR AREAS OF KISHOREGONJ DISTRICT**" submitted to the Department of Development and Poverty studies, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in DEVELOPMENT AND POVERTY STUDIES**, embodies the result of a piece of bona fide research work carried out by **SABIQUNNAHER PEYA**, Registration No. **14-06063** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledge.

Date:
Place: Dhaka, Bangladesh

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Dedicated to my Beloved Parents,
who are more than just the sum of my part.

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The Author

ABSTRACT

The present study was conducted to examine the socio-economic profile of the Boro rice growers of the Haor areas, determine the profitability of Boro rice cultivation in the Haor areas by farm size, identify the problems faced by the farmers in boro rice cultivation, and suggest policy implication. A total number of 100 Boro rice growers were randomly selected in 2021 by using interview schedule technique of which 58 were small, 34 were medium, and 8 were large. Four Upazila namely, Itna, Mithamoin, Nikli and Austagram were the locale of the study. Sample farmers are classified as small, medium and large. Simple random sampling was used in the study. The finding of benefit cost analysis reveals that Boro rice production is a profitable activity in Bangladesh as the estimated cost of production was lower than the return in the selected study areas. Per hectare gross cost of small, medium and large farmers were respectively Tk 101649.6, Tk 97181.36and Tk 98793.81 and per hectare gross returns were Tk 124527, Tk 118925.32and Tk 125970.5, respectively. It was observed that per hectare net return was Tk. 22877.4, 21743.96 and 27176.69 for the small, medium, and large farmers, respectively. This result indicated that large farmers earned more profit than the other group of farmers. The undiscounted BCR were 1.23, 1.22, and 1.28 in small, medium ant and large farmers, respectively. In addition, the functional analysis identifies three inputs such as the cost of human labor, fertilizer and irrigation as the significant determinants of profitability of Boro rice production in the study area. Some recommendations suggested to improve the present production situation so that Boro rice cultivation could be more viable and attractive commercial enterprise.

Table of Contents

Table of Contents(cont'd)

Table of Contents(cont'd)

List of Tables

List of Figures

ACRONYMS AND ABBREVIATIONS

BBS	:	Bangladesh Bureau of Statistics
BER	:	Bangladesh Economic Review
BCR	:	Benefit-Cost Ratio
DAE	:	Department of Agricultural Extension
et al.	:	And others (at elli)
GDP	:	Gross Domestic Product
GM	:	Gross Mean
GR	:	Gross Return
Ha	:	Hectare
HIES	:	Household Income and Expenditure Survey
IOC	:	Interest on Operating Capital
Kg	:	Kilogram
MDV	:	Modern Varieties
MT	:	Metric Ton
NGO	:	Non-Government Organization
TFC	:	Total Fixed Cost
Tk.	:	Taka
TSP	:	Triple Super Phosphate
TVC	:	Total Variable Cost
USDA	:	United States Department of Agriculture

CHAPTER 1

INTRODUCTION

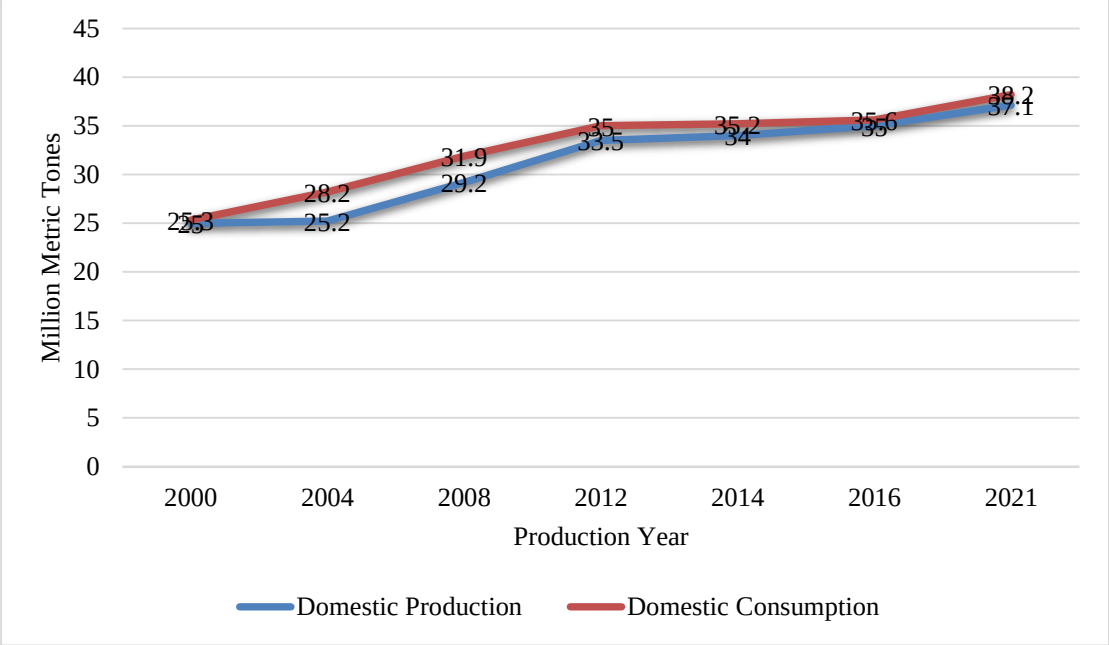
1.1 Background

Bangladesh is predominantly an agricultural country and agriculture has been the mainstay of Bangladesh economy as it comprises about 12.56% of the country's GDP and employ around 39.46% of the total labor force (BBS, 2021).

Rice is the main cereal crop among them and leading crop in Bangladesh due to its higher yield, nutritional value and versatile uses. Rice is a crop that has a positive impact on increasing household income and alleviating poverty (Emaga, et al., 2018). Demand of rice in Bangladesh is augmenting day by day as Bangladesh is the 8th most populous country in the world with a total population of 167.2 million, population growth rate is 1.37% (BER, 2021) and its density of population is 1134.54 persons per square km (BER, 20121).

Rice is grown in three different seasons, namely Aus, Aman and Boro in Bangladesh which covers 74.85% of the total cultivable area (BBS, 2020). In Bangladesh, Aus is grown during March to June, Amon rice during june/july to October/November and irrigate Boro rice during January to April/May (the Rabi season popularly known as Boro season). Both Aus and Aman rice are mainly rain fed or only occasionally irrigated. The Rabi season has very little rainfall and hence the Boro rice is fully irrigated.

Currently, 61% of the total cropped area in the Rabi season is under Boro cultivation which contributes 55% to total rice production (BBS, 2018). Bangladesh has achieved major advances in agricultural development over the last 30 years, especially in rice production. The average yield of rice has increased linearly over the past four decades (Mainuddin et al., 2014)



Source: Bangladesh Bureau of Statistics (2021)

Figure 1.1 Domestic production and consumption of rice in Bangladesh (2000-2021)

Rice production in Bangladesh has been doubled since independence (in 1971, we produced 10.59 million metric tons of rice, and it reached 37.4 million metric tons in 2020) as per an official figure. due to introduction of new rice production technologies. This production will produce a surplus of 6.9, 10.29 and 13.65 MMT in 2030, 2040 and 2050, respectively, over the production target (40.40, 43.80 and 47.20 MMT in 2030 and 2050, respectively). As a result, the regions which were earlier deficient in rice production have become surplus particularly where Boro have been introduced extensively.

In in recent years, though rice has increased overall profitability has been reducing due to rising input prices and the increasing cost of labor discouraging rice production (Papademetriou et al., 2000). Yield is intricately linked with profitability and yield gains have helped keep rice cultivation profitable, especially after 2005 in Bangladesh. While making decisions for rice cultivation, farmers always consider the expected returns against the cost of production (Neumann K, Verburg PH, Stehfest E, Muller C 2010). This is highly laudable progress but this sectors are still prone to shocks for high cost of the market price, irrigation cost, fertilizer cost, seed cost and land preparation cost, volatility in rice income has become the norm among rice farmers in Bangladesh.

Reducing income volatility and increasing profitability is an important step to increase social welfare sustainability of rice production. And for this effective policy interventions, is an important task to analyze the cost, actual yield, profitability and problems of rice cultivation under varying farming conditions (locations, different varieties, input applications, irrigation water source, planning dates etc.).

These studies are either based on the combination of secondary data and primary data available in the statistical yearbook. This study provides a detailed determination of the state (Socio-economic characteristic, profitability and problems) of irrigated Boro rice cultivation, based on intensive field observations conducted during one consecutive season (2020-21) in 100 rice production farmers across 4 upazila in the Kishoregonj district of Bangladesh.

1.2 Importance of Boro rice in the Economy

Rice plays an important role in all spheres of life in Bangladesh and when it comes to food security of the rural farmers, it is the most significant commodity in terms of livelihood and food. It provides nearly 48% of rural employment, about two-third of total calorie supply and about one-half of the total protein intake of an average person in the country. Rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh. Almost all of the 13 million farm families of the country grow rice. Rice is grown on about 10.5 million hectares which has remained almost stable over the past three decades. About 75% of the total cropped area and over 80% of the total irrigated area is planted to rice.

The highest share of rice production comes from boro varieties (BBS, 2021). The weather condition for Boro rice cultivation is favourable in Bangladesh. It has been persistently contributing to higher rice production in last successive years. The area, production and yield rate of Rice and Boro rice in different years were shown in Table 1.1

Table 1.1. Area, production and yield of cleaned rice in Bangladesh over the years 1972-2020

Year	Area (000' ha)				Production (000'ton)				Yield (ton/ha)		
	Aus	Aman	Boro	Total	Aus	Aman	Boro	Total	Aus	Aman	Boro
1972-73	2930	5713.8	1002.6	9646.4	2243	5587	2071	9901	0.77	0.98	2.07
1980-81	3111.2	6035.8	1160	10307	3289	7964	2630	13883	1.06	1.32	2.27
1985-86	2844.9	6018.9	1533.2	10397	2828	8542	3671	15041	0.99	1.42	2.39
1990-91	2107.3	5775.3	2547.9	10430.5	2261	9167	6357	17785	1.07	1.59	2.49
1995-96	1541.85	5646.4	2753.57	9941.82	1676	8790	7220.6	17686.6	1.09	1.56	2.62
2000-01	1325.23	5709.96	3761.84	10797.03	1916	11249	11920.5	25085.5	1.45	1.97	3.17
2005-06	1034.27	5429.01	4065.81	10529.09	1745	10810	13975.3	26530.3	1.69	1.99	3.44
2010-11	1112.87	5645.64	4770	11528.51	2132.82	12791	18616	33539.82	1.92	2.27	3.9
2015-16	1025	5590.4	4685.1	11300.5	2468	13591.4	19001.1	35060.35	2.44	2.43	4.06
2019-20	1152.55	5876.44	4863.92	11892.91	2930	15357	20437	38724	2.54	2.5	4.2

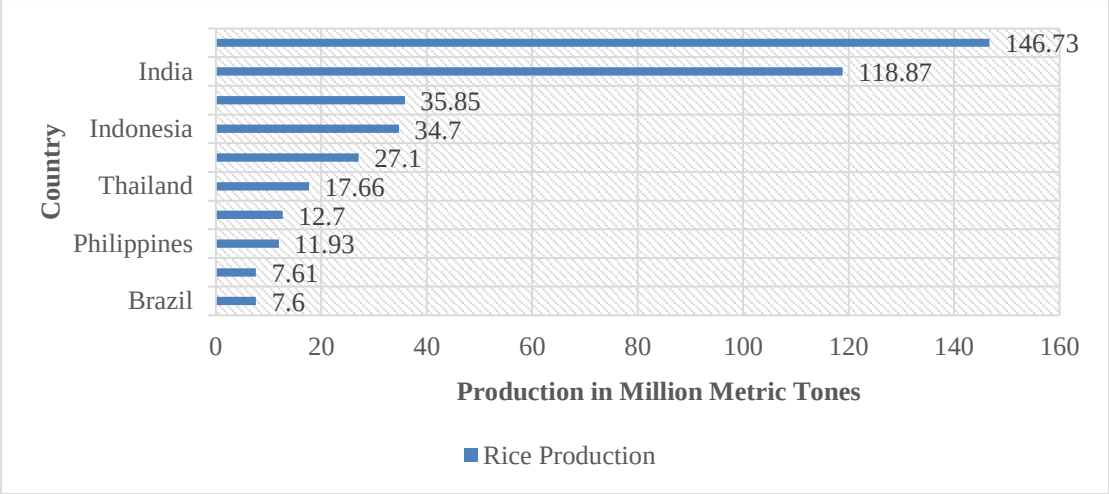
Source: Various issues, BBS(2021)

1.3 Contribution of Boro rice in Bangladesh and the world

Almost 75 years ago, the British had left India and yet the people in this part of the world were not yet meaningfully free of their economic shackles and their struggle to be free continued. Ultimately, the people prevailed and this year we are celebrating the golden jubilee of liberation from Pakistan oppression. This is thus the right moment to reflect back on what we as a nation have achieved and what we must strive to aim for. And while food and nutrition security in its fullest sense is yet to be achieved, major progress has been made and at least in the case of rice, the main staple, the country is sufficient. Rice plays a vital role in the livelihood of the people of Bangladesh.

Rice is the backbone of Bangladesh's agriculture; here, like in many other countries, 'food security' almost entirely depends on 'rice security' (BRRI, 16); it alone contributes about 4.5% to the GDP (BBS, 2020). According to government estimates, Bangladesh is self-sufficient in food production at present which is the result of increased rice production (Rab, 2012). And total rice production in Bangladesh was about 10.59 million tons in the year 1971 when the country's population was only about 70.88 million. However, the country is now producing about 25.0 million tons to feed her 135 million people. This indicates that the growth of rice production was much faster than the growth of population. This increased rice production has been possible largely due to the adoption of modern rice varieties on around 66% of the rice land which contributes to about 73% of the country's total rice production.

Rice is playing a dominant role to increase total population as well as total food grain production in Bangladesh. So it can be apparent that Bangladesh is placed among the three of the world's fastest growing economies in the years through to 2050. Agriculture sector, that includes rice, is to double the productivity as the government commits to meet the SDG goal.



Production in million metric tons

Source: USDA; 2022

Figure 2. Bangladesh's position in rice production (2022)

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' rice while Indonesia 34.9 million metric tons, India 118 million metric tons and China 149 million metric tons in 2022. Rice production has increased by three times since the liberation of Bangladesh. Bangladesh was 4th in rice production while Indonesia 3rd, India second and China first in the world. Boro rice production may increase 4.5 lakh metric tonnes from the target production of 204.360 lakh metric tonnes this year. The USDA report said a good weather condition and increased yield due to further cultivation of hybrid and high yield varieties (HYV) lead to increase such production in Bangladesh. Rice is cultivated on 71 percent of the total 1.54 crore hectares of cropland in the country.

1.4 Justification of the study

Bangladesh strives to attain self-sufficiency in food by taking appropriate management technologies. She has been dependent on rice in the past, present and will remain so in future. The average per hectare yield of Boro rice is higher than of Aus and Amon rice. But it is argued that the cost of production of Boro rice is increasing day by day due to

increase in the input price but the output price is not increased accordingly. It is also observed that farmers generally use different quantities of inputs depending upon their economic viabilities in producing Boro rice. Thus in many cases resources are not used efficiently. Moreover, farmers have to face a lot of problems in producing Boro rice like high price of inputs, lack of capital and shortage of hired labor at the critical stage of cultivation.

Keeping this idea in mind, this study has been undertaken to get an insight into profitability of Boro rice cultivation across farm size categories in Kishoregonj District.

1.5 Objectives of the study

The overall objectives of the study are to analyze Profitability of Boro rice production in Kishoregonj district. The specific objectives of the study were as follows to:

- To describe the socio economic profile of the Boro rice growers;
- To determine profitability of Boro rice cultivation across far, size categories; and
- To identify the problems of Boro rice cultivation.

CHAPTER 2

REVIEW OF LITERATURE

Review of related literature in any research is necessary in the sense that it provides a scope for reviewing the stock of knowledge and information. And this knowledge and information give a guideline in designing the future research problem and validating the new findings. Costs and returns of production might vary from time to time, place to place, farm to farm and it is necessary to mention. However, relevant findings directly or indirectly related to this study are briefly described below:

Akhter et al. (2010) conducted a survey on Boro rice production in some selected areas of Bangladesh. This study showed that boro rice production is highly profitable and it could be provided cash money to farmers. In terms of profitability, boro rice production was more attractive than any other crops. Per unit yield and gross return of rice were found higher than other competitive crops.

Alam et al., 2010 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.

Ali et al. (2019) evaluated the agroeconomic performance of Boro rice cultivation at farmer's level of haor area in Bangladesh and found that productivity of Boro rice was low due to imbalance use of fertilizers but yield showed higher.

Arif (2004) conducted a study on boro rice on selected areas of Kishoregonj district. He showed that the per hectare gross returns were TK. 33219,32484.88, 32501.79; gross costs were TK. 26814.45, 24914.02 and 24340.77; net returns were Tk. 6404.98, 7570.86, 8161.02 for small, medium and large categories of farmers respectively.

Basavaraj et al., (2020) conducted a survey at some selected villages of Trishal Upazila in Mymensingh for studying the effects of different farm sizes under different tenurial arrangements on production efficiency. He found that the medium farms (0.75 to 2.0

ha) achieved the highest efficiency followed by small farms (below 0.75 ha) and large farms (above 2.0 ha).

Bishop, and Toussaint (1987) studied economic efficiency of farm size adopting ordinary least square regression equation in Bangladesh observed that neither small nor large farms were economically efficient.

Hossain et al. (1998) conducted a study on cost, return and resource use efficiency of HYV Boro rice production in a selected area of kishoregonj, He observed that the costs of production of boro rice per ha were TK. 25547, Tk. 25874.73 and TK 27548.7 for small, medium and large farms respectively. Per hectare yield of HYV boro rice production under different farm categories were 77.04, 86.55 and 84.45 mounds, respectively.

Huda (2004) investigated input use efficiency and productivity of different sizes of farms producing HYV Boro in some selected areas of Brahmanbaria district. Returns to scale and farmers capability of producing at the least cost level were statistically tested. Farm size and productivity relationships were found to be positive. Boro production characterized by increasing returns to scale only for the medium farms. Few inputs were used in Boro production at the least cost combined level. Adequate extension services including application of right quantity of inputs at right time were suggested to achieve efficiency in input use and improving level of profitability

Islam et al. (2018) examined the knowledge gap of the haor farmers in Boro rice cultivation and experienced that the socioeconomic characteristics of the haor farmers like education, farming experience and attitude towards modern Boro rice cultivation practices had the significant effect

Kamruzzaman et al. (2018) studied on flood and sustainable agriculture in the haor basin of Bangladesh and revealed that Boro-fallow-fallow was the dominant cropping pattern and flash flood severely destroy standing Boro rice just before harvesting almost every year.

Masud and Kawnine (1975) studied the farm costs and returns in the production of Boro rice under low-lift pump irrigation of 40 farms. The Author included the different factors causing variations in cost and net profits for individual farm and finally outlined the economy of the boro enterprise under low-lift-pump condition. He also studied the

different causes of variation in farmer's income and efforts of introduction of irrigation and winter crops that study outlined principles of successful operation.

Muttaleb et al. (2008) found that in order to have higher yield, the local farmer recently switched to cultivate HYV rice (BRRI dhan29, BRRI dhan28, etc.) instead of local Boro rice variety. But the longer duration and dwarf plant height characteristics of these varieties often become the victim of flash flood. As a result, farmers cannot harvest potential yield of these rice varieties.

Numan (2003) conducted a study on the profitability of different rice patterns with and in two villages in kishoregonj district. The yields of local Aus, Amon and Boro per acre were respectively 461kg, 502 and 724kg. He (2011) also observed that the yields of local Aus, Amon and Boro per acre were respectively 472kg, 640and 807kg.

Rahman (1965) studied the costs and return of Boro rice production in some irrigated village of kishoregonj. The author considered the variable costs and excluded the fixed cost. Then items like interest on the value of land, land revenue, value of bullock power and implements were excluded from his study. He also ignored the interest on operating cost. He showed that the per acre costs of Boro was Tk.260.1, the average returns over variable costs from Boro was Tk. 181.33.

A few studies related to Boro rice production practices of haor people have been conducted by different researchers which are: Shamim et al. (2019) evaluated the agro economic performance of Boro rice cultivation at farmer's level of haor area in Bangladesh and found that productivity of Boro rice was low due to imbalance use of fertilizers but yield showed higher.

The above review reveals that a number of studies have so far been conducted on the cost and return analysis of Boro rice production. All these workers helped in conceptualization of the study.

CHAPTER 3

METHODOLOGY

Methodology is an indispensable and integral part of any research. This chapter presents a detail description of the methods adopted at different stages of the study and presents the methodology followed in the study, which included the selection of the study area, selection of samples, preparation of survey schedule, method of data collection, period of survey, editing and tabulation of data and analytical techniques. The tools and methods used and followed for the study with considering the specific objectives of the study are given below.

3.1 Study areas and sample size:

The Boro rice growers of the selected areas were considered as major part of the study. A list of rice growers of the selected areas was prepared through a preliminary survey. Considering the limitation of time and fund, the sample size for Boro grower was fixed at 100, taking from the selected upazilla. Out of 100 selected growers, 30 from Itna, 20 from Nikli, 20 from Austhogram, and 30 from Mithamoin Upazila were selected from Kishoregonj district. The main criteria behind the selection the study area were as follows:

1. Availability of different categories of rice farms in the study area.
2. The study area is not far away from the researher's resident Nikli upazila.
3. The study area was accessible to the researcher who was familiar with the local farmers, and socio-economic characteristics of the farmers.
4. No specific study of this type was done in the study area.

3.2 Preparation of the interview schedule

For collecting necessary data from different types of samples interview schedule was prepared. An interview schedule contains questions about the Land preparation, Seed, Fertilizer, Pesticides, Irrigation, Harvesting, Transportation, Marketing and others variable cost of production of Boro rice per hectare of land. An interview schedule was prepared for collecting primary data from Boro rice returns form one hectare of land and by product returns from one hectare of land. And all the schedules were pretested and finally prepared after careful modifications.

3.3 Period of the study

The largest harvest is Boro planted from December to early February and harvested between April and June and accounting for more than half of annual production. The data was collected during the months of April to June 2021 by several visits by the researcher himself. All the data collected with their suitable time and date.

3.4 Methods of data collection

Simple random sampling was used in the study. The study was based on a set of field level primary data collected from the sample farmers by direct interview with a set of interview schedules designed for this research. The researcher frequently visited the sample farmers and stayed overnight to collect data and other necessary information. Before taking interview the aims and objectives of the study were explained to the farmers so that they could understand that the study was purely academic one and was not likely to have an adverse effect. During interview the questions were asked systematically and explained whenever it was felt necessary. In order to minimize the response error, questions were asked in simple Bangla terms and many answer were checked at the farmed for attaining reasonable accuracy. To calculate the economic performance (the average, percentage, total cost, total return, gross margin and benefit cost ratio) of Boro rice, a simple statistical technique method was used.

3.5 Analytical technique

This study was based on field level data. The data were analyzed using descriptive statistics and farm budget analysis. The descriptive statistics were used to describe the socio economic characteristics of rice producing farmers in the study area. Furthermore, the farm budget analysis which include revenue, cost, gross margin and net farm profit were utilized for the cost and returns estimation of rice production in the area. The Gross Margin which is the difference between the Total revenue(TR) and the Total Variable Cost(TVC) was utilized to estimate the profitability of rice production in the area. The Gross Margin Model is expressed as:

$$GM = TR-TVC$$

Where,

GM = Gross Margin,

TR = Total Revenue,

TVC = Total Variable Cost(TVC).

And Benefit Cost Ratio estimates as a ratio of gross returns and gross costs.

Benefit cost ratio,

$$(BCR) = \frac{Gross\ Return}{Total\ Cost}$$

Where,

BCR < 1 indicates that Investment option generates losses,

BCR = 1 indicates that Investment option is neither profitable nor loss.

BCR > 1 indicates that Investment option is profitable.

3.6 Problems faced in data collection

The problems which had to face during data collection are:

- As farmers did not keep record of their farm activities, so researcher had to depend on the memory of the farmers.
- Two or more visits were required to conduct a single interview since sometimes the farmers were not available at home.
- For being suspicious about the research thereof, were not cooperative at the initial stage of data collection.
- Afraid of tax imposition, crop hectare restriction and acquisition of land by the government farmers were reluctant to provide necessary information relating to their income, expenses and land holding.

Chapter 4

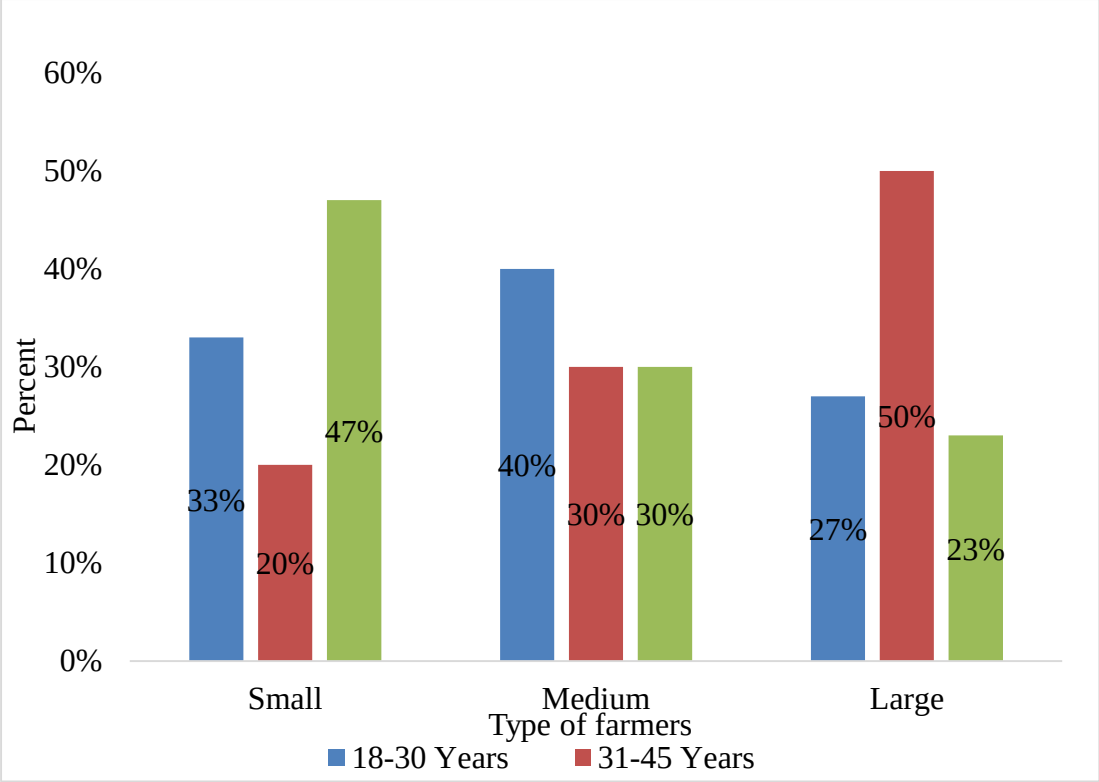
SOCIO-ECONOMIC CHARACTERISTICS OF BORO RICE FARMERS

4.1 Introduction

This chapter presents a brief description of the socio-economic characteristics of the selected Boro rice growers. Social-economic characteristics indicates the decision making behavior of individual and socio-economic background and characteristics of the farmer's influences the productions to a great extent. So, a description of the characteristics of farmer is necessary for analyzing the main objective of the present study. The aim of this chapter is to highlight the major socio-economic aspects such as type of farmers and age, Occupation, Educational Status, Family members of Different Farmer, Farming Experience, Educational Status**,** Place of Sales etc of selected farmers under study.

4.2 Types of Farmers and Distribution of Age

From the figure 4.1, it is shown that 33% of the small farmers, 40% of the medium farmers and 23% of the large farmer's age is 18-30 years. 20% of the small farmers, 30% of the medium farmers and 50% of the large farmer's age is 31-45years. 47% of the small farmers, 30% of the medium farmers and 23% of the large farmer's age is above 45 years. It means that most of the small farmers are above 45years, most of the medium farmers are more than 18-30 years and most of the large farmers are 31-45years.



Source: Field Survey, 2021

Figure 4.1 Age Distribution of Farmers

4.3 Family members of Different Farmer

A family has been defined as a group of persons living together and taking their meals from the same kitchen under the administration of the head of the family. The family members include the owner of the farm and his wife, brother and his wife, unmarried sister, sons, unmarried daughters, father and mother. The family size and its composition are related to both occupation and income. Besides, persons who have been employed in farm family for household works like Agriculture, Fish Culture, Livestock Rearing, Labor, Business, Student, Housewife, Service etc.

Table 4.1 Family members of different farmer

Types of Farmers	Family Members		
	1-4 members	5-7 members	>7 members
Small	33.7%	47.5%	35%
Medium	41.5%	23%	25%
Large	24.8%	29.5%	40%
Overall	100%	100%	100%

Source: Field Survey, 2021

From the table 4.1, it showed that 33.7% of small farmers had 1-4 members, 41.5% of medium farmers had 1-4 members and 24.8% of large farmers had 1-4 members. 47.5% of small farmers had 5-7 members, 23% of medium farmers had 5-7 members and 29.5% of large farmers had 5-7 members. Then, 35% of small farmers had more than 7 members, 25% of medium farmers had more than 7 members and 40% of large farmers had more than 7 members.

4.4 Place of sale

Farmers generally sell agricultural product in two place such as a. Primary Wholesale Markets: These are located in big towns near the Centre's of production of agriculture commodities, transaction mostly take place between farmers and traders. b. Secondary Wholesale Markets: These are generally located at districts headquarters or important trade Centre's near railway stations.

Table: 4.2 Sales place of different farmer

Types of Farmer	Sales place of the Respondents	
	Primary Wholesale Markets	Secondary Wholesale Markets
Small	58%	16.5%
Medium	26%	23.5%
Large	16%	60%
Overall	100	100

Source: Field Survey, 2021

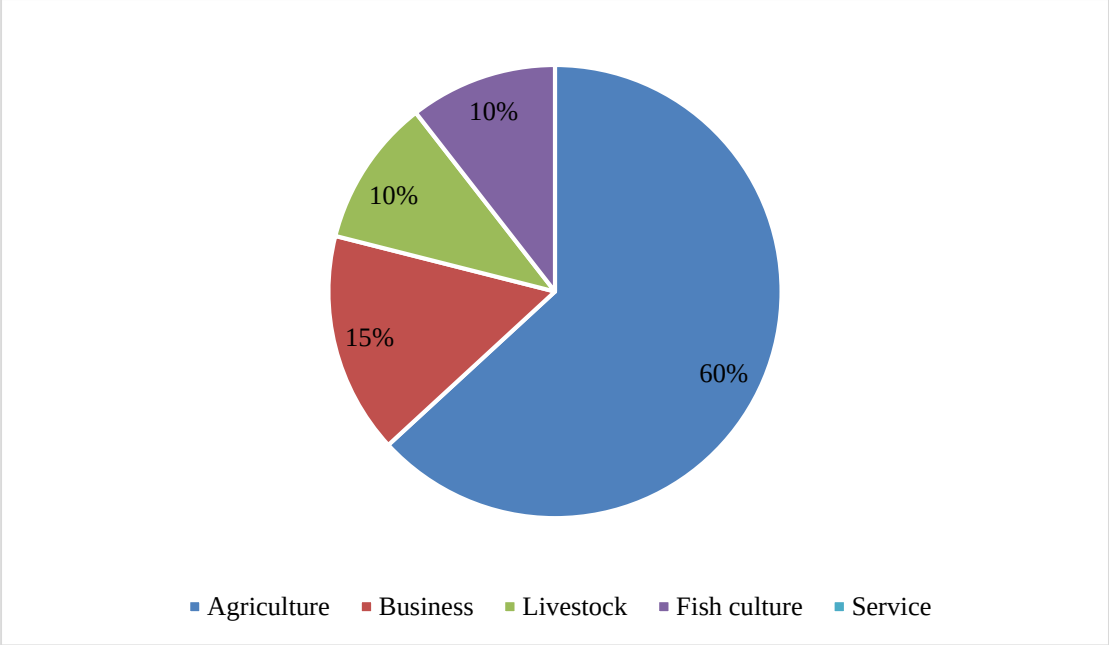
Primary Wholesale markets: These are located in big towns near the Centre's of production of agriculture commodities, transaction mostly take place between farmers and traders.

Secondary wholesale markets: These markets are located in district or regional cities and take the bulk of their produce from rural assembly markets located in production areas, where the transactions are small scale and usually take place between farmers and traders.

From the table, it showed that 58% of small farmers, 26% of medium farmers and 16% of large farmer's sales place was primary wholesale markets. And 16.5% of small farmers, 23.5% of medium farmers and 60%of large farmer's sales place was secondary wholesale markets.

4.5 Distribution of the Respondents Based on their Occupation

Agriculture is the mainstay of the people living in the rural areas and so farming is the major occupation in the rural areas. As a result, high income variability of farm income of rural farmers from agriculture.



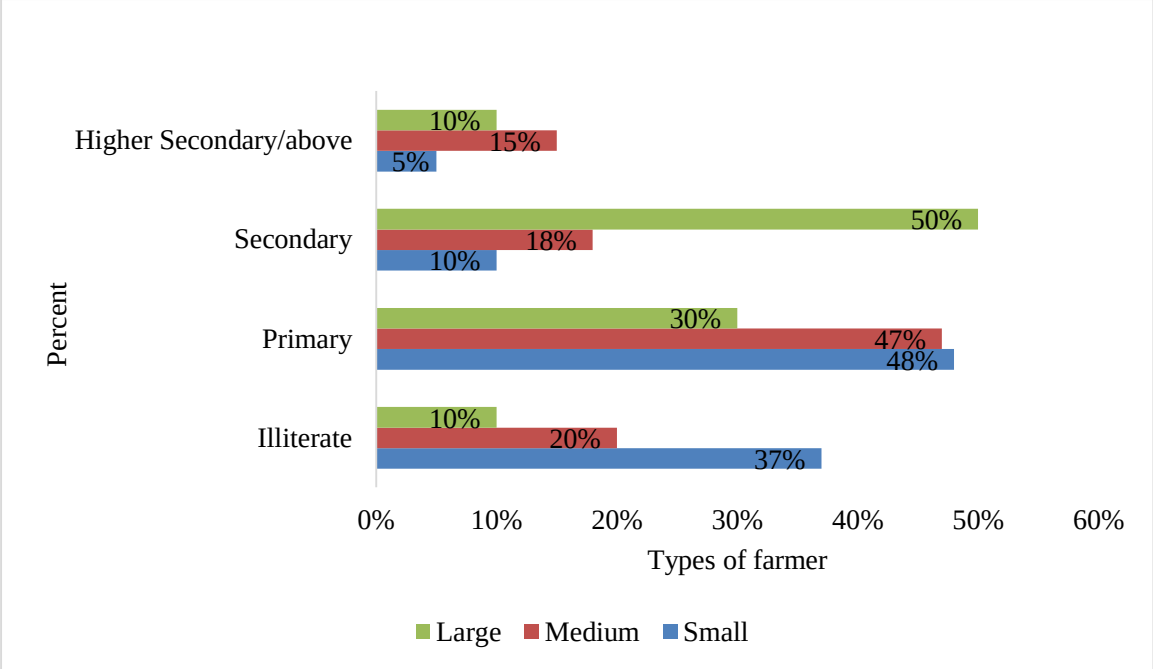
Source: Field Survey,2021

Figure 4.2 Occupation of the respondents

The pie chart(Fig.4.2) presented occupation of the respondents. From the figure it could be said that in rural areas, occupation in agriculture (where production of Boro rice played a vital role), business, livestock and service was 60%, 15%, 10% and 10%.

4.6 Educational Status

Education plays a vital role in the acquisition of information about the innovation in various production processes of agriculture. In order to adopting improved technology and scientific knowledge regarding farming, education plays a significant role. Educated farmers can have better access to the relevant technical information for improved production. Though education has its own merits and it contributes to economic and social development, as education is the backbone of a nation and it makes a man more capable to manage scare resources and hence to earn maximum profit. Depends only on their life experience many of the farmers in our country are four groups in their educational status such as illiterate, primary, secondary and higher secondary or above.



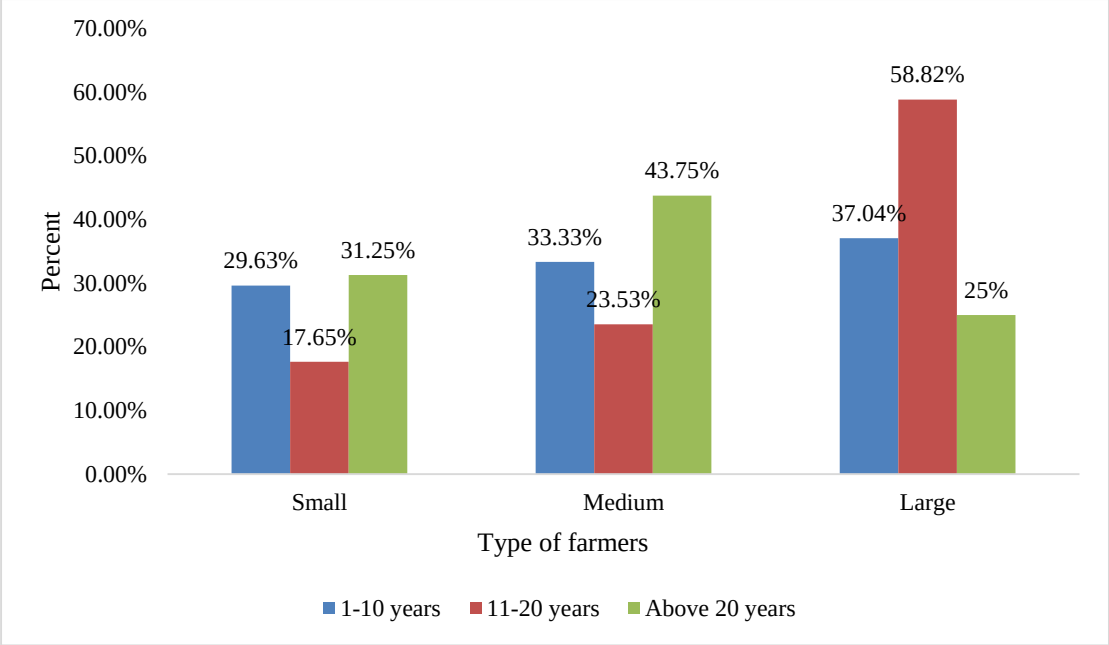
Source: Field Survey, 2021

Figure 4.3 Educational Level for different types of Farmer

From the figure 4.3, It could be said that only few farmers had secondary and higher secondary & above degree. Most of the farmer only completed their primary level. It was observed that 37% of small farmers, 20% of medium farmers and 10% of large farmers were illiterate. Farmer who completed their primary level, 48% were small farmers, 47% were medium farmers and 30% were large farmers. Farmer who completed their Secondary level, 10% are small farmer, 18% are medium farmer and 50% are large farmers and finally 5% small, 15% medium and 10% large farmers completed higher secondary or above.

4.7 Farming Experience

Farm experience is an important factor to ensure farm productivity. Technical inefficiencies of the production are significantly related to farming experience of the farmers. Farmers who have more experience in farm operations generally attain higher levels of technical efficiency. Every farmer has his own method of running to patches and training skill. It is best for him to figure out the best path, the best seeds to plant, what he wants to plant, what he can afford.



Source: Field Survey, 2021

Figure 4.4 Farming experience of different farmer

From the Figure 4.4, most of the families, farming experience was 1-10 years. It showed that 29.63% of small farmers had 1-10 years farming experience, 33.33% of medium farmers had 1-10 years farming experience and 37.04% of large farmers had 1-10 years farming experience. 17.65% of small farmers had 11-20 years farming experience, 23.53% of medium farmers had 11-20 years farming experience and 58.82% of large farmers had 11-20 years farming experience. Then, 31.25% of small farmers had more than 20 years farming experience, 43.75% of medium farmers had more than 20 years farming experience and 25% of large farmers had more than 20 years farming experience.

Similar results were obtained by Kamal et al. (2015b). This chapter analyzed the socio-demographic attributes of different farm categories which affected their productivity and income. Where such information and the limitations exist, solutions that can help improve their productivity can be proffered.

Chapter 5

PROFITABILITY OF BORO RICE CULTIVATION

A farm earns profit when its net return is above its total costs. Profitability is the main aim of any farm. This chapter deals with the estimation and analysis of costs, returns and profitability of growing Boro rice. For agricultural production, cost of inputs is an important element and to expense incurred in organizing and carrying out the production processes. Farmer's decision about production is mainly influenced by the cost of inputs. Farmers had to pay cash for the purchased inputs like land preparation, seeds, organic and inorganic fertilizers, insecticides, irrigation charge etc. An attempt has been made in this chapter to determine and compare the per hectare total costs, gross return, gross margin, net return and benefit cost ratios (undiscounted) of rice production in the selected areas. For the convenience of analysis, the cost items were classified into two groups: (a) variable cost and (b) fixed cost.

5.1 Variable Cost

Variable inputs using costs is called variable cost. These costs vary with the level of production. Seed costs, human labor cost, animal power/mechanical power cost, cost of organic and inorganic fertilizer, irrigation cost, costs of pesticides are considered as variable cost. The costs considered as variable costs of Boro rice is discussed under the following headings.

5.1.1 Land Preparation Cost

5.1.1.1 Human labor cost

Human labor is the most important and largely used input for producing MDV Boro rice. It was required for different operations i.e., land preparation, seedling, transplanting and harvesting and carrying, weeding, fertilizer and insecticides application, irrigation, threshing, cleaning, drying, storing of Boro rice was computed in terms of man-days. One man-day was equivalent to 8 hours work of an adult man. For women and children, man equivalent day was estimated. This was computed by converting all women and children day into man equivalent day according to the

following ratio. 1 man –day = 1.5woman day = 2 child day. The Table: 6 reveals that considering all farmers the cost of human labor for rice production was calculated BDT 31046.49 per hectare, which covered 31.28% of the total cost.

Table 5.1 Per Hectare Cost of Human Labor

Category	Total Family Labor (m-d)	Total Hired Labor (m-d)	Total Labor (m-d)	Total Labor Cost (Tk)	Percent of Total Cost
Small	28	76	104	32975.07	32.44
Medium	25	69	94	29451.1	30.31
Large	30	64	94	30713.3	31.09

Source: Field Survey, 2021

The results presented in the Table-5.2.1 reveal that the small farms are more dependent on hired labor than the medium and large farmers. The dependence on family labor is higher in large than in small and medium farmers.

5.1.1.2 Power tiller cost

Power tiller was mainly used for land preparation. It appears that, the cost of power tiller cost for Boro rice production was higher for medium farmers (11318.56) than those of small (11075.55) and large (11212.07) farmers, respectively (Table 6). And or all farmers power tiller cost is 11.3% of total cost.

5.1.2 Cost of seedling

In the study area, many farmers used purchased seedlings for producing MDV Boro rice. Per hectare total cost of seedling for rice production were calculated at BDT 3835.78, 3065.29 and 2510.39 for small, medium and large farmers, respectively (Table 6) which were 3.78, 3.15 and 2.54 percent of their respective total costs of production (Table-5.2). From the Table-5.2 it shows that per hectare cost of seed was higher for small farmers than other groups.

5.1.3 Cost of manure

Manure is useful for increasing organic matter of soil to eventually increase crop yield. In the study area, farmers used cow dung and ash as manure for producing rice. Thus, the overall cost of manure was calculated at BDT 1764.2 per hectare in rice farming.

5.1.4 Cost of fertilizers

Almost all the farmers used chemical fertilizer and all kinds of fertilizer are bought from the market at the prevailing market price. Urea, TSP, MoP (Muriate of Potash) and Gypsum were the most commonly used fertilizer in the study area. Table 6 shows per hectare costs of chemical fertilizers.

Per hectare costs of Urea were Tk 5721.68, Tk 5217.4 and Tk 5595.95 for small, medium and large farmers respectively and their percentages of total cost of production were 5.63, 5.37and 5.67 percent, respectively.

Per hectare costs of TSP were Tk 3755.51, Tk 3833.02 and Tk 3772.05 for small, medium and large farmers respectively and their percentages of total cost of production were 3.69, 3.94 and 3.81 percent, respectively.

Per hectare costs of MoP were Tk 1529, Tk 1546.47and Tk 1539.88 for small, medium and large farmers respectively and their percentages of total cost of production were 1.5, 1.59 and 1.56 percent, respectively.

Per hectare costs of Gypsum were Tk 960, Tk900, and Tk 920 for small, medium and large farmers, respectively and their percentages of total cost of production were .0.94, .0.93 and 0.93 percent, respectively.

Bathan et al. (2010) supported the findings slightly by stating that labor and fertilizer has significant effect on boro rice yield.

5.1.5 Irrigation cost

Irrigation is an essential input for cultivating rice. Most of the farmers had to pay mechanical irrigation water charges and they used manual labor for irrigation. In the study area, the all farmers use irrigation for their cultivation. Per hectare costs of irrigation for Boro rice production were almost similar (i.e. BDT6011.33, 5802.25 and 5466) for small, medium and large farmers, respectively and their percentages of total

cost of production were 5.91, 5.97 and 5.53 percent respectively. The irrigation cost was highest in small farmers and lowest in large farmers.

5.1.6 Pesticides/Insecticides cost

Farmers used different kinds of insecticides to protect their rice in the field from various insects and pests. The pesticides used by the farmers in the study area were Basudin, Dimocrone, Sumithion, Theovit, Furadon, Malathianon, etc. Table 6 reveals that per hector cost of pesticides were Tk 3929.22, Tk 3910.08 and Tk 3732.4 for small, medium and large farmers respectively and their percentages of total cost of production were 3.87, 4.02 and 3.78 percent respectively. The irrigation cost was highest in small farmers and lowest in large farmers.

2 Fixed cost

Fixed costs are costs, which do not change in magnitude as the amount of output changes and are incurred even when production is not undertaken. Land use cost, interest on operating capital were considered as fixed cost of Boro rice production in this study.

5.2.1 Land use cost

The seasonal rental cost of land was treated as land use cost for the farmers. Land use cost was calculated on the basis of lease value of per hectare land for cropping period 12 months. This amount was BDT 28464.39 for all categories of farmers of boro rice cultivation, which covered 28.71% of the total cost.

5.2.2 Interest on operating capital

Interest on operating cost includes variable costs in the production of Boro rice for a period of 4 months of production period. Here, interest was charged at the rate of 10 percent per annum and was estimated for 4 month's interest on operating capital and it was calculated by the following formula (Adapted from Bhuiyan,2000).

Interest on operating capital,

$$= \frac{\text{Operating capital} \times \text{Interest rate} \times \text{Time considered}}{2}$$

The interest actually means the average operating costs over the time 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. The interest on operating capital for different categories of farmers, such as small, medium and large were estimated at BDT 2385.93, 2217.56 and 2236.07, respectively (Table 6).

5.3 Gross cost

Gross cost was calculated by adding all costs of variable inputs and fixed inputs. In the present study, per hectare gross costs of producing Boro rice were BDT 101649.6, 97181.36 and 98793.81 for small, medium and large farmers, respectively and average gross cost of producing Boro rice was BDT 99208.26 (Table 6). As a result, it found that highest and lowest cost per hectare occurred in small farmers and medium farmers, respectively.

5.4 Gross return

Per hectare gross return was calculated by multiplying the total amount of yield (product and by product) by their respective per unit farm gate price of rice ((Dillon and Hardaker,1993). Per hectare gross returns of boro rice were BDT 124527, 118925.32, 125970.5 for small, medium and large farmers, respectively (Table 6). The average gross return of boro rice was BDT 123140.94.

5.5 Gross margin

Gross margin is obtained by deducting variable cost from gross return (Barnard and Nix, 1999). In the present study, per hectare gross costs of producing Boro rice were BDT 52877.47, 52331.94 and 58821.37 for small, medium and large farmers, respectively

5.6 Benefit- cost ratio (undiscounted)

The final economic measure is the calculation of BCR (undiscounted) which is generally used to compare benefits per unit of cost, which is equal to 1.24 for all farmers in the study areas during 2021. It implies that BDT 1.24 would be earned by investing BDT 1.00 on boro rice farming, thereby, it indicates that boro rice production is not so profitable business.

Table 5.2 Per Hectare costs, Returns, and Other Parameters for MDV Boro Rice Producing Small Farmers

Particulars	Quantity	Rate (TK/unit)	Cost (TK/ha)	% of Total Cost
Seed (Kg/ha)	75.66	50.7	3835.78	3.78
Animal Labor /Power Tiller cost (TK/ha)			11075.55	10.9
Human labor cost (No. of Man-days/ha)	104.03	316.98	32975.07	32.44
Urea(Kg/ha)	268.12	21.34	5721.68	5.63
TSP (Kg/ha)	131.77	28.5	3755.51	3.69
MOP (Kg/ha)	72.82	21	1529.18	1.5
Gypsum (Kg/ha)	53.33	18	960	0.94
Manure (Kg/ha)	2320.26	0.80	1856.21	1.83
Cost of Fertilizers			13822.58	13.60
Cost of irrigation (TK/ha)			6011.33	5.91
Cost of Pesticides (TK/ha)			3929.22	3.87
A.Total Variable Cost (TVC)			71649.53	70.48
Interest on operating capital			2385.93	2.35
Rental value of land			27614.14	27.17
B. Fixed Cost (FC)(Interest on operating capital+ Rental value of land)			30000.07	29.52
C. Total Cost (A+B)			101649.6	100.00
Main product value(Kg/ha)	4689.32	25	117233	
By-product value			7294	
D.Gross Return (Tk/ha) i. e. (GR)			124527	
E.Gross Margin (Tk/ha) i.e. (D-A)			52877.47	
F.Net Return (Tk/ha) i.e. (D-C)			22877.4	
G.BCR (undiscounted) i.e. (GR/GC)			1.23	

Source: Field Survey, 2021

Table 5.3 Per Hectare costs, Returns, and Other Parameters for MDV Boro rice Producing Medium Farmers

Particulars	Quantity	Rate (TK/unit)	Cost (TK/ha)	% of Total Cost
Seed (Kg/ha)	57.14	53.65	3065.29	3.15
Animal Labor /Power Tiller cost (TK/ha)			11318.56	11.65
Human labor cost (No. of Man-days/ha)	94.13	312.88	29451.1	30.31
Urea(Kg/ha)	260.87	20	5217.4	5.37
TSP (Kg/ha)	136.89	28	3833.02	3.94
MOP (Kg/ha)	71.93	21.5	1546.47	1.59
Gypsum (Kg/ha)	50	18	900	0.93
Manure (Kg/ha)	1749.29	10	1749.29	1.8
Cost of Fertilizers (Tk./ha)			13246.18	13.63
Cost of irrigation (TK/ha)			5802.25	5.97
Cost of Pesticides (TK/ha)			3910.08	4.02
A.Total Variable Cost (TVC)			66593.38	68.53
Interest on operating capital			2217.56	2.28
Rental value of land			28370.42	29.19
B. Fixed Cost (FC)(Interest on operating capital+Rental value of land)			30587.98	31.47
C. Total Cost (A+B)			97181.36	100.00
Main product value(Kg/ha)	4441.481	25.2	111925.32	
By-product value			7000	
D. Gross Return (TK/ha) i. e. (GR)			118925.32	
E. Gross Margin (TK/ha) i.e. (D-A)			52331.94	
F.Net Return (TK/ha) i.e. (D-C)			21743.96	
G.BCR (undiscounted) i.e. (GR/GC)			1.22	

Source: Field Survey, 2021

Table 5.4 Per Hectare costs, Returns, and Other Parameters for MDV Boro rice Producing Large Farmers

Particulars	Quantity	Rate (TK/unit)	Cost (TK/ha)	% of Total Cost
Seed (Kg/ha)	49.20	51.02	2510.39	2.54
Animal Labor /Power Tiller cost (TK/ha)			11212.07	11.35
Human labor cost (No. of Man-days/ha)	94.43	325.25	30713.3	31.09
Urea(Kg/ha)	263.96	21.2	5595.95	5.67
TSP (Kg/ha)	134.72	28	3772.05	3.81
MOP (Kg/ha)	76.99	20	1539.88	1.56
Gypsum (Kg/ha)	52.57	17.5	920	0.93
Manure (Kg/ha)	2249.45	0.75	1687.09	1.7
Cost of Fertilizer (Tk./ha)			13514.97	13.68
Cost of irrigation (TK/ha)			5466	5.53
Cost of Pesticides (TK/ha)			3732.4	3.78
A.Total Variable Cost (TVC)			67149.13	67.97
Interest on operating capital			2236.07	2.26
Rental value of land			29408.61	29.77
B. Fixed Cost (FC)(Interest on operating capital +Rental value of land)			31644.68	32.03
C. Total Cost (A+B)			98793.81	
Main product value(Kg/ha)	4742.82	25	118570.5	
By-product value			7400	
D. Gross Return (TK/ha) i. e. (GR)			125970.5	
E. Gross Margin (TK/ha) i.e. (D-A)			58821.37	
F.Net Return (TK/ha) i.e. (D-C)			27176.69	
G.BCR (undiscounted) i.e. (GR/GC)			1.28	

Source: Field Survey, 2021

From the above discussion, it is easy to understand about the different cost items and their application doses in the different categories of farmers regarding of returns per hectare Boro rice cultivation. All the figures (gross return, gross margin and net return) were noticeably larger for the large farmers than small and medium farmers (Table 6). It was also observed that BCR of large farmers was the highest among different farm categories. The average BCR of all categories of farmers was 1.24, which revealed that Boro rice production is profitable business for the large farmers achieved higher level of profit per hectare of Boro rice production than the medium farmers and small farmers. Drought, flood, lack of adequate use of inputs, poor extension leading to large yield gaps, lack of assured and adequate irrigation and crop failure were the main causes of low benefit cost ratio of small, medium and large farmers.

Chapter 6

PROBLEMS OF BORO RICE CULTIVATION AND SUGGESTIONS

Boro Rice production in Bangladesh is beset with a number of socioeconomic and bio-physical factors. With those objectives in view, the farmers were interviewed accordingly. Diverse replies were received regarding the problems and their solutions. Farmer's opinions on the status of the said problems were recorded such as less, medium and severe problems, respectively. According to their opinions, the problems and probable solutions were analyzed and discussed in this chapter. The focus of this chapter is to identify the problems confronted by the Boro rice farmers in the study areas and to find out probable solution of them.

6.1 Problem face in Boro Rice Cultivation

Farmer's in the study areas were mentioned a number of problems which affected Boro rice production are discussed below:

Lack of good quality seeds

It is a significant job to select good quality seeds for higher generation. Farmers were more often acquired seeds from the nearby markets which were not a decent quality seed as their germination rate was poor and for this reason production was low. And 78.57% farmers were referenced that they had lacking of good quality seeds in the market.

Lack of proper knowledge

Bangladesh is the 4th largest rice producer in the world. The increase in rice yield and area harvested contributed to the growth in rice production, which nearly doubled in 1995 to 2021. In case of Boro Rice, both area and production were increased in Bangladesh during 1980-81 to 2020-21. But in the Haor areas where Boro Rice is grown as single crop in almost 80% of the Haor areas, the highest yields recorded in 2020 was not fulfilled the expectation for Boro rice variety. The major contributing reasons behind this higher yield gap are the difference existing in the knowledge level of the Haor farmers about modern rice cultivation and non-adoption of recommended rice

production technology. And it was examined by the ranchers that about 61.43 percent of the farmers needed appropriate learning with respect to different rice generation.

Table 6.1 Problems of rice Production as Mentioned by the Farmers

Problems	No Of Farmers(%)	Order
Lack of good quality seeds	78.57	1
Lack of proper knowledge	61.43	2
Inefficient marketing systems and unfair Price of Products	55.71	3
Declining soil fertility	40	4
Inadequate management practices (fertilizer, water, and pests & diseases)	37.14	5
Inadequate credit support to farmers	15.71	6
Natural calamities	10	7
Lack of storage facility	7.14	8

Source: Field Survey, 2021

Inefficient marketing systems and unfair price of produces

In Bangladesh rice occupied the first position among all the cereal crops in respect of area coverage and production but for being inefficient marketing system and low product price return did not satisfy the producers. Lack of information on input cost all types of farmers, buy back the same crops in the off-season at a much higher price for their consumption and seeds, naturally, the product prices of rice are low during and immediately after harvest, Different types of middlemen are engaged in agricultural marketing and so farmers do not get the appropriate prices of their products. Fluctuations in the prices of rice are the main reasons to get low returns. Inefficient marketing systems and the price of rice was very low mentioned by 55.71 percent of the respondents.

Declining soil fertility

Farmers mentioned that they got less yield from same amount of fertilizers used than before due to declining soil fertility. About 40 percent of the respondents mentioned that declining soil fertility hampered rice production. Declining of soil fertility productivity of some crops have either stagnated or declined.

Inadequate Management Practices (Fertilizer, Water, and Pests & Diseases)

Lack of irrigation facilities or proper utilization of available irrigation facilities, disease and pest infestation were problems for sustainable development of rice production. Mainly due to ownership of irrigation channel and equipment, excessive irrigation charge during peak periods, mechanical trouble of irrigation equipment, unskilled in using knowledge based pest management techniques were the problems faced by the farmers. And 37.14 percent of the respondents had to meet with the problems.

Inadequate Credit Support to Farmers

Boro rice is a capital intensive enterprise and its needed large amount of money for cultivation but many of the farmers could not afford it. For this reason, they have to take loan. Though Bangladesh Krishi Bank, Rajshahi Krishi Unnayan Bank (RKUB), Grameen Bank (GB) and Palli Daridro Bimochan Foundation (PDBF) provided credit for the purpose of agriculture but they charge a higher amount of interest rate. Also they have to face problems in obtaining bank loans for different terms and conditions. And sometimes they do not get loans in due time at peak season. Therefore, the farmers have to borrow money from other sources such as money lender (local name Mahajan) with high interest rate. In the study areas, about 15.71 percent of Boro Rice farmers were faced problem due to this complicated credit system.

Natural calamities

Farmers faced some acute problems relating to the nature in their production process was found in this study. Natural calamities like kalboishakhi, drought hail storm, excessive rainfall, caused substantial damage to the crop. Excessive rainfall during the harvesting period reduces both the quantity and storability of rice said by the farmers. On an average, only about 10 percent of the farmers faced untimely/unnecessary rainfall during growing period. This problem arises when rainfall occurred immediately after giving irrigation to the Boro rice plot.

Lack of storage facility

After harvesting of cereal crops, it needs space to dry for storage. But for lack of proper knowledge, farmers could not store their produced rice in proper place, resulted storage loss. And for this they could not keep grains for selling later on when market price would go up and did not get the appropriate prices of their products. It is indicated from about 7.14 percent Boro rice producing farmers stated lack of storage facility.

6.2 Suggestions to Overcome the Problems

The suggestions to overcome the problems identified earlier in Boro rice production were given by the farmers are briefly discussed below:

Quality seed production

If the target of 20-25% of seed requirement is to be met, BADC's current seed production needs to be strengthened. To achieve this, present breeder's programmed of NARA institutes should be expanded. Besides, private sector and NGOs are to be supported by the government for the production of quality seeds by providing credit on easy terms.

Sufficient Investment in Research

Different studies indicate that the investment in Boro rice production related research is highly rewarding and beneficial (M. Miah et al., 2005; J. Nagy et al., 2000). The government is, therefore, urged to raise the investment to at least 2% (Boro rice contributes a great part) GDP as recommended by World Bank and FAO (FAO, 1996; Strat Plan, 1995). The increased investment will certainly encourage scientist's to develop technologies to cope with the hazards of climate change and disseminate the same at farmer's level.

Availability of inputs at subsidized rate

Inputs should be available to the farmers at subsidized rate. And Government should take due steps against impure fertilizers, pesticides and poor seeds for efficient production of Boro rice.

To improve marketing facility

Transport facilitates the movement of goods from places where they were less useful to places where they were in much demand. A dependable transport is yet another prerequisite for the successful operation of the marketing system. On the basis of priority, village roads should be developed at least brick bedded road so that rickshaws or motor vehicles could move easily. It would also help farmers in reducing the transportation cost. They furthermore suggested that market information and weather forecasts should be made at right time. Government should ensure a stable price to stop market price fluctuation.

Availability of institutional credit

Farmers need cash money at the time of cultivation and institutional credit facilities at the right time play a vital role for increasing the volume of production. Government should provide such facilities through various institutional and non- institutional sources at low interest rate on easy terms and conditions.

Provision of training on Boro Rice production

To enhance knowledge and skill, training play a crucial role. Providing training on proper number of ploughing and laddering, optimum seed sowing time and method, application of recommended manure and fertilizers, efficient use of irrigation method, judicial use of insecticides, proper number of weeding, thinning as well as harvesting of crop were approached by the farmers. Formal training should be provided to the farmers by the Government authorities and the responsibilities of local agriculture officers.

Introduction of storage facility

Farmers in the study areas received lower price due to lack of storage facility. Lack of storage facilities farmers sold rice at lower prices in off season on the contrary to higher price in peak season. And for this reason farmers wanted developing low cost storage facilities at the primary and secondary markets by the local Government authority.

CHAPTER 7

SUMMARY, CONCLUSION AND RECOMMENDATIONS

In the light of discussions made in the earlier chapters, a summary of the results, some conclusions on the basis of empirical findings and some recommendations to improve the existing inefficiency of Boro rice production in Bangladesh is presented in this chapter.

7.1 Summary

Bangladesh is the fourth largest rice producing country in the world(FAOSTAT,2012) and third largest(FAPRI,2009) consume of rice in the world. Boro rice productivity was very high which resulted in a significant impact on economic prospects of Haor farmers, since the opportunity of producing other profitable crops was very limited to them. The average production level in Boro season for modern rice farming is 84.01%, which means that substantial potential remains to improve cost efficiency by increasing the efficient utilization of resources.

The study exposed that producing Boro rice was not same, it was moderately profitable for small, medium and large farmer's. This is because all type of farmers can't properly allocate resources (land rental charges, human labor costs, irrigation costs, and pesticide costs) and do not go in the production process efficiently and effective utilization of socioeconomic and farm-specific factors (greater experience, greater access to credit, and training on rice cultivation techniques).

Considering the findings of the study, some essential policy recommendations have been arisen which reduce the cost of the all type of farmers and also benefitted the farmers are:

i) Short- duration, high-yielding and pest-tolerant rice varieties should be developed for the farmers considering the Haor agricultural environment

ii) Research on exploring proper disease and insect control methods by both chemical and biological means is necessary

iii) Government should motivate farmers through proper extension services to adopt such technological advancements for producing Boro rice economically more viable in the Haor areas.

iv) Farmers should consider electronic banking, and implement a modern, cost-effective distribution system so that they used this to purchase the necessary agricultural supplies for crop cultivation, including modern and approved seeds, fertilizers, farming equipment, and pesticides, which may increase efficiency.

v) Improving rural infrastructure and reinforcing extension services would influence the profitability of Boro rice cultivation significant.

vi) Farmers must therefore be provided with training, as training allows farmers to acquire practical know-how for emerging technologies and technical information.

7.2 Conclusion

Boro rice production in the Haor region of Bangladesh is crucial for the country's self-sufficiency in rice production. Boro rice yield, paid-out cost, gross benefit, and gross income varies in between seed quality, transplanting dates, farmland sites and irrigation well-operating modes. I monitored actual Boro rice production in 100 fields across the region over one consecutive crop season and analyzed the yield, profitability, and problems. My results show that uncertainty of input costs, productivity and profitability are serious concerns for sustaining Boro production. Amongst the input costs, Human labor cost is the highest contributor to the production cost (31.28). So, Government should take proper steps to introduce to farmers with mechanization of agricultural production which created value in agricultural production practices through the more efficient use of labor, the timeliness of operations, and more efficient input management. I also observed that the costs of inputs do not vary in between cultivating different rice varieties but are increasing in recent years which needs to be stabilized to minimize farmer's problems. The increasing fertilizer cost which is also very high to the total production cost, is likely to continue in the future. However, MDV rice yield was found to be most unstable, and farmer's gross income was lower than the most other varieties. Thus, the government and the private sector's push to promote the cultivation of HybridMDV rice needs to be carefully monitored and re-evaluated. Another major finding of the research is that the variation in the market price of rice has a serious impact on overall profitability. Farmers gross benefit increased twofold in 2020-21 than the previous year primarily due to the higher market

price. This result highlights that the market price needs to be adequate and stable to ensure farmers profitability and sustainability.

7.3 Recommendations

Recommendations were drawn on the basis of the results and discussions made in earlier chapters. Based on the findings of the study, these are stated below in brief:

- To encourage the use of balanced fertilizers, chemical fertilizers must be integrated with organic manures. The governments should clearly spell out the need for balanced fertilizers in its new NAP in the interest of sustainable production of Boro rice. Farmers should as well as be motivated to reduce their dependence on the use of chemical fertilizers to maintain soil fertility.

- Irrigation should be applied at the appropriate growth stages of rice for efficient use of water.

- Different NGO's may as well as used to excavated derelict ponds and canals for the conservation of rain water for irrigation in dry seasons.

- Emphasize the importance of the use of integrated pest management.

- For quality seed production, they should be given massive training on seed production, processing and preservation. It is also important to support them through credit supply on easy terms and at low interest rate.

- A new institution/foundation following the model of Palli Karmo Sahayak Foundation(PKSF) to be established along with necessary manpower and other facilities to cater the needs of resource-poor marginal and small farmers. The institution must have an in-built provision for strong monitoring unit to monitor the use of credit at regular intervals.

- Storage facilities may be established in rural areas following the experience of SHOGORIP that may follow farmers to store rice and sell the same at better prices.

- Alternatively, the government might encourage to establish farmer's cooperative to ensure fair price of their products.

The results and recommendations, though based on data collected from Haor areas are relevant for entire Bangladesh and expected to help guide policymakers, advisors, and farmers.

7.4 Limitation of the study

The study suffered from some limitations. And those are:

1. Results obtained from an investigation of 100 samples may be inadequate to represent the actual situation. Therefore, the scope of generalization is limited and many not represent the actual situation prevailing all over Bangladesh.
2. Qualification of family labor was very difficult because it was not so easy to separate to productive use of labor from non-productive use.
3. Farmers do not keep any record of their costs and return and for this information were collected depending upon the memory of the farmers. So, the possibility of data errors could not be ruled out although precarious were taken to minimize the errors.

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APPENDIX

Interview Schedule for Field Survey

On

PROFITABILITY ANALYSIS OF BORO RICE CULTIVATION IN SOME SELECTED HAOR AREAS OF KISHOREGONJ DISTRICT

Sample No: Date:

Name of the Respondent:

Village: Upazila: District:

A. Socio economic information

1. What is your age? (Please put (√) on the following option)

a.18-30 years b. 31-45 years c. Above 45 years

2. What is your educational status? (Please put (√) on the following option)

a. Illiterate b. Primary c. Secondary d. Higher Secondary/Above

3. How long have you been involved in farming? (Please put (√) on the following option)

a.1-10 years b.11-20 years c. Above 20 years

4.How many family members do you have? (Please put (√) on the following option)

a.1-4 members b.5-7 members c.>7 members

5.Farmers occupational sources

Please put (√) on your occupational source(Main/Subsidiary)

a. Agriculture b. Business c. Livestock d. Fish culture e. Service

6. Where is the place of sales? (Please put (√) on the following option)

a. Primary wholesale market b. Secondary wholesale market

7. What is the size of your farm? (Please put (√) on the following option)

a. 0.01-1 Hectare b. 1.01-2 Hectare c. 2.01 Hectare/ Above

B. Profitability analysis of jute production

1.Human labor requirement (man/day)

Operation	Labor (man-days)		Unit Cost (Tk.)	Total Cost (Tk.)
	Family labor	Hired labor		
Land preparation and sowing seeds				
Weeding and fertilizing				
Harvesting and carrying				
Retting, washing and Drying				

2.Per hectare material inputs used

Various inputs	Quantity	Unit price(Tk.)	Total Cost (Tk.)
Seed			
Fertilizer			
Urea			
TSP			
MOP			
Manure			
Power tiller			
Transportation			
Pesticide			

3.Land use information

Name of the crop	Land area under cultivation	Rental price (Tk.)
Boro rice		

4.Profitability situation of Boro rice

Sources of income	Price(Tk./unit)	Total income (Tk.)
Product		
By-product		

5.Problems in Boro rice production and marketing

Problems	Put (√) if you agree
Lack of good quality seeds	
Lack of proper knowledge	
Inefficient marketing systems and unfair Price of Products	
Declining soil fertility	
Inadequate management practices (fertilizer, water, and pests & diseases	
Inadequate credit support to farmers	
Natural calamities	
Lack of storage facility	

Date:

Signature of the interviewer: