A PRODUCTIVITY ANALYSIS WITH COMPARISON ON BORO RICE AND JUTE PRODUCTION IN SHIBCHAR UPAZILLA OF MADARIPUR DISTRICT

BY

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JUNE, 2020

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A Thesis
Submitted to the Department of Agricultural Statistics
Sher-e-Bangla Agricultural University, Dhaka
in partial fulfillment of the requirements
for the degree of

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CERTIFICATE

This is to certify that the thesis entitled **"A PRODUCTIVITY ANALYSIS WITH COMPARISON ON BORO RICE AND JUTE PRODUCTION IN SHIBCHAR UPAZILLA OF MADARIPUR DISTRICT"** submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (M.S.) in AGRICULTURAL STATISTICS** embodies the result of a piece of *bona fide* research work carried out by **KHALEDA NASRIN,** Registration No. **13-05723** under my supervision and guidance. No part of this thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information as has been availed of during the course of this investigation has duly been acknowledged.

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DEDICATED TO

MY

BELOVED PARENTS

ACKNOWLEDGEMENTS

All praises and thanks to almighty Allah, the supreme ruler of the universe for ever- ending blessing for the successful completion of this research work. as well as to submit the thesis for the degree of Master of Science (M.S.) in Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh.

I would like to express my heartfelt respect, deepest sense of gratitude, profound appreciation and ever indebtedness to my supervisor Hasan Mahammad Sammy, Assistant Professor, Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Dhaka for his sincere guidance, scholastic supervision, constructive criticism, extending generous help and constant inspiration throughout the course and in preparation of the manuscript of thesis.

I express my sincere respect to my Co-supervisor, Professor Dr. Md. Mizanur Rahman Sarker, Agricultural Statistics, Sher-e-Bangla Agricultural University (SAU), Dhaka for his utmost cooperation, constructive suggestion to conduct the research work as well as preparation of the manuscript of thesis.

I express my sincere respect to the Chairman, Professor Md. Zulfikar Ahmed Reza and all the teachers of the Department of Agricultural Statistics, Sher- e-Bangla Agricultural University, Dhaka for providing the facilities to conduct the experiment and sympathetic consideration in connection with the study.

I express my gratefulness to Md. Abdul Khaleque Mia, Retried Assistant Agricultural Extension Officer for passing his valuable time with me during data collection. Thanks are also extended to those boro rice and jute growers who patiently provided needed information through long interviews.

Finally, I deeply express my gratitude to my beloved parents, brother and sister for their immense blessings, sacrifice and help which will never be forgotten.

The Author

ABSTRACT

The profitability of boro rice and jute production was explained in this research. The Shibchar upazila of Madaripur was selected as study area. Total 60 farmers, 30 boro rice farmers and 30 jute farmers were randomly selected for the present study. The data were collected during March-April 2020, by using a structured questionnaire. Cobb-Douglas production function was used for analyzing data. The major findings of the study were that the cultivation of boro rice and jute was profitable from the view point of farmers. The estimated average cost of boro rice production was Tk 216103.48 per hectare and jute production was Tk 142991.39 per hectare. The gross return of boro rice and jute per hectare were Tk 235698.17 and Tk 161608.83 respectively. The estimated gross margin of boro rice was Tk 52457.85 per hectare, jute was Tk 50287.26 per hectare, net return of boro rice and jute productions per hectare were Tk 19594.69 and Tk 18617.44 respectively. The undiscounted Benefit Cost Ratio (BCR) of boro rice production was 1.09 and jute production 1.13. In the study, it was observed that jute production was more profitable than boro rice production of the study area. It was also evident from the study that per hectare net return was significantly influenced by human labor (0.2872***), power tiller (0.1490**), fertilizer cost (0.5253***) for boro rice. In the case of jute production, per hectare net return was significantly influenced by human labor (0.3441***), power tiller (-0.0755**), fertilizer (0.3791**), manure cost (0.0482**). The research identified and ranked some of the issues that boro rice and jute growers faced. High input costs, a labor scarcity and a high pay rate, a lack of storage facilities, a lack of capital, insect attacks, and natural disasters were all the major issues. Various recommendations were made in this research for improving the current production situation, with the goal of increasing boro rice and jute yields.

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ACRONYMS AND ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BCR	Benefit-Cost Ratio
BRRI	Bangladesh Rice Research Institute
DAM	Department of Agriculture Marketing
Df	Degree of Freedom
et al	and others
Ep	Elasticity of Production
FY	Fiscal Year
GDP	Gross Domestic Product
Ha	Hectare
IOC	Interest on Operating Capital
Kg	Kilogram
MoP	Murate of Potash
MT	Metric Tons
RTS	Return to Scale
SPSS	Statistical Package for Social Science
Tk	Taka
TSP	Triple Super Phosphate

CHAPTER 1

INTRODUCTION

Bangladesh is a country of lower developing economy. Agriculture in Bangladesh is already under pressure both from huge and increasing demands for food, and from problems of agricultural land and water resources depletion (Ahmed *et al*., 2000). The economy of Bangladesh is developing and agriculture based. The nation has 163.7 million populations with a land of 56977 sq. miles or 147570 sq. km. (BER, 2019). Almost 75.15 percent of total populations live in rural areas (BBS, 2017). Most of the people of Bangladesh earn their living from agriculture. Rice and jute are primary crop, maize and vegetables are also assuming greater important. Bangladesh is predominantly an agricultural country. (Rasha R. K., 2018)**.** Bangladesh performed relatively well in agriculture sector due to increased productivity, emerging diversification into value added products, such as fruits, vegetables, poultry, dairy and fish self-sufficiency in rice production. Despite a huge population, insufficient cultivable land, a relatively high population density and the frequent incident of natural disasters, this achievement was accomplished. 21.8 percent population is under poverty line, most of the poor concentrating in the rural areas. (BER, 2019). Cereal crops like wheat, maize etc. are also cultivated to ensure its food security and Bangladesh has achieved tremendous success in agriculture in recent past.

1.1 Background of the study

Bangladesh is agro-based economic small developing country. The agriculture sector plays an important role in the overall economic growth and food security of this densely populated country. Historically, agricultural sector is prominent for a long time in Bangladesh (Molla *et al.,* 2015). Although rice is the main crop in Bangladesh and the country is ranked as the sixth largest rice producer in the world, researchers observe that rice is not produced with full efficiency in the country (Hasnain M. N. *et al.*,2015),

14.23 percent of agriculture sector of the overall GDP in Bangladesh is accounted. About 40.6 of the labor force engaged in agriculture, remain the largest employment sector in Bangladesh (BBS, 2017). Table 1.1 shows the contribution of agriculture to the GDP of Bangladesh.

Table 1.1 Share of agriculture to GDP (%) of Bangladesh

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Agriculture	17	16.81	16.18	15.49	15.35	14.78	14.05	13.41	13.07	12.68

(Source: BBS, 2019)

Major agricultural crops include rice (73.94%), wheat (4.45%), jute (3.91%), rape and mustard (3.08%), lentil (1.54%), potato (1.13%), sugarcane (1.12%) and chili (1.05%) of total GCA dominate the cropping pattern (BBS, 2017).The dominant food crop of Bangladesh is rice, accounting for about 75 percent of agricultural land use (and 28 percent of GDP). Rice production increased every year in the 1980s (through 1987) except FY 1981, but the annual increases have generally been modest, barely keeping pace with the population. Rice production exceeded 15 million tons for the first time in FY 1986. In the mid-1980s, Bangladesh was the fourth largest rice producer in the world; it is currently the world'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.

1.2 Status of Bangladesh agriculture

Most Bangladeshis earn their living from agriculture. Although rice and jute are the primary crops, maize and vegetables are assuming greater importance. Due to the expansion of irrigation networks, some wheat producers have switched to cultivation of maize which is used mostly as poultry feed. Tea is grown in the northeast. Because of Bangladesh’s fertile soil and normally ample water supply, rice can be grown and harvested three times a year in many areas. Due to a number of factors, Bangladesh’s labor-intensive agriculture has achieved steady increases in food grain production despite the often unfavorable weather conditions. These include better flood control and irrigation, a generally more efficient use of fertilizers, and the establishment of better distribution and rural credit networks. With 195, 60,546 MT rice production (BBS 2019), rice is Bangladesh’s principal crop. By comparison, wheat output is 10, 16,811 MT (BBS 2019).

Table 1.2 Food Grains Production (In lakh MT.)

Food Grains	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Aus	21	22.18	21.33	23.33	21.58	23.26	23.28	22.89	21.33	27.72
Aman	122.25	126.6	127.91	127.98	128.97	130.23	131.9	134.83	136.56	140.54
Boro	182.87	185.25	186.17	187.59	187.78	190.07	191.9	189.38	180.24	195.6
Total Rice	326.12	333.71	335.41	338.9	338.33	343.56	347.1	347.1	338.13	347.18
Wheat	9.58	10.39	9.72	9.95	12.55	13.02	13.48	13.48	14.23	10.16
Maize	11.37	13.7	15.52	19.54	21.78	25.16	23.61	27.59	35.78	35.69
Total	347.07	358.12	360.65	368.39	372.66	381.74	384.2	388.17	388.14	393.03

(Source: Bangladesh Bureau of Statistics (BBS) and DAE, 2019)

1.3 Rice production in Bangladesh

There are three seasons of rice production in Bangladesh- aus, aman and boro. BRRI has already developed 94 rice varieties. Among them 27 varieties are boro rice, 36 are aman rice and 10 are aus rice (Elahi, 2017). BINA has developed 20 rice varieties (Elahi, 2017). The cultivation of rice in Bangladesh varies according to seasonal changes in the water supply. The largest harvest is aman, occurring in November and December and accounting for more than half of annual production. Some rice for the aman harvest is sown in the spring through the broadcast method, matures during the summer rains, and is harvested in the fall. The higher yielding method involves starting the seeds in special beds and transplanting during the summer monsoon. The second harvest is aus, involving traditional strains but more often including high-yielding, dwarf varieties. Rice for the aus harvest is sown in March or April, benefits from April and May rains, matures during the summer rain, and is harvested during the summer. With the increasing use of irrigation, there has been a growing focus on another rice-growing season extending during the dry season from October to March. The production of this boro rice, including high-yield varieties, expanded rapidly until the mid-1980s, when production leveled off at just below 4 million tons. Where irrigation is feasible, it is normal for fields throughout Bangladesh to produce rice for

two harvests annually. Total area under boro crop has been estimated at 18.32.309 acres (47, 88,276 hectares) in this year (2018-19) as compared to 120, 07,983 acres (48, 59,367 hectares) of the last year (2017-18). The harvested area has decreased by 1.46 % in 2019.

Comparative area and production estimates are shown be

Table 1.3 Estimates of Total Area and production by Type of rice

Variety	2016-17 Area (000.Ace)	2016-17 Production (000.M.tons)	2017-18 Area (000. Aces)	2017-18 Production (000. M. tons)	2018-19 Area (000.Aces)	2018-19 Production (000.M.tons)
Local Aus	466	254	396	223	433	241
HYV Aus	1861	1880	2260	2487	2298	2534
Total Aus	**2327**	**2134**	**2657**	**2710**	**2731**	**2772**
Broadcast Aman	810	396	903	442	837	400
Local Aman	2676	1820	2313	1341	2155	1268
HYV Aman	10311	11440	10818	12210	10900	12386
Total Aman	**13797**	**3656**	**14034**	**13993**	**13892**	**14054**
Local Boro	84	66	80	62	112	84
HYV Boro	9268	14675	9992	15835	9612	15364
Hybrid Boro	1708	3273	1935	3678	2108	4111
Total Boro	**11060**	**1629**	**12008**	**19575**	**11832**	**19560**
Total	**27184**	**33804**	**28699**	**36279**	**28455**	**34718**

(Source BBS, 2019)

1.4 Economic importance of boro rice in Bangladesh

Agriculture is one of the most important sector of Bangladesh economy (Nargis, 2013). Rice is an essential commodity in Bangladesh in all aspects of life; it is the most important commodity in terms of livelihood and food when it comes to the food security of rural farmers. Bangladesh has been attempting to attain food self-sufficiency since its independence (Rahman, 2017). In Bangladesh, rice is grown in three distinct seasons: boro (post-monsoon rice) from January to June, aus (pre-monsoon rice) from April to August and aman (monsoon rice) from August to December (Nargis, 2013). Bangladesh is self-sufficient in food production at present which is the result of increased rice production according to government estimation. The highest share of rice production comes from boro varieties (BBS, 2019). Comparative area and production estimates of boro rice are shown below:

Table 1.4 Estimates of Total Area and production by Type of Boro Crop

Variety	2016-17 Area (000.Ace)	2016-17 Production (000.M.tons)	2017-18 Area (000. Aces)	2017-18 Production (000. M. tons)	2018-19 Area (000.Aces)	2018-19 Production (000.M.tons)
Local Boro	84	66	80	62	112	84
HYV Boro	9268	14675	9992	15835	9612	15364
Hybrid Boro	1708	3273	1935	3678	2108	4111
Total	11060	1629	12008	19575	11832	19560

(Source BBS, 2019)

Farmers can improved the quantity of yield by using modern high yielding rice varieties. There are many high yielding rice varieties. Among them the most popular high yielding and modern boro varieties are BR 17 (Hashi), BR 18 (Shahjalal), BR-19 (Mongal), BRRI dhan 28, BRRI dhan 29 (Khan *et al.*, 2011).

1.5 Jute production in Bangladesh

Jute is an eminent cash crop of Bangladesh. Bangladesh is rated as second in the production of jute fiber worldwide (Hassan *et al.*, 2018). Farmers of some regions

cultivate jute on regular basis. Kushtia, Jessore, Khulna, Rajshahi, Pabna and Dhaka are the region where the best quality of jute cultithe jat type is produced and are which is also known as the jat region is prevalent for its capacity to create the most astounding nature of jute on the planet (Bepari, 2018). Jute is basically self-pollinated and cultivated in the rainy season. In a subjective manner, farmers were interviewed relating to cultivation of jute. They opined that due to unfavorable weather condition, jute cultivation has persistently decreased this year. Moreover, due to incessant rain during the Bangla month of Chaitra, the sowing season of jute seeds, increasing Boro paddy cultivation the production of Jute decreased now-a-days. Total area under jute crop has been estimated at 18, 52,479 acres (7, 49,658hectares) in this year which is 1.13% lower than that of last year. Comparative area estimates of jute crop of 2017-18 and 2018-19 are as follows:

Table 1.5 Year wise area and production of jute in Bangladesh

Fiscal Year	Area (000, ha)	Production (000, Bales)
2016-17	1823	8247
2017-18	1873	8895
2018-19	1852	8576

(Source: BBS, 2019)

1.6 Economic importance of jute in Bangladesh

Jute is a cash crop of Bangladesh. Jute (*Corchorus* spp.) is obtained from two species (annual and short day plants) of the genus *Corchorus* belonging to the family *Tiliaceae*. These are, *Corchorus capsularis* L. and *Corchorus olitorius* L. There are over 30 species, the genus *Corchorus*, is grown in the summer season (Kharif-I) (Islam, 2019). Nowadays, most of the farmers are familiar with late jute seed production technology. The optimum sowing time of late jute seed is from mid-July to August in medium high to high land where rain or flood water may not stand (Alam *et al.*, 2012). Jute production was 26% as of all agricultural crops (Miah *et al.* 2020).Jute is important for the textile and paper industries because it is a valuable ingredient for the production of paper and quality textiles as well as a renewable source of biofuels. Jute fibers characteristically show high gloss, good moisture absorption performance, rapid dehydration capacity and easy degradation. Unlike heavy cotton requirements, jute is a rain-fed product that needs little fertilizer or insecticide. Production mainly concentrates in Bangladesh and India, almost 85% of world jute farming in this area

(www.jutecomm.gov.in.2014). Bangladesh Jute Research Institute (BJRI) has established a gene bank in 1982 now having world's largest collection of about 6060 accession of jute and allied fiber (JAF) germplasm from home and abroad. The foreign currency earnings from exports of jute is 6% of (Karim *et al.* 2020). Jute fiber used for making hessian, blankets, sacks, gunny bag, carpets, furnishing fabrics, mats, ropes and packaging materials. Jute sticks and root stamps are used as house construction materials like compress sheet of hardboard, and fuels in the rural areas. The green leaves of jute contain minerals and proteins, which are edible and are popular as leafy vegetable. Nowadays, Jute plants are used as pulp in paper industries (Tareq *et al.,* 2015 and Miah *et al.* 2020). More than three million little homestead family units, the biggest business, delivering around 33% of assembling yield, and the biggest agricultural export item in Bangladesh (Bepari, 2018). The livelihood of about 25 million people is dependent on jute related activities in agriculture, domestic marketing, manufacturing and trade (Nahar *et al.*, 2017). Bangladesh is currently producing 42% of the total jute in the world and exports 70% of the raw jute produced (Hassan *et al.,* 2018).). The country spent $701 million on the import of jute pulp in 2017 (Hassan *et al.*, 2018).

1.7 Rationale of the study

The main produced crops all over Bangladesh are rice and jute. Rice is most produced cereal and most of the people depend on rice as food security. Jute was called as the golden fiber of Bangladesh. Jute can use as substitute of polythene and plastic. In recent years, international community is very conscious about global warming caused by artificial plastic products. Bangladesh is now focusing highly on producing eco-friendly products like -jute bags for reducing the climate impact and saving the nature. Farmers are now focused on jute production as the price of jute is increasing day by day. The market of jute is spread widely. Thus, it is time demanding to study boro rice and jute production and analysis their profitability in Bangladesh.

1.8 Objectives of the study

The specific objectives of this study are-

1 To determine the socio-economic characteristics of the respondents.
2 To analysis and compare the costs, returns and profitability of boro rice and jute production.
3 To determine factors affecting the gross return of the boro rice and jute producers.
4 To identify the major problems associated with boro rice and jute production.

1.9 Outline of the study

The study consists of 8 chapters. Chapter 1 describes the introduction of the study, Chapter 2 relevant to literature. Chapter 3 deals with the methodology of the study. In Chapter 4, the socioeconomic characteristics of the sample farmers, production cost and profit, etc. are presented. In Chapter 5 depicts the total cost, gross return, net return, and Benefit cost ratio and resource use pattern. Chapter 6 reveals the factors affecting in production. Problems which were faced by boro rice and jute producers were described in chapter 7.Finally, the conclusion, and recommendations of the study are presented in Chapter 8.

CHAPTER 2

REVIEW OF LITERATURE

This chapter aims at represent some review of the past research works that are related to the present study. A few researches have been done on boro rice and jute production in Bangladesh partly. However, comparative economic profitability of boro rice and jute production is hardly ever found in this country. Some important studies on boro rice and jute production, which have been conducted in the recent past, are discussed below:

Majumder (2009), explained the measure and compare resource use efficiency and relative productivity of farming under different tenure conditions in an area of Bhola district. A total of 90 samples, 30 from each class were selected on the basis of random sampling technique. The study explored the difference in the efficiency and productivity among owner, cash tenant and crop share tenant. Total cash expenses as well as total gross costs for producing HYV Boro rice was highest in owner farms and lowest in crop share tenant's farm. When individual inputs were concerned it was observed that expenses on human labor shared a major portion of expenses in the production of HYV Boro rice where owner operators used more hired labor in compare to other groups. However, the cash tenant farmers were more efficient than owner and crop share tenant farmers. At last it was observed that due to poor resource base the crop share tenants were unable to invest on modern farm inputs. It may be mentioned that in Bangladesh the predominant tenancy arrangement is share cropping, which is an inefficient form of tenure arrangement in compare to cash tenancy.

S Ahmed *et al.* (2009), explain the profitability of boro rice and potato production of Gouripur Upazila in Mymensingh district. His sample size was 60, 30 potato and 30 boro rice producers. By using Cobb-Douglas production function he determined that individual inputs had effect on boro rice and potato production. Descriptive as well as statistical analysis was done to achieve the objectives of the study. The major finding of the study was boro rice and potato were both profitable to producers and potato cultivation was more profitable of the study area.

Rezoyana (2018), found that Boro rice production was profitable. Production function analysis suggested that, among the variables included in the model, quantity of seed, animal labor and power tiller cost, No. of human labor, quantity of fertilizer, cost of irrigation, had a positive and significant effect on the gross yield of Boro rice production, except for cost of manure and cost of pesticides had an insignificant effect on the gross yield of rice production. Efficiency analysis indicated that most of the farmers inefficiently used their inputs.

Hasnain M. N. *et al.* (2015), explained that the study found that technical efficiency of boro rice farms in Meherpur district is 89.5%. It is also found that 'labor', 'fertilizer and pesticide', 'seed' and 'irrigation' are the significant factors that affect the level of technical efficiency while 'farm size' and 'ploughing cost' are found insignificant in affecting technical efficiency of boro rice production in the study area. The results indicate that boro rice farms in the study area have been operating below the maximum level of production frontier and given the available technology, farmers can increase their production by 10.5% through increasing the use of labor, seed and irrigation inputs and also by using proper doses of fertilizer and pesticide inputs.

Quayum M. A. *et al.* (2012),), takes an attempt to assess the differences in income distribution among the participants in modern rice (MV) production using power tiller (PT) and draught animal power (DAP) in 2003 in some selected areas of Bogra, Comilla, Chuadanga and Manikganj districts in Bangladesh. Human labour earned the largest share of output in case of both PT users and DAP users for MV T. Aman and T. Aus cultivation but the share accrued to the human labour was always lower in mechanized farms (PT users) largely as a result of the decline in use of family labour. The income share analysis indicates that hired human labour earned higher income share under PT users (both owner-users and hirer-users taken together) than that of DAP users (both owner-users and hirer-users taken together). Similar results were found in case of pure owner-users and pure hirer-users of both PT and DAP. The imputed total cost of a factor as a proportion of total value of the crop grown was the highest for human labour irrespective of cultivation method used. Share of farmer in total value added in the crop production was higher when DAP was used for rice production. Share of hired labour in total value added was greater for PT than for DAP in MV rice production.

Sarker B. C. (2013), studied morphological, yield and yield contributing characters of four boro rice varieties of which three were local viz., Bashful, Poshursail and Gosi; while another one was a high yielding variety (HYV) BRRIdhan 28. The BRRIdhan 28 were significantly superior among the cultivars studied. Among the local rice cultivars, Gosi showed the higher yielding ability than Bashful and Poshursail.

Sujon M. H. K. (2017), explained the profitability and and resource use efficiency of boro rice cultivation in Bogra district of Bangladesh using farm level survey data of April-May, 2016. In total 103 farmers were selected randomly from the study area. . Cobb-Douglas production function analysis showed that the key production factors, that is, human labour, irrigation, insecticide, seed and fertilizer had statistically significant effect on yield. MVP and MFC ratio analysis showed that growers allocated most of their resources in the rational stage of production

Rahman S. M. (2016), reported on an empirical study of the rice farmers' production phenomenon emphasizing on cost based on farm operation. The data stem from a survey of 95 farmers in Jessore District, Bangladesh. To investigate the significant difference of the inputs quantity, their prices and amount spent for necessary production elements, one-way ANOVA method was adopted. It argued that for reducing the cost of production increased attention by both the government and non-government organizations.

Basak J. K. (2009), studied the effect of climate change on yield of two varieties of boro rice has been assessed using the CERES-Rice model of the DSSAT modeling system. Increases in incoming solar radiation and atmospheric carbon-di-oxide concentration increases rice yield to some extent, but their effect is not significant compared to the negative effects of temperature. Variations in rainfall pattern over the growing period have also been found to affect rice yield. Increasing temperatures and solar radiation have been found to reduce the duration of physiological maturity of the rice varieties. Model results also suggest that in addition to reducing yield, climate change may also make rice yield more vulnerable to transplanting date, predicting

significant reduction in yield as transplanting date is delayed, especially beyond 15 January. DSSAT modeling system could be a useful for assessing possible impacts of climate change and management practices on different varieties rice and other crops.

Islam *et al.* (2017) conducted to assess the profitability, constraints and factors affecting rice production in coastal area of Shamnagar upazila, Satkhaira district, Bangladesh by using stratified random sampling method. Simple statistical technique as well as the Cobb-Douglas production function was used to achieve the objectives of the study. It is found that the coefficient of seed, fertilizer, power tiller, irrigation cost and human labor have significantly impact on gross return. Lack of saline tolerable good quality seeds, high price of inputs, low price of outputs and natural calamity were the major problems for rice farming in the study area though rice farming was a profitable enterprise.

Tama *et al*. (2015) undertaken to assess the financial profitability of aromatic rice production. A total of 45 farmers of some selected villages of Chirirbandar upazila of Dinajpur district were considered as sample for achieving these objectives. Collected data were analyzed with descriptive statistics. The undiscounted Benefit Cost Ratio on the basis of total cost was 1.77 implying that the aromatic rice production was highly profitable.

Reza *et al.* (2013) investigated to find out the input productivity and resource use efficiency of boro rice farm in Sylhet District. Cobb-Douglas Production Function, Marginal Value Product (MVP) and Marginal Factor Cost (MFC) are used for analysis Findings of the study revealed that the farmers were inefficient of the use of resources.

Bhuyan *et al.* (2012) evaluated the water and fertilizer application efficiency of rice cropping system under bed planting method. This study concluded that bed planting method is a new approach for optimum fertilizer and water use efficiency as well as higher yield compared to conventional flat method.

Rahman *et al.* (2012) estimated the farm-size-specific productivity and technical efficiency of all rice crops. The application of efficient management system would be able to increase production in the marginal farms. In the technical inefficiency effect,

age, education and family size had positive impact on efficiency effect, whereas land under household had negative impact on efficiency effect.

Hasan (2000) studied on the economic potential of alok hybrid rice and found that per hectare total cost for hybrid alok was Tk. 36,276.33 per hectare variable cost was calculated as Tk. 2,927.05 and per hectare yield was 6,557.07 kg. The price of alok paddy was Tk. 7.81/kg. Taking the by product into account the gross return of hybrid alok per hectare was Tk. 5,465.02. The net return per hectare was Tk. 18,375.50 and the gross margin was Tk. 26,409.97.

Saha *et al.* (2017) looked for the economic profitability of Alternate Wet Drying (AWD) irrigation methods over conventional irrigation practices to address concerns of groundwater depletion associated with Boro rice production. In total 80 farmers of which 40 practice AWD and 40 farmers involved in conventional irrigation were selected randomly from Fulbaria and Trishal Upazilas of Mymensingh district and Nakla and Nalitabari Upazilas of Sherpur district. Descriptive as well as statistical analyses were done to achieve the objectives of the study. The key finding of the study is that AWD farmers gained more profit than conventional farmers on Boro rice production. The results indicated that application of AWD method was more profitable than conventional practices in Boro rice production.

Hasan *et al.* (2016) estimated the technical efficiency of boro rice farms and determines the important factors affecting the level of technical inefficiency of the farms. This study mainly uses primary data for the analysis, collected from 112 rice producing farms of Jhenaidah district using multistage random sampling technique. The Cobb-Douglas stochastic production frontier approach is employed to estimate the technical efficiency of Boro rice farms. An inefficiency effect model is also used to determine the factors that affect the level of inefficiency of the Boro rice farms. The empirical results of the Cobb-Douglas stochastic production frontier approach show that the technical efficiency of Boro rice production is on average 0.92. This indicates that the level of technical efficiency in the study area is high. It also finds that cost of labor, irrigation, seed and ploughing are the important factors which affect increasing efficiency of Boro rice production. The results from the estimated inefficiency effect model reveal that farm size, age, education, training and credit

facility are the significant factors which are negatively related to technical inefficiency of Boro rice production.

Rafiq M. Z. A. *et al.*, (2020), conducted that jute variety BJRI Tossa pat-8 could be more successful productive variety compares to the other tested varieties in the regional condition in Bangladesh.

Islam M. (2018), explained that, jute was found grown in Bangladesh almost solely as a rain fed crop without any irrigation or drainage provisions. The status of jute as a cash crop of Bangladesh was not at all satisfactory. Millions of people of Bangladesh depend on all affairs of jute crop. Lack of proper government policy on jute, lack of production of jute, random closures of jute mills, failure to modernize the cultivation system and manufacturing units, mismanagement and malpractice, fall of demand of jute in world market, use of alternative source to jute etc. were found as problems in the development of jute fiber in Bangladesh. Proper Government policy could solve the problems in jute sector of Bangladesh.

Islam M. S. (2012), explained worldwide awareness on environment is the reason for the opportunities of Jute, due to environment friendly characteristics. The study is to evaluate the impacts of Jute production on environment in Bangladesh. It is taken the data of Production Area, of Jute for 19 years of Bangladesh. The jutes increase the fertility of land, preserve the ozone layer by absorbing CO2 and clean the air by emitting O2. The jute is used as vegetable, geotextile, biogas, biodegradable products which have impact on the environment. The recommended issues are to use the scientific method of cultivation, to implement the law for using jute rather synthetic, to make jute policy, to enhance the application area of jute, to develop the awareness of Jute as environment friendly fiber, and to develop the research institutions etc.

Thakur (2003), studied on local boro and hybrid boro rice production in Brahmanbaria district with a sample of 60 farmers considering Cobb-Douglas production function and found that the net return of hybrid Boro rice was 15.04% higher than local boro rice.

Khatun M (2010), designed to estimate the costs, returns and relative profitability of White and Tossa jute production in Sirajganj district. In total 60 farmers, out of which 30 farmers were producing White jute and 30 farmers producing Tossa jute, were selected purposively from 3 adjacent villages of Ullahpara Upazila in Sirajganj district. Primary data were collected during the period from August to September 2010. Descriptive statistics and Cobb-Douglas production function model were used for achieving the main objectives of the study. The study also identified some problems faced by the jute producers. The study suggested taking adequate measures by the researchers and extension workers to expand the production of both the varieties as far as possible for increasing jute production, increase cropping intensity as well as farm income in Bangladesh. Bangladesh is a famous for jute production since 1971 and earned a significant Therefore, this paper suggests using NN model to forecast the jute jute productions in Bangladesh.

Hossain M (2017), discussed the jute crop status of Bangladesh as regard to its production, cultivation areas, cultivation ratio, sowing and harvesting tine etc. due to global climatic changes. The study was based on secondary data. Results revealed that in Bangladesh there was pre-monsoon shower during the month of March and April thereby offering optimum condition for land preparation and sowing. Following that there were moderate and intermittent rain and shower during May and June providing enough moisture in the soil needed for growth of jute plants. Due to global warming the increasing temperature and rainfall were observed during the jute growing season. . The seed sowing time of different released varieties changed over the time due to changing behaviors of temperature and rainfall. At present cultivation ratio of white and tossa jute was also reversed. The seed sowing time of different released varieties changed over the time due to changing behaviors of temperature and rainfall. At present cultivation ratio of white and tossa jute was also reversed.

Islam M (2009), undertook the review at Agronomy Division, Bangladesh Jute Research Institute (BJRI), Dhaka on jute weeds, their management, weeding cost and control measures through collecting secondary information in 2013.. The cost of weeding alone comes to 30% to 40% or even more of the total cost of jute cultivation. Weeds competed with jute crops for water, light and mineral nutrients, which directly

reduce the quality and quantity of fibre. Jute weeds indirectly reduce fibre yield by serving as alternate host for diseases and pests. Since the cost as well as availability of agricultural labour is being copped up as problem, more attention in the field of scientific methods of jute weed control and sequence of weed vis-à-vis cropping pattern is warranted.

Islam M. S. (2012), study was on the worldwide awareness on environment is the reason for the opportunities of Jute, due to environment friendly characteristics. The study is to evaluate the impacts of Jute production on environment in Bangladesh. It is taken the data of Production Area, of Jute for 19 years of Bangladesh. The jutes increase the fertility of land, preserve the ozone layer by absorbing CO2 and clean the air by emitting O2. The jute is used as vegetable, geotextile, biogas, biodegradable products which have impact on the environment. The recommended issues are to use the scientific method of cultivation, to implement the law for using jute rather synthetic, to make jute policy, to enhance the application area of jute, to develop the awareness of Jute as environment friendly fibre, and to develop the research institutions etc.

Hussain M. (2011), explained analysis of productivity and profitability of jute under improved management practices showed distinctly higher benefit over farmer's traditional practices at sadar Upazila of Rangpur district during 2007-2009. From the productivity and profitability it can be said that farmers did not follow the recommended improved agronomic management practices in cultivation of jute in the area under study. So farmers should be motivated to practice improved management and agronomic practice of jute cultivation which would be helpful in obtaining productivity and profitability.

Alam *et al* (2000), was conducted on 8-15 November 1996 in 7 districts of Bangladesh (i.e., Rangpur, Bogra, Pabna, Netrokona, Gazipur, Gopalganj, and Jessore) to find out the state of jute cultivation. . Farmers do not use fertilizers in a balanced way. Only 11% of farmers sprayed pesticides but none followed recommended practice.

Forman (2011), observed on comparative economic analysis of Aus rice and jute production in Mymensingh district with a sample of 80 farmers by using Cobb-

Douglas production function and found that jute was more profitable than aus rice as jute had higher net return than Aus rice.

Afroz and Islam (2012) studied on economics of aus rice and jute cultivation in Narsingdi district with a sample of 70 farmers by considering Cobb-Douglas production function and found that jute had three times more net return than aus rice and BCR of jute was 30% higher than Aus rice.

Hasan (2015), explain the comparative economic analysis of aus rice and jute production in Narayangonj district with a sample of 60 farmers by considering Cobb-Douglas production function and found that jute had higher return than aus rice.

Khan (2013), studied on a comparative assessment of financial and economic profitability of aus rice and jute in Bangladesh with a sample of 90 farmers using Policy Analysis Matrix and found that jute production was more profitable than aus rice.

2.1 Research gap

The above reviews show that different studies were conducted on rice and jute production in Bangladesh where few researches were done on comparative profitability of aus rice and jute production. However, none of them compared profitability of boro rice and jute production in Shibchar of Madaripur district. Rice is a staple food in Bangladesh and Bangladesh earns a lot of foreign currency by exporting jute and jute goods. These two crops are highly related with rural economy. It would be very fruitful and interesting to study on productivity of boro rice and jute production. Thus, the present study has been undertaken to make an in-depth study to fill the knowledge gap to determine the profitability of boro rice and jute production and help farmers and policy makers in decision making by providing information of boro rice and jute production.

CHAPTER 3

METRHODOLOGY

Study on farm management relies on the applicant of suitable methods and the quality of the primary data. Proper methodology is a prerequisite of a good research. . The design of any survey is predominantly determined by the nature, aims, and objectives of the study. It is also depends on the availability of necessary resources, materials and time. The research targets decide the essence of the primary data to be obtained. Various data collection methods exit. A farm business study usually involves collection of information from individual farmers; collection of data for farm business analysis involves judgment of the analyst in the selection of data collection methods within the limits imposed by the resources available for the work (Dillon and Hardaker 1993). For the following purposes, the survey approach was used in the analysis to gather primary data.

- The technique of surveying is relatively easy to administer.
- Compare to other information collecting methods, it can be produced in less time.
- Cost-effective, realistic and widely applicable.
- This kind of survey enables quick investigations of large number of cases.
- Equipped for collecting knowledge from a broad number of respondents.

There is some downside to this data collection approach as the investigator has rely on the memory of farmers who cause some problem. Many farmers are illiterate and do not keep track of any details. In order to collect the missing information and to minimize the severity of any misinformation, frequency visits have been made to the research area and the farmers. In chronological order, the approach used in this analysis is listed below.

3.1 Selection of the study area

Selection of the study region is an important phase for the farm management research. “The area in which a farm business survey is to be carried out depends on the particular purpose of the survey and the possible cooperation from the farmers” (Yang, 1965). Although rice and jute grown all over Bangladesh. A preliminary

survey in Shibchar Upazila of Madaripur district was conducted to achieve the objectives of the present study. On the basis of preliminary information, different villages were selected. For data collection purpose farmers are selected randomly.

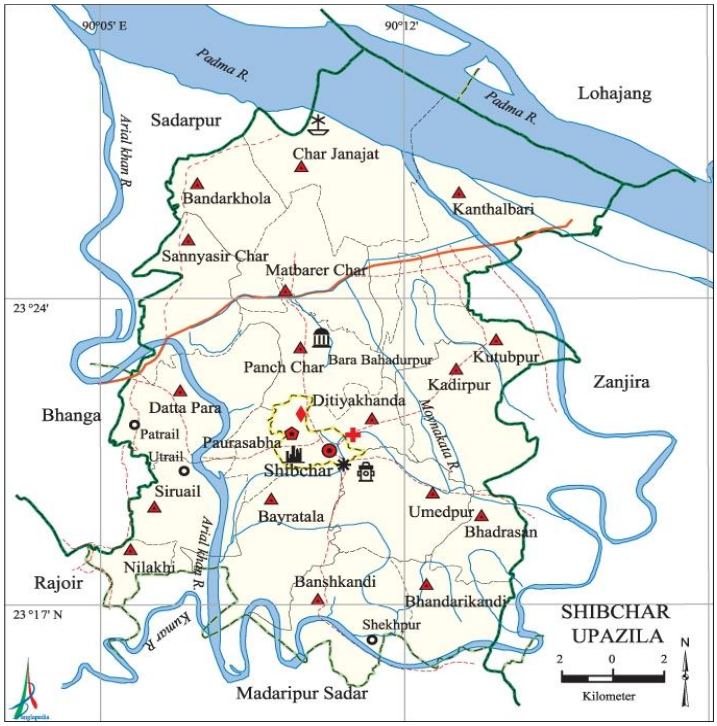
The main reasons why the area for data collection purpose was selected were —

1. There was no analysis done in that field on this research subject.
2. Boro rice and jute were the main crop in that region.
3. The chosen villages had similar physical characteristics for the cultivation of jute and boro rice, such as topography, soil and climate conditions.
4. Since most of the farmers were engaged in the production of jute and boro rice, accurate data was expected to be successfully obtain from that region.
5. Fast connectivity and good facilities for communication in the city.
6. Co-operation from the respondents was expected to be high so that the reliable data would be obtained.

3.2. Description of the Study Area

3.2.1 Geographic Area and Location of Shibchar upazila

Shibchar Upazila (Madaripur district) area 321.88 sq km, located in between 23°15' and 23°30' north latitudes and in between 90°05' and 90°17' east longitudes. It is bounded by Padma river, lohajang and sadarpur upazilas on the north, rajoir and madaripur sadar upazilas on the south, zanjira upazila on the east, bhanga upazila on the west.



(Source: Banglapedia, 2015)

Figure 3.1 Map of Shibchar Upazila Showing the Study Area

(Source: Banglapedia, 2015)

Figure 3.2 Map of Madaripur district showing the Study Area

3.2.2 Characteristics of the upazila

A) Population: Total 324438; male 165125, female 159313; Muslim 311430, Hindu 12978, Buddhist 13, Christian 8 and others 9.

B) Water bodies

Main Rivers: Padma, Kumar, Arial Khan, Moynakata.

C) Main sources of income

1. Agriculture 63.95%,
2. Non-agricultural labourer 2.16%,
3. industry 0.81%,
4. Commerce 14.57%,
5. Transport and communication 2.18%,
6. Service 6.16%,
7. Construction 1.22%,
8. Religious service 0.15%,
9. Rent and remittance 0.71% and
10. Others 8.09%.

D) Ownership of agricultural land

1. Landowner 65.77%,
2. Landless 34.23%;

E) Agricultural landowner:

1. Urban 46.31% and
2. Rural 67.53%.

F) Main crops Paddy, jute, wheat, pulse, sugarcane, onion, garlic, mustard, betel leaf, and ground nut.

G) Extinct or nearly extinct crops: Kaun, arahar, china, sesame, and mehti.

H) Main fruits: Mang**o**, blackberry, wood apple, tamarind, banana.

I) Fisheries, dairies and poultries: Dairy 20, poultry 41, hatchery 3, artificial breeding centre 1.

3.3 Sampling technique and sample size

In 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). However, because of diversity in the technical and human environment, it is necessary to sample several numbers of the population before any conclusion can be drawn. Therefore, the purpose of sampling is to select a sub-set of the population that is representative of the population (Rahman, 1998).

The sampling process requires five activities,

I. Specification of the sampling unit;

II. Preparation of an adequate sample frame;

III. Selection of the sampling method;

IV. Determination of the sample size; and

V. Selection of the sample.

It was not possible to include all the farmers of the study area due to limitation of time, money and personnel. In total 60 farmers were randomly selected taking 30 from jute farmers another 30 from boro rice farmers. A simple random sampling technique was followed in the present study for minimizing cost, time and to achieve the ultimate objectives of the study.

3.4 Preparation of the survey schedule:

To gather data from the survey respondents while keeping the targets in mind, a draft questionnaire was prepared. Interviewing several farmers who cultivated boro rice and jute pre-tested the questionnaire. Required improvement, amendments and alternatives were made and the draft questionnaire was finalized afterwards. There were three knowledge groups in the final questionnaire. To collect socio-economic details, the first part was planned. Information on the costs and returns of jute and boro rice was included in the second section. The third section included in the second section. The third section included questions concerning the constraints and challenges facing farmers in the development of boro rice and jute in the selected region.

3.5 Period of the study:

Data were collected during the period of March to April in 2020 through direct interview with the farmers. Data relating to inputs and outputs were obtained by making time to time visit in the study area.

3.6 Data collection method:

By interviewing the jute and boro rice farmers, needed information was gathered through field survey. The relevant information was gathered through field survey from farmers of jute and boro rice who were chosen. The chosen farmers were first approached so that, according to their convenient time, they could be interviewed. The investigator systematically asked questions during the interview and explained the intent of the research for deeper understanding. The interviewer assured the farmers that the analysis was adequately scholarly. When the interview was finished, the interview timetable was updated to ensure that and of the necessary evidence was correctly gathered.

3.7 Processing, tabulation and analysis of data:

The data obtained was manually coded and edited. After that, all the data gathered was scrutinized and very thoroughly outlined. Data entry and analysis were done by using Microsoft Excel software in computer. The knowledge was first obtained in local units and then translated into regular international units.

3.8 Analytical technique

There are several analytical methods are used to achieve basic testing targets. Using Microsoft Excel and SPSS, the collected data was analyzed, since they are very popular and widely used.

Eventually, the influence of the independent variables on the dependent variables in the production function of boro rice and jute were analyzed using econometric methods such as the Cobb-Douglas production function. The data processing function was divided into two sectors-

A. Descriptive statistics.
B. Cobb-Douglas production function

3.8.1 Descriptive statistics

The descriptive statistics is a tool that was used through SPSS software for the sum, average and percentage of total costs, gross returns, net returns and profitability of boro rice and jute growing farmers. It was also used for analyzing the socio-economic conditions and problems faced by the jute and boro rice growers.

3.8.2 Profitability Analysis

Cost of variables inputs such as land preparation, labor, seed, fertilizer, irrigation, and insecticides were calculated. Different descriptive statistics like mean, percentage, ratio, etc. Land use cost was calculated on the basis of per year lease value of land.

Gross Margin

GM = TR – VC

Where, GM = Gross Margin, TR = Total Revenue, VC = Variable Cost

Net Income

NI = TR – TC

Where, NI = Net Income, TR = Total Revenue, TC = Total Cost

For estimating net income total cost was subtracted from total revenue. Total cost includes variable cost plus fixed cost.

Interest on Operating Capital

Interest on operating capital was calculated by using the following formula:

Interest on Operating Capital (IOC) = Alit

Where,

Al = Total investment /2,

t = Total time period of investment

i = interest rate which was 9 percent per year.

3.8.3 Undiscounted Benefit Cost Ratio (BCR)

A benefit-cost ratio (BCR) is an indicator showing the relationship between the relative costs and benefits of a proposed project, expressed in monetary or qualitative terms. If a project has a BCR greater than 1.0, the project is expected to deliver a positive net present value to a firm and its investors.

BCR on TC = GR /TC

Where, GR = Gross return, TC = Total Cost

If BCR>1, then the return from farm is economically satisfactory;

If BCR<1, then the return from the farm is not economically satisfactory;

If BCR=1, then the farm is in break- even point.

3.8.4 Cobb-Douglas production function

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

The model of Cobb-Douglas for both jute and boro rice is as follow:

$Y= aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}X_6^{b_6}X_7^{b_7}e^{ui}$

The Cobb-Douglas production function was transformed into the following logarithmic form by logging on both sides, because it could be solved by the Ordinary Least Square (OLS) method:

$\ln Y= \ln a +b_1 \ln X_1+ b_2 \ln X_2+ b_3 \ln X_3+ b_4 \ln X_4+ b_5 \ln X_5+ b_6 \ln X_6+ b_7 \ln X_7+ ui$

Where,

Dependent variable, Y = Gross return (Tk/ha)

Independent variables, X_1 = human labor cost (Tk/ha)

X_2 = Power tiller cost (Tk/ha)

X_3 = seed/seedlings cost (Tk/ha)

X_4 = Fertilizer cost (Tk/ha)

X_5 =Pesticide cost (Tk/ha)

X_6 = Manure cost (Tk/ha)

X_7 = Irrigation cost (Tk/ha)

a = constant or intercept term

b_1 to b_7 = production coefficients of respective input variables to be estimated

ui = Error term

ln = Natural logarithm

3.8.5 Elasticity of production (Ep)

Production elasticity is defined as the percentage change in output and the percentage change in input, providing the other variables remain constant. In measuring the elasticity of output, the Cobb-Douglas production function is very beneficial. It is possible to express the elasticity of output as-

Elasticity of production, Ep = bi

If Ep = 1, Production elasticity is unity

Ep> 1, Production is elastic, and

Ep<1, Production is inelastic.

3.8.6 Return to scale (RTS)

The return to scale can be achieved by summarizing the coefficients of regression of all explanatory variables in the output function of Cobb-Douglas.

This can be expressed as—

Return to scale, RTS= $\sum$bi

Where, n= number of regression, and bi= regression coefficients.

If, RTS=1 then it is constant return to scale

RTS>1 then it is increasing return to scale

RTS<1 then it is decreasing return to scale.

3.9 Limitations of the study

The present study was performed with respect to the development of boro rice and jute production. The data was collected in rural areas. During data collection, several problems faced. Some of the problems were-

- In a limited time period, researchers had to conduct this study, which was not enough to conduct an in-depth study.
- The researchers have had no funds for this report. So, it was not practical to cover a wide area.
- During the interview, the interview found it impossible to avoid interrupting anyone as interviews took place in farmer's field or in their house.

CHAPTER 4

SOCIO-ECONOMIC PROFILE

4.1 Socio-economic characteristics of boro rice and jute farmers

The purpose of the chapter is to provide a concise overview of farmer's socio-economic environment in which they live, the type and degree of the involvement of farmers in national development activities. It was not possible to gather all the details on the socio-economic characteristics of the sample farmers. The socio-economic characteristics of farmers influence their pattern of production. It also legally defines the behavior of decision-making. This influences the implementation of inventions. The socio-economic context of the sample farmers.in particular the size and composition of the family, degree of literacy, profession, land ownership pattern and its distribution etc. are discussed in this section.

The socio-economic characteristics of boro rice and jute farmers are important component of the study since they can have an effect on the production decision and production pattern of the sample farmer. The socio-economic characteristics of rice and jute farmers in the areas chosen were very different. Farmers age, family size and composition, education status, material status, occupation level, farming experience and farm holdings of the farmer were included in the socio-economic characteristics of the sample farmers taken into account in the study field.

4.1.1 Age structure of the sample farmers

The respondents were categorized into five groups of boro rice and jute farmers, such as 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61 years and above.

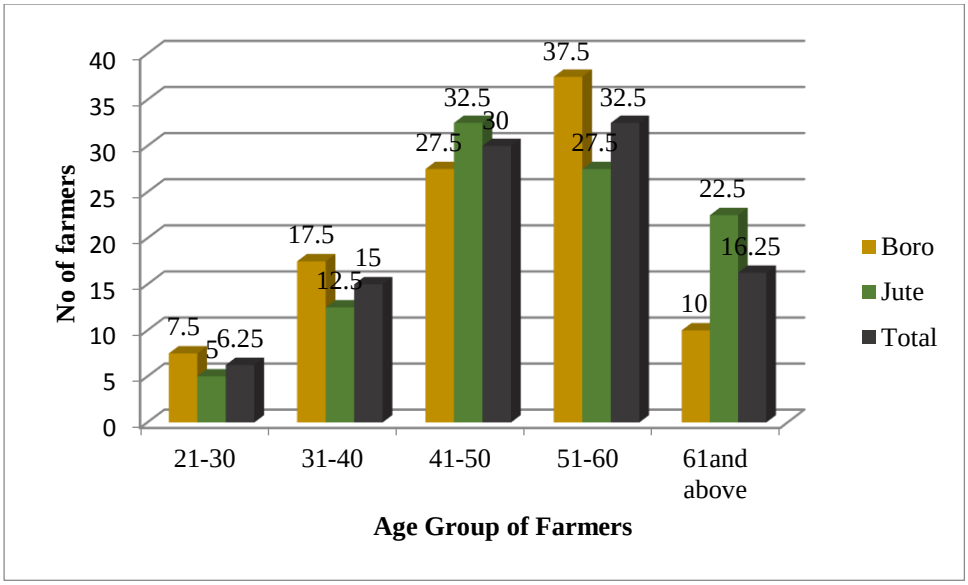


Figure 4.1. : Age group of boro and jute farmers

Figure 4.1 reveals that 7.5 percent of overall boro rice farmers are 21-30 years old, 17.5 percent are 31-40 years old, 27.5 percent are 41-50 years old, 37.5 percent are 51-60 years old and 10 percent are above 60 years old. Table 4.1 also shows that 6.25 percent of total jute farmers belong to 21-30 years old, 15 percent 31-40 years old, 30 percent 41-50 years old 32.5 percent belong to 51-60 years old and finally 16.25 percent belong to 61 and above years old. It was clear from Table 4.1 that the majority of boro rice growers fell into the age range of 51-60 years, which was 37.5 percent, while the majority of jute growers were between 41-50 years, which was 32.5percent.

4.1.2 Gender

In the study area most male members worked in the field and most female members worked inside home. It was rare to see any female farmers in the study area. Table 4.1 shows that 100% farmers of jute and boro growers are male among the sample respondent.

Table 4.1 Gender of Boro rice and jute growers

Gender	Boro rice growers		Jute growers	
	No of growers	%	No of growers	%
Male	30	100	30	100
Female	0	0	0	0
Total	30	100	30	100

(Source: Field survey, 2020)

4.1.3 Marital status

Marital status of the respondent is a significant factor that affects the lifestyle and economic activities of a family. Farmers were coded as Married = 1, Unmarried = 2 and Widow/widower = 3 for analysis purpose.

Table 4.2 shows that 96.67 percent farmers of boro rice were married and 3.33 percent were unmarried. 90 percent farmers of jute were married according to table 4.3 and 6.67 percent were unmarried and 3.33 percent were widow.

Table 4.2 Marital status of the respondent

Marital status	Boro rice growers		Jute growers	
	No of growers	%	No of growers	%
Married	29	96.67	27	90
Unmarried	1	3.33	2	6.67
Widow/Widower	0	0	1	3.33
Total	30	100	30	100

(Source: Field survey, 2020)

4.1.4 Educational status of the respondents

Education has its own merits and it contributes to economic and social development, as education is the backbone of a nation. It plays a vital role in the acquisition of information about the innovation in various production processes of agriculture. It helps person to make right decision regarding his farm business. It makes a man more capable of managing scarce resource and hence to earn maximum profit (Miah, 1990). The farmers were classified into four categories such as illiterate, 1-5, 6-10, 11-12 and more than 12 for research purpose. Literacy of farmers were coded for analyzing purpose as Illiterate = 1, 1-5 = 2, 6-10 = 3, 11-12 = 4, more than 12 = 5.In case of boro rice farmers, it can be seen from figure 4.2, that 6.67 percent famers were illiterate, 43.33 percent 1-5 level, 50 percent 6-10 level but no farmer were found in 11-12 and more than 12 level of education.

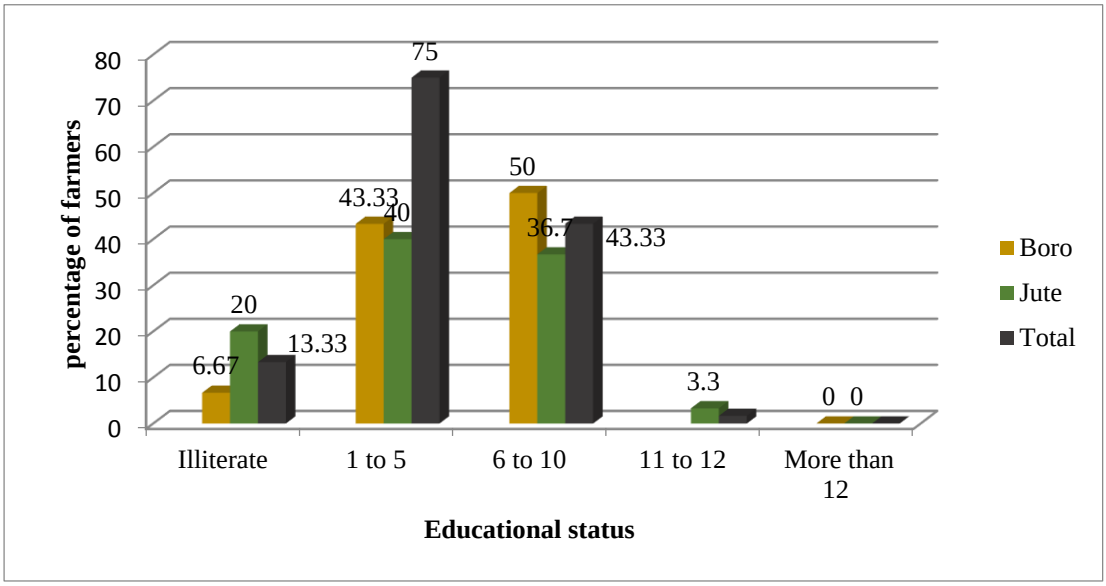


Figure 4.2. : Educational status of the respondents

Again in jute farmers 20 percent were illiterate,40 percent were 1-5 level,36.7 percent were 6-10 , 3.33 percent were 11-12 level of education but no one was in more than 12 level.

But in total 8 percent farmers were illiterate and jute farmers were more illiterate than boro rice farmers. It was obvious from figure 4.2 that majority of farmers of both boro rice and jute had 1-5 level of education which was 75%.

4.1.5 Family size and composition

The family is an essential social structure that maintains a close social connection between members of the family. Family size plays a vital role in framers social and economic lives. Family size was described in this study as the total number of individuals living together under the supervision of the head of the family. The size of the family includes the farmer, children, wife, father, mother, sister and brothers themselves. A large family has more labor to gain from multiple tasks, but higher costs are needed to satisfy the everyday needs of family members.

Table 4.3 show that all farmers' family consist of below 8 members and in the case of boro farmers 43.33 percent had 1-4 members, 56.67 percent farmer's family had 6-8 members. Again from table 4.3, 60 percent jute farmer's family consisted of 1-5 members and 40 percent consisted of 6-8 members.

Table 4.3 Distribution of the farmers by family size

No. of family members	Boro rice growers		Jute growers	
	Frequency	%	Frequency	%
1-4	13	43.33	18	60
5-8	17	56.67	12	40
Above 8	0	0	0	0
Total	30	100	30	100

(Source: Field survey, 2020)

Table 4.4 shows that total family members of boro rice farmer were 130 and among them 66 members were male and 64 members were female in percentage 50.77percent male members and 49.23 percent female members.

Again from table 4.4 total numbers of family members of jute farmers were 124 and male members were 63 and female members were 61 which explain that, 50.81 percent male members out of total members and 49.19 percent female members out of total members.

Table 4.4 Male-female ratio of sample farmer's family

Categories	Male		Female		Male/female	Total
	No of male	%	No of female	%		
Boro rice Farmers	66	50.77	64	49.23	1.03	130
Jute Farmers	63	50.81	61	49.19	1.03	124
Total	129	50.79	125	49.21	1.03	254

(Source: Field survey, 2020)

4.1.6 Occupational structure

Farmers were engaged were various types of occupation like crop cultivation, private service, public job, small business, poultry and livestock rearing and fish culture in the study area. Farmers were classified as agriculture, business, service, wage labor, van/rickshaw pulling. All farmers were involved at least one of these five categories. The agriculture category consists of crop cultivation, fish cultivation, fishing, poultry and livestock rearing. The occupation of respondents agriculture=1, business = 2, service = 3, wage labor = 4, Rickshaw/van pulling = 5.Table 4.7 shows that 93.33 percent farmers were directly involved in agriculture as main income source among all respondents of boro rice farmers and 6.67 percent involved in business. On the other side 88.33 percent farmers of jute were involved in agriculture sector as main income source and 6.67 percent were business sector, 3.33 percent were service, 3.33 percent wage labor,3.33 percent were van or rickshaw pulling sector.

It was found from table 4.7, 88.33 percent respondents of both boro rice and jute was involved in agriculture sector.

Table 4.5 Occupational status of the sample farmers

Occupation	Boro rice		Jute growers		All groups	
	Main	Subsidiary	Main	Subsidiary	Main	Subsidiary
Agriculture	28 (93.33%)	2	25 (83.33%)	5	53 (88.33%)	7
Business	2 (6.67%)	8	2 (6.67%)	5	4 (6.67%)	13
Service	0	1	1 (3.33%)	0	1 (1.67%)	1
Wage labor	0	1	1 (3.33)	3	1 (1.67%)	4
Van /Rickshaw pulling	0	0	1 (3.33)	1	1 (1.67%)	1
Total	30 (100%)	12	30 (100%)	14	60 (100%)	26

(Source: Field survey, 2020)

4.1.7 Farming experience

Experience is an important factor for operating of agriculture activities. An experienced farmer know better the operational activities like how to till land correctly, spray pesticide and optimum doses of fertilizers than an inexperienced farmer. The farmers were divided into five groups of the study area on their years of farming experience.

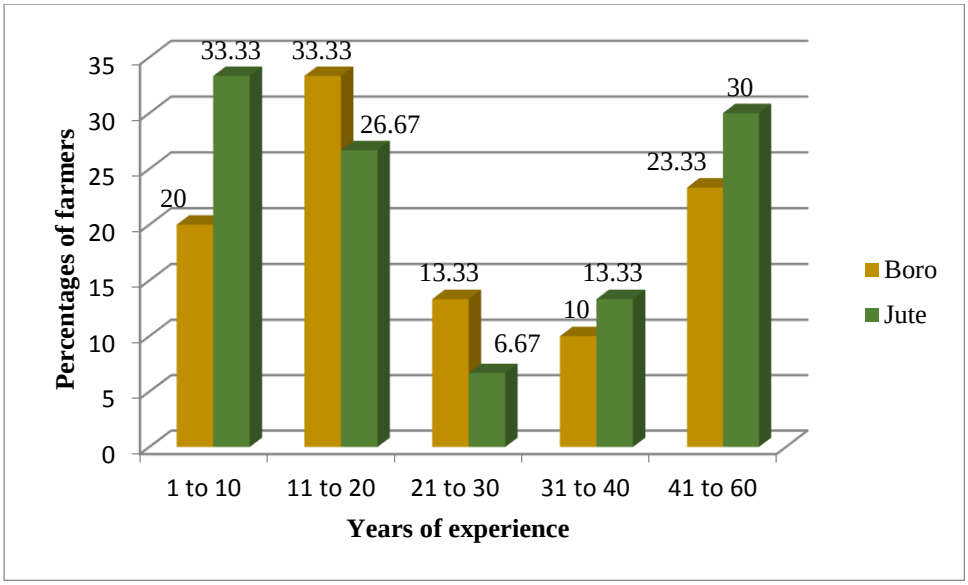


Figure 4.3. Distribution of sample farmers according to farming experience

Figure 4.3 shows that 20 percent boro rice producers have 1-10 years, 33.33 percent have 11-20 years, 13.33 percent have 21-30 years, 10 percent have 31-40 years and 23.33 percent have 41-60 years experiences.

Figure 4.3 also reveals that 33.33 percent of jute producers have 1-10 years, 26.67 percent have 11-20 years, 6.67 percent have 21-30 years, 13.33 percent have 31-40 years and 30 percent have 41-60 years of farming experience.

It is also observed that most of the farmers of boro have 11-20 years of farming experience and most of the farmers of jute have 1-10 years of farming experience.

4.1.8 Farm holdings of the respondents

Land tenure refers to the possession of and right to the use of land. People hold varying kind of rights in the use of land and are said to belong to the different tenure classes (Bishop and Toussaint, 1958) Farm holding is the entire land owned by the farmers and is used by the farmers for any agricultural purpose. Farmers were classified into three categories- small (0.02-2.49 acre), medium (2.50-7.49 acre) and large farmers (>7.50 acre) based on the farm holding size. Farmers were coded as small farmer = 1, Medium farmer = 2, Large farmer = 3.

Table 4.6 shows that 96.67 percent farmers of boro rice were small farmers and 3.33 percent were medium farmers. Again from table 4.6 it is found that 96.67 percent farmers were small farmers and 3.33 farmers were medium farmers.

Both boro rice and jute producers 96.67 percent farmers were small farmers in the study area.

Table: 4.6 Classification of the respondents according to farm holding size

Land holding	Farm size	Boro rice growers		Jute growers	
		Frequency	%	Frequency	%
Small farmers	0.02-2.49	29	96.67	29	96.67
Medium farmers	2.50-7.49	1	3.33	1	3.33
Large farmers	7.50-above	0	10	0	0
Total		30	100	30	100

(Source: Field survey, 2020)

The socio-demographic profile indicates that most of the boro rice producers were old aged and also jute farmers their age rages were 51-60 and 41-50.All farmers were male of the study area female of this area were not involved in farming. After study it was found that nearly most of the boro rice producers were married, larger numbers of jute producers were married. The illiterate rate of farmers both boro rice and jute were lower, between them jute farmers were more illiterate than boro rice producers. The primary (1-5) education level of both jute and boro rice farmers were higher percent than others, it was unable to found any producer in level of education was more than 12; it is not good news for our agriculture sector. Higher educated producers can search the new opportunities and also can create scope for agricultural products, which can increase our economy.

The larger number farmers of the study area had 6-8 members and male members were larger than female number. Higher number of farmers involved in agriculture as main earning source to maintain their family.

Higher level of producers had more than 10 years farming experience both jute and boro rice producers. Both boro rice and jute producers were small farmers in this area.

CHAPTER 5

PROFITABOLITY OF BORO RICE AND JUTE PRODUCTION

The main purpose of this chapter is to assess the costs, returns and profitability of boro rice production and jute production. Profitability is a major criterion to make decision for producing any crop at farm level. It can be measured based on net return, gross margin and ratio of return to total cost. The costs of all items were calculated to identify the total cost of production. The returns from the crops have been estimated based on the value of main products and by-products. In this chapter, in terms of boro rice and jute production per hectare yield, gross return, gross margin, net return and undiscounted benefit-cost ratio are discussed. Therefore, a financial return of farm production was calculated from the standpoint of farmers. All the returns were accounted for the study period. A brief account showing how the individual costs and returns were estimated in the present study is presented below. For analytical advantages, the cost items were classified into two groups;

(I) Variable cost; and

(II) Fixed cost.

Variable cost included the cost of all variable factors like seed, human labor, tillage, fertilizer and manure, irrigation water and insecticides and pesticides.

On the other hand, fixed cost was calculated for land use cost and interest on operating capital.

5.1 Estimation of variable costs

Variable costs includes are different types of cost which are vary according to level of production. In case of crop production those are seeds, fertilizers, human labor, manure, irrigation, power tiller insecticides etc. These inputs are essential in production. So, for calculating production costs, the variable costs have to be estimated. The variable costs of boro rice and jute production are discussed below:

5.2 Cost of human labor

The most important input for boro rice and jute production is human labor. It shared a large portion of total cost of jute and boro rice production. Human labor is required for various activities and management such as land preparation, weeding, fertilizing,

using insecticides and herbicides, harvesting etc. There were two sources of human labor in the study area,

1. Family labor and

2. Hired labor, both are included in human labor.

Table 5.1 shows that per hectare required labors man per day is 241.29, among them 48.94 were family labors and 182.14 are hired labor. The average estimated cost of labor man per day was Tk 441.67 per hectare and total cost of human labor of boro rice was Tk 95647.50. Land preparation, transplanting, weeding, fertilizer and insecticide, harvesting and threshing costs were estimated as 9.97%, 22.39%, 20.94%,6.42%,27.18% and 13.10% respectively.

Table 5.1 Per hectare operation wise average human labor cost for boro rice production

Operation	Labor (man-days)		Total (man-day)	Unit Cost	Total (Tk.)	% of total labor cost
	Family Labor	Hired Labor				
Land preparation	6.68	17.16	23.85	400	9540	9.97
Transplanting	8.35	46.18	53.53	400	21412	22.39
Weeding	8.81	35.7	44.51	450	20029.5	20.94
Fertilizer and insecticide	11.7	3.65	15.34	400	6136	6.42
Harvesting	8.2	43.59	52	500	26000	27.18
Threshing	7	18.08	25.06	500	12530	13.10
Total	50.74	164.36	214.29	2650	95647.50	100

(Source: Field survey, 2020)

Table 5.2 reveals that total labors required for per hectare jute production was 150.29 man per day, 24.1were labors were family labors and 126.19 were hired labors man

per day. The estimated average unit cost of labors was Tk 450 and total cost of human labor for jute production was Tk 67563. The table also shows the rate of costs of land preparation and seeds sowing, weeding and fertilizing, harvesting and carrying, retting, washing and drying were such as 9.93%, 34.95%, 33.58%, and 21.53%.

Table 5.2 Per hectare operation wise average human labor cost for jute production

Operation	Labor (man-days)		Total labor (man-days)	Unit Cost (Tk.)	Total Cost (Tk.)	% of total labor cost
	Family Labor	Hired Labor				
Land preparation and seeds sowing	8.78	8	16.78	400	6712	9.93
Weeding and fertilizing	7.02	52.02	59.04	400	23616	34.95
Harvesting and carrying	2.83	42.55	45.38	500	22690	33.58
Retting, washing and drying	5.47	23.62	29.09	500	14545	21.53
Total	24.1	126.19	150.29	1800	67563	100

(Source: Field survey, 2020)

5.3 Cost of seed/seedlings

The cost of seed is the single most important cost item for rice and jute production. For any agricultural crop production seed is the basic input. Yield of any agricultural production is highly dependent on the quality of seed. High quality of seed can yield high production and bad quality can produce low rate of production. In the study area, it was found that farmers used both home supplied and purchased seeds.

Table 5.3 shows that boro rice producers used 45.12 kg seed per hectare and unit cost was Tk 50 during data collection. Total seed cost was Tk 2255.81 which is 2.70 percent of total cost of input material for one hectare.

Again from table 5.4, jute producers used 7.12 kg seeds for per hectare production and unit cost was Tk 300.Total seed cost was Tk 2136 and it was 4.88% cost of total material input cost.

Table 5.3 Per hectare cost of material inputs for boro rice production

Various Inputs	Units	Quantity	Unit price (Tk.)	Total Cost (Tk.)	% of total Cost
Seed	Kg	45.12	50	2255.81	2.70
Fertilizer	Kg				
Urea	Kg	230.14	16	3682.21	
TSP	Kg	151.60	22	3335.26	
MOP	Kg	101.70	15	1525.52	
Total fertilizer	Tk.			10798.8	13
Manure	Kg	221.02	12	2652.24	3.19
Power tiller	Tk.			21813.78	26.15
Animal labor	Tk.			60.76	0.073
Thresher	Tk.			151.91	0.182
Irrigation	Tk.			39864.07	47.80
Pesticide	Tk.			5802.83	6.95
Total				83400.20	100

(Source: Field survey, 2020)

5.4 Cost of fertilizer

Farmers of boro rice and jute used Urea, TSP and MOP. Those were required for jute and boro cultivation. From table 5.3 the estimated cost of fertilizers for boro rice production was Tk 2255.81 and it was 13% of total input material cost.

Again table 5.4 reveals that fertilizers estimated cost was Tk 6799.57 and 15.53% of total input material cost.

5.5 Cost of manure:

Most of the producers of boro rice had their own cow and for this reason they did not have to buy manures for using in the field. So the farmers can use their own supply. Table 5.3 and table 5.4 show that per hectare manure cost of boro rice and jute producers were Tk 2652.24 and Tk 9356.92 which were 3.19 and 21.35 percent of total input material cost.

Table 5.4 Per hectare cost of material inputs for jute production

Various inputs	Units	Quantity	Unit price (Tk.)	Total Cost (Tk.)	% of total Cost
Seed	Kg	7.12	300	2136	4.88
Fertilizer	Kg				
Urea	Kg	116.132	16	1858.11	
TSP	Kg	167.86	22	3692.80	
MOP	Kg	83.24	15	1248.66	
Total fertilizer cost	Tk.			6799.57	15.53
Manure	Kg	779.74	12	9356.92	21.35
Power tiller	Tk.			14638.48	33.45
Transportation	Tk.			7338.76	16.77
Pesticide	Tk.			3488.84	7.97
Total Cost				99521.84	100

(Source: Field survey, 2020)

5.6 Cost of power tiller

Farmers of boro rice and jute production used power tiller to land preparation in the study area. Table .5.3 and 5.4 show that the cost of power tiller were Tk 21813.78 and Tk 14638.48, percentages were 26.15 percent and 33.45 percent of total input material cost.

5.7 Cost of animal labor and thresher

Animal labor used for land preparation of boro rice production. But most of the boro rice farmers used power tiller for land preparation in the study area. Very small farmers used animal labor. The cost of pair of bullocks was consider as animal labor. According to table 5.3 animal labor cost was Tk 60.76 per hectare and .073 percent of total cost. Thresher was needed for threshing boro paddy after harvesting. Table 4.12 shows that total cost of thresher is Tk. 151.91 per hectare which is 0.182 percent of total material input cost.

5.8 Cost of irrigation and transportation

Proper irrigation is essential for any kind of agricultural production. Boro rice needed a large amount of water from land preparation to harvest. Other side jute needed a moderate amount to wet the land for land preparation and a light irrigation later on. Local and tossa jute needed a huge amount of water during retting of jute after harvesting in the study area. Jute farmers had free access to water source like closed

water bodies without any cost. Besides, jute was generally cultivated in rainy season, so the farmers did not need to provide extra water for irrigation. Farmers of boro rice had to depend on machine supplied water. Table 5.3 shows that the charge of irrigation water for producing boro rice is Tk 39864.07 and 47.80 percent of total cost. After harvesting of jute, van and rickshaw was used for carrying jute fiber and stick to their home and to local market. From table 5.4 total cost of transportation was Tk 7338.76, 16.77 percent of total input material cost.

5.9 Cost of pesticide

Different types of insects can damage yield of boro rice and jute production. Termites, caterpillars, beetles, horned grasshoppers, rats, brown plant hopper, yellow stem borer, gal midge, leaf folder and rice bug cause serious damage in boro rice and jute production. So, farmers needed to apply insecticides to control pest. Table 5.3 and table 5.4 reveals the total costs of pesticides of boro rice and jute production for per hectare were Tk 5802.83, Tk3488.84 and their percentages were 6.95 and 7.97 percent respectively.

5.10 Estimation of fixed costs

Fixed costs are not dependent on the level of output and do not change with the level of output. The producers have to bear the expensive even if the production is not undertaken. Land cost and interest on operating capital are included in fixed cost.

5.11 Land use cost

Most of the boro rice and jute producers of the study area had their own land. Land use cost was fixed for the farmers, table 5.5 shows that it was Tk 30000 for both boro rice producers and jute producers, 13.88 percent of total boro rice production cost and 20.98 percent of total jute production cost.

5.12 Interest on operating capital (IOC)

The interest on operation cost was calculated by taking into account all the operating cost incurred during the production period of boro rice and jute. Table 5.5 shows that, per hectare interest on operating costs were estimated as Tk 2863.16, 1.32 percent of total cost of boro rice production and Tk 1669.82, 1.17 percent of total production cost of jute.

5.13 Total cost

0898The variable cost and the fixed cost were aggregated to calculate the total cost for both boro rice and jute production. Table 5.5 reveals that total cost of boro rice and jute production were Tk 216103.48 and Tk142991.39 respectively.

Table 5.5 Per hectare total cost of boro rice and jute production

Items	Boro rice (Tk)	% of total cost	Jute (Tk)	% of total cost
A. Variable Cost				
1.Human labor cost	95647.50	44.26	67563	47.25
2. Seed cost	2255.81	1.04	2136	1.49
3. Fertilizer cost	10798.8	5.00	6799.57	4.76
4. Power tiller	21813.78	10.09	14638.48	10.24
5. Animal labor	60.76	0.03	-	-
6. Pesticide	5802.83	2.68	3488.84	2.44
7. Thresher	151.91	0.07	-	
8.Transportation	4192.62	1.94	7338.76	5.13
9.Manure	2652.24	1.23	9356.92	3.93
10. Irrigation	39864.07	18.45		
Total Variable Cost	183240.32	84.79	111321.57	77.85
1. Fixed Cost				
Land use cost	30000	13.88	30000	20.98
Interest on Operating Capital	2863.16	1.32	1669.82	1.17
Total Fixed Cost	32863.16	15.21	31669.82	22.15
Total Cost (A+B)	216103.48		142991.39	

(Source: Field survey, 2020)

5.14 Gross return

Total earning amount of main product and by product is the amount of gross return.. Gross return per hectare was calculated by multiplying the total amount of products by average farm gate price. By product was included for boro rice and jute production. From table 5.6 gross return of boro rice and jute production were Tk 235698.17 and Tk 161608.83.The returns from main product and by-product specifically were Tk 188485.62, Tk 47212.55 form boro rice and Tk 149195.4 Tk 12413.4 form jute

Table 5.6 Per hectare gross returns from boro rice and jute

Name of the crops	Value of Main product			Value of the Byproduct (Tk.)	Gross (Tk./ha)
	Quantity (kg/ha)	Price (Tk./kg)	Value (Tk.)		
Boro rice	8567.528	22	188485.62	47212.55	235698.17
Jute	2486.59	60	149195.4	12413.4	161608.83

(Source: Field survey, 2020)

5.15 Profitability of boro rice and jute production

Table 5.7 shows the profitability of boro rice and jute production. Here, the gross return of boro rice and jute per hectare were Tk 235698.17 and Tk 161608.83 respectively. The variable cost of boro rice was Tk 183240.32 and jute was Tk 111321.57. Total fixed cost of boro rice was Tk 32863.16 and jute was Tk 31669.82. Here the estimated gross margin, net return and BCR of boro rice were Tk52457.85, Tk 19594.69 and Tk 1.09 respectively, again estimated gross margin, net return and BCR of jute were Tk 50287.26, Tk 18617.44 and Tk 1.13.

Table 5.7 Profitability of per hectare boro rice and jute production

Items	Boro rice (Tk)	Jute (Tk)
A. Gross Return	235698.17	161608.83
B. Total Variable Cost	183240.32	111321.57
C. Total Fixed Cost	32863.16	31669.82
D. Total Cost	216103.48	142991.39
E. Gross Margin (A-B)	52457.85	50287.26
F. Net Return (A-D)	19594.69	18617.44
G. BCR (A/D)	1.09	1.13

(Source: Field survey, 2020)

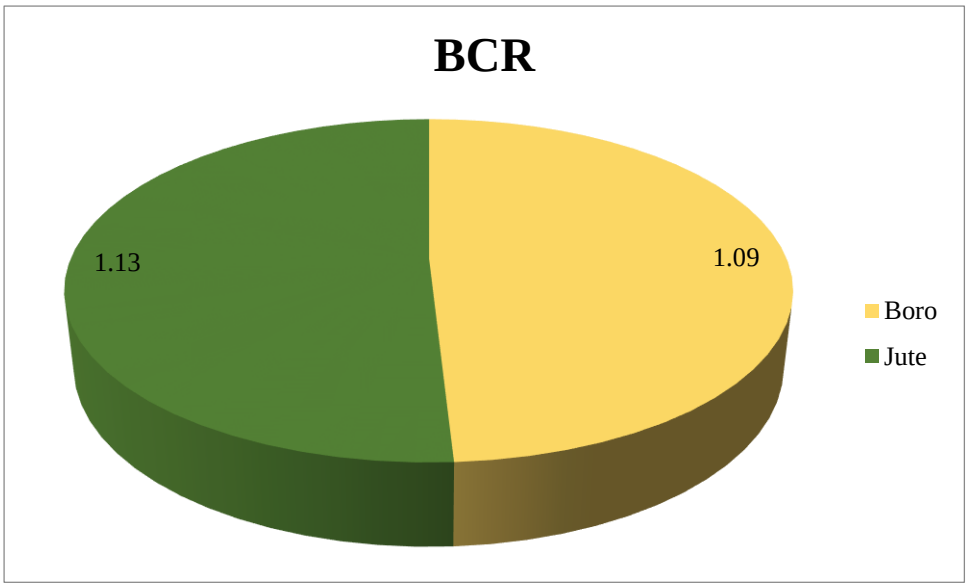


Figure 5.1 Benefit- Cost Ratio of boro rice and jute

The estimated BCR (benefit cost ration) of boro rice explain that if the producer invest Tk 1 on boro rice production, the producer get Tk1.09 in return.

Again, in the case of jute, if farmers invest Tk 1 on jute production, farmers earn Tk 1.13 in return.

Both boro rice and jute product were profitable in the study area. Jute production was more profitable for the producers in the study area.

CHAPTER 6

FACTORS AFFECTING OF BORO RICE AND JUTE PRODUCTION

The effect of different inputs on the profitability of boro rice and jute production was determined by the model of Cobb-Douglas production function because of its best fit. The significant effects of using various inputs on returns from boro rice and jute cultivation can be estimated by analyzing the production function of those crops. This model enables to analyze the production function easily. Seven independent variables such as human labor cost, power tiller cost, seed cost, fertilizer cost, manure cost, irrigation cost and pesticide cost were taken into consideration as they were likely to have an impact on gross return of boro rice production. All the variables except irrigation were also considered for jute production. Other variables such as rainfall, soil condition and topography were not considered as there were problems of specification of those variables.

6.1 Estimation of boro rice and jute production function

The estimated values of co-efficient and related statistics were shown in Table 6.1. Human labor cost, power tiller cost, seed cost, fertilizer cost, pesticide cost, manure cost and irrigation cost these seven variables were taken under consideration. The first six variables were also considered for jute but the last variable irrigation cost was not considered because jute was mainly sown in rainy season and did not need that much irrigation. The impact of each variable on gross return for producing boro rice and jute are interpreted below.

6.1.1 Human labor cost (X1)

Table 6.1 shows that the regression coefficient of human labor cost for boro rice is 0.2872 which positive and significant at 1% level. It indicates that considering all other factors constant, 1% increase in the cost of human labor would increase gross return by .2872%. Table 6.1 also shows that the regression coefficient of human labor for jute is 0.3441; it is positive and significant at 1% level which indicates that 1% increase in the cost of human labor gross return would increase by 0.3441% under all other factors constant.

Table 6.1 Estimated values of coefficients of Cobb-Douglas production function.

Explanatory variable	Co-efficient (Boro Rice)	t-Value (Boro Rice)	Co-efficient (Jute)	t-value (Jute)
Intercept	2.4085	6.6526	4.1074	7.6138
Human labor Cost (X1)	0.2872***	5.7284	0.3441***	4.8674
Power tiller Cost (X2)	0.1490**	2.2674	-0.0755**	-2.5877
Seed Cost (X3)	0.0423	0.6215	-0.0085	-0.3082
Fertilizer Cost (X4)	0.5253***	5.7726	0.3791**	3.4125
Pesticide Cost (X5)	-0.0056	-0.1325	0.1742	1.9955
Manure Cost (X6)	0.0110	0.9634	0.0482**	2.4827
Irrigation Cost (X7)	0.0068	0.2396	_	_
R^2	0.8710		0.8311	
Adjusted R^2	0.8618		0.8131	
F-value	105.4178***		51.7977***	

(Source: Field survey, 2020)

Note: *** and ** indicate significant at 1% level and 5% level

6.1.2 Power tiller cost (X2)

Table 6.1 shows that regression coefficient of power tiller cost for boro rice is 0.1490 positive and significant at 5% level. It explains that considering all other factors constant, it power tiller cost increase 1%, gross return increase by 0.149%. In case of jute the value of regression coefficient of power tiller cost is -0.0755 that negative and significant at 5% level. It indicates that considering all other factors constant, the cost of power tiller if increase by 1%, gross return would decrease by 0.0755%.

6.1.3 Seed cost (X3)

Table 6.1 shows the regression coefficient of seed cost for boro rice is 0.0423 that is positive and insignificant and the regression coefficient of seed cost for jute is -0.0085 that is negative and insignificant.

This indicates that seed cost had no significant effect on the gross return of boro rice and jute production in the study area.

6.1.4 Fertilizer cost (X4)

Table 6.1 reveals the regression coefficient of fertilizer cost for boro rice is 0.5253, which is positive and significant at 1% level. It explains that considering all other factors constant if fertilizer cost increase by 1%, gross return would increase by 0.5253%.

From table 6.1 the regression coefficient of fertilizer cost for jute is 0.3791, positive and significant at 5% level. This indicates considering all others factor constant by increasing 1% cost of fertilizer gross return increase by 0.3791%.

6.1.5 Pesticide cost (X5)

From table 6.1, the regression coefficient of pesticide cost for boro rice is -0.0056, negative and insignificant. So, it has no significant effect on gross return of boro rice production.

Again from table 6.1, the regression coefficient of pesticide cost was 0.1742, which was positive and insignificant. It explains that pesticide cost had no significant effect on gross return of jute production.

6.1.6 Manure cost (X6)

Table 6.1 shows that regression coefficient of manure cost for boro rice is 0.0110, positive and insignificant, so, manure cost had no significant effect on gross return of boro rice production. In the case of jute production from table 6.1 the regression coefficient of manure cost is 0.0482, positive and significant at 5% level. It indicates that considering all other factors constant. This indicates that considering all other factors constant by increasing 1% cost of manure, gross return would increase by 0.0482%.

6.1.7 Irrigation cost (X7)

Table 6.1, explains the regression coefficient value of irrigation cost is 0.0068, positive and insignificant. It is explained that, there is no significant effect of irrigation cost for gross return of boro rice production.

6.1.8 Coefficient of Multiple Determination (R^2, adjusted R^2)

The coefficient of determination (R^2) is the summary of how well the sample regression line fits the data. Table 6.1 shows that the R^2 value for boro rice and jute is 0.8710and 0.8311which means that 87.10% and 83.11% variation in the gross return of boro rice and jute was explained by the independent variables included in the model respectively. The values of adjusted R^2 were 0.8618 for boro rice and 0.8131 for jute. This means that after taking into account the degrees of freedom (df), independent variables in the model still explained 86.18% and 81.31% of the variation in the gross return of boro rice and jute respectively.

6.1.9 Goodness of Fit (F-Value)

The F value for boro rice was found 105.4178 which were highly significant at 1% level indicating the good fit of the model, from table 6.1. The F value for jute was found 51.7977 which were highly significant at 1% level indicating the good fit of the model from table 6.1.

6.1.10 Elasticity of production (Ep)

The percentage change in output in relation to the percentage change in input is elasticity of production. The coefficients of the various inputs of boro rice and jute production functions show the elasticity of the respective production function.

Elasticity of production refers how much of the impact of inputs on the gross return of boro rice and jute can be explained. The elasticity of input is shown in table 6.2. By observing table 6.2 it clears that all inputs were individually inelastic both for boro rice and jute production. It indicates that the gross return per hectare of boro rice and jute does not change as much with the change of the independent variables.

Table 6.2 Elasticity of production and return to scale

Inputs	Boro Rice	Remarks	Jute	Remarks
Human Labor Cost	0.2786	Inelastic	.0344	Inelastic
Power Tiller Cost	0.1500	Inelastic	-0.0755	Inelastic
Seed Cost	0.0689	Inelastic	-0.0084	Inelastic
Fertilizer Cost	0.4979	Inelastic	0.3791	Inelastic
Pesticide Cost	-0.0091	Inelastic	0.1743	Inelastic
Manure Cost	0.01240	Inelastic	0.0482	Inelastic
Irrigation Cost	0.0127	Inelastic	-	
Return To Scale ($\sum$ Bi)	1.0115	Increasing Return To Scale	0.8616	Decreasing Return To Scale

(Source: Field survey, 2020)

6.1.11 Return to scale (RTS)

The total elasticity of production when equal to 1, it refers to constant returns to scale. If total elasticity is greater than 1, it indicates increasing return to scale and when it is less than 1, it refers to decreasing return to scale. Table 6.2 shows that the return to scale for boro rice and jute are 1.0115 which is greater than 1 and 0.8616 respectively which is less than 1. It was obvious that boro rice had increasing return to scale and jute had decreasing return to scale. This implied that the production function exhibits increasing returns to scale. That is, the farmers were operating their boro rice farming in the first stage of production function. In this case, if all the variables specified in

the production function were increased by one percent, gross return would increase by 1.0115.

For jute production, it implied that jute farmers were operating in the rational zone of production (stage 2). It explains that an increase in all the variables would lead to a less than proportional increase in gross return. From Table 6.2 it was obvious that if all the variables were increased by 1%, the gross return of jute would increase by 0.8616%.

CHAPTER 7

PROBLEMS FACED BY THE BORO RICE AND JUTE PRODUCERS

Farmers face social, cultural, financial and technical problems during producing boro rice and jute. The socioeconomic problems during producing boro rice and jute were discussed. The problems faced by the farmers were identified according to opinions given by them. The major problems and constraints related to jute and boro rice cultivation are discussed below:

7.1 High input cost

Most of the farmers in Bangladesh are marginal, small and medium. The price of inputs in Table 7.1 shows that 63.33percent boro rice producers and 96.67percent jute producers in the study area reported this problem.

7.2 Shortage of labor and high wage rate

Most of the human labor is being used during seed/seedling plantation and harvesting period of boro rice and jute production. Table 7.1 shows that 66.67 percent boro rice farmers reported this problem. Again table 7.1 reveals that 86.67 percent jute farmers reported shortage of labor and high wage rate was their problem.

7.3 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 and jute remained low because of ample supply. So they could not get reasonable return for their products. Table 7.1 reveals that 13.33 percent boro rice producers and 50 percent jute producers reported this problem.

Table 7.1 Rank order of the problems faced by boro rice and jute growers

Problems	Boro rice		Jute	
	%	Rank	%	Rank
1. High input cost	63.33	7	96.67	1
2. Shortage of labor and high wage rate	66.67	6	86.67	3
3. Low price of output	13.33	11	50	7
4. Lack of storage facilities	100	1	83.33	4
5. Lack of capital	96.67	2	63.33	6
6. High irrigation cost	26.67	10	23.33	11
7. High transportation cost	43.33	8	36.67	10
8. Poor agronomic practice	86.67	5	43.33	8
9. Attack of pests	93.33	3	93.33	2
10. Natural disaster	90	4	80	5
11. Lack of extension service	30	9	40	9

(Sources: Field survey 2020)

7.4 Lack of storage facilities

Farmers of the study area had no storage facility that created many problems. In the case of boro rice, seed storage problem was so serve that the farmers could not store rice seeds for sowing purpose. The existing storage method was inefficient for maintaining seed quality. That why, they had to purchase seed every year. Table 7.1 shows that, 100 percent boro rice farmers and 83.33 jute farmers claimed about storing facilities and they could not store their products to ensure fair price in future.

7.5 Lack of capital

The farmers of the study area had capital constraints. For cultivation of boro rice and jute a huge amount of cash money was needed to purchase various inputs like, human labour, seed, fertilizers, pesticides, etc. From table 7.1, 96.67 percent producers reported lack of capital was their problems and 63.33 percent jute producers reported they did not have sufficient amount of money for purchasing the required quantity of inputs for the relevant enterprises

7.6 High irrigation cost

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. Boro farmers 43.33 percent reported this higher irrigation problem from table 7.1. Again jute farmers need irrigation at moderate rate at seedling stage, 23.33 percent farmers claim against this problem.

7.7 High transportation cost

Farmers need transportation to carry crop field to home after harvest. They also used to carry main product and byproduct home to market. So it was important for them. According to survey 43.33 percent boro rice reported that transportation cost was high and 36.67 percent jute farmers reported same also, that shows table 7.1.

7.8 Poor agronomic practice

Table 7.1 shows that, 86.67 percent boro rice producers and 43.33 percent jute producers reported about poor agronomic practice.

7.9 Attack of pests

The growers of boro rice and jute were also affected by the problem of attack of pests and diseases. Pests and diseases attack reduce crop yield and increase cost of production. Table 7.1 shows that for both boro rice and jute production 93.33 percent producers reported this problem.

7.10 Natural disaster

It was found that boro rice and jute 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 boro rice and jute. Table 7.1 shows that 90 percent of boro rice farmers and 80 percent jute farmers reported that in the study area.

7.11 Lack of extension service

According to the sample farmers Table 7.1 shows that 86.67 percent boro rice producers and 43.33 percent jute producers reported that they did not get proper extension service.

CHAPTER 8

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of findings, conclusions and recommendations of the study. This finding on various issues like costs, returns and profitability along with the socio-economic condition of farmers of both boro rice and jute production are presented briefly in this chapter.

8.1 Summary

The economy of Bangladesh is developing and agriculture based. The nation has 163.7 million populations with a land of 56977 sq. miles or 147570 sq. km. (BER, 2019). Almost 75.15 percent of total populations live in rural areas (BBS, 2017). Most of the people of Bangladesh earn their living from agriculture. Rice and jute are primary crop, maize and vegetables are also assuming greater important. Bangladesh is agro-based economic small developing country. The agricultural sectors account for 14.23 percent of the overall GDP in Bangladesh. About 40.6 of the labor force engaged in agriculture, remain the largest employment sector in Bangladesh (BBS, 2017). Boro is one of the most important cereal and commercial crops of Bangladesh; it is a crop of tropical and sub-tropical regions and requires a warm humid climate. Number of varieties of Boro are grown, which can be used as vegetable, condiments and pickles. Boro occupies an important place in Bangladeshi diet and it is an indispensable item in the kitchen, as it is consumed daily as a condiment in one or other form. Boro is rich in vitamin A and C and has many medicinal properties. According to the Department of Agriculture Extension (DAE), around 85 percent of boro rice has been harvested from in Madaripur Sadar, Kalkini, Rajor and Shibchar upazilas.

Bangladesh is currently the second largest producer of jute fiber. The Jat Area, popular for highest quality of jute fiber is located in Bangladesh. Therefore, Bangladesh is able to supply the highest quality of jute fiber in the world. However, Bangladesh falls behind its other competitors in applying recent technological advancements. In terms of world export of jute fiber, Bangladesh's share is more than 70%, which makes Bangladesh the largest exporter of jute fiber in the world. Jute

Industry in Bangladesh is an industry that is historically and culturally important that once was the biggest industry in the region but has declined since then. Jute was historically a major export item of Bangladesh but has declined since the 1970s. Exports have fallen as other countries grew jute and alternate products like plastic and hemp found more widespread use

Shibchar upazilla of Madaripur district was selected as the study area as boro rice and jute is the major cultivated crop of the area. A sample size of 60 is generally regarded as the minimum requirement for larger population that will yield a sufficient level of certainty for decision-making (Poate and Daplyn, 1993). Besides extensive study on all the secondary sources, 60 farmers, 30 boro rice growers and 30 jute producers, were randomly selected for conducting field level survey to collect primary data. A structured interview schedule was developed based on the background information, expert's appraisal and pre-test questionnaire. Primary data obtained by administering interviews from producers. The data were collected during March-April 2020. The collected data were checked and verified for the sake of consistency and completeness. Editing and coding were done before putting the data in computer. Data entry was made in computer and analysis was done using the concerned software Microsoft Excel and SPSS. The Cobb-Douglas production function was used to analyze the effects of the independent variable on the dependent variable. The socio-economic profile of the rice farmer's reveals that 7.5 percent of overall boro rice farmers are 21-30 years old, 17.5 percent are 31-40 years old, 27.5 percent are 41-50 years old, 37.5 percent are 51-60 years old and 10 percent are above 60 years old. Again 6.25 percent of total jute farmers belongs to 21-30 years old, 15 percent 31-40 years old, 30 percent 41-50 years old 32.5 percent belong to 51-60 years old and finally 16.25 percent belong to 61 and above years old. All producers were male. After analysis 96.67 percent farmers of boro rice were married and 3.33 percent were unmarried of the respondents and 90 percent farmers of jute were married, 6.67 percent were unmarried and 3.33 percent were widow.

In case of boro rice farmers, it can be seen that 6.67 percent famers were illiterate, 43.33 percent 1-5 level, 50 percent 6-10 level but no farmer were found in 11-12 and more than 12 level of education. Again in jute farmers 20 percent were illiterate,40 percent were 1-5 level,36.7 percent were 6-10 , 3.33 percent were 11-12 level of

education but no one was in more than 12 level. But in total 8 percent farmers were illiterate and jute farmers were more illiterate than boro rice farmers. It was obvious from that majority of farmers of both boro rice and jute had 1-5 level of education which was 75%. All farmers' family consists of below 8 members and in the case of boro farmers 43.33 percent had 1-4 members, 56.67 percent farmer's family had 6-8 members. Again from, 60 percent jute farmer's family consisted of 1-5 members and 40 percent consisted of 6-8 members. Total family members of boro rice farmer were 130 and among them 66 members were male and 64 members were female in percentage 50.77percent male members and 49.23 percent female members. Again total number of family members of jute farmers was 124 and male members were 63 and female members were 61 which explain that 50.81 percent male member out of total members and 49.19 percent female members out of total members. It was found that 93.33 percent farmers were directly involved in agriculture as main income source among all respondents of boro rice farmers and 6.67 percent involved in business. On the other side 88.33 percent farmers of jute were involved in agriculture sector as main income source and 6.67 percent were business sector, 3.33 percent were service, 3.33 percent wage labor,3.33 percent were van or rickshaw pulling sector. In total 88.33 percent respondents of both boro rice and jute were involved in agriculture sector. It was observed that most of the farmers of boro have 11-20 years of farming experience and most of the farmers of jute have 1-10 years of farming experience. Both boro rice and jute producers 96.67 percent farmers were small farmers in the study area. Profitability is a major criterion to make decision for producing any crop at farm level. It can be measured based on net return, gross margin and ratio of return to total cost. The average estimated cost of labor man per day was Tk 441.67 per hectare and total cost of human labor of boro rice was Tk 95647.50. The estimated average unit cost of labors was Tk 450 and total cost of human labor for jute production was Tk 67563. Total seed cost of boro rice was Tk 2255.81 which is 2.70 percent of total cost of input material for one hectare. Total seed cost was of jute producers was Tk 2136 and it was 4.88% cost of total material input cost. The estimated cost of fertilizers for boro rice production was Tk 2255.81 which was 13% of total input material cost and jute was Tk 6799.57 which was 15.53% of total input material cost. The estimated per hectare manure cost of boro rice and jute producers were Tk 2652.24 and Tk 9356.92 which were 3.19 and 21.35

percent of total input material cost. The cost of power tiller were Tk 21813.78 and Tk 14638.48, percentages were 26.15 percent and 33.45 percent of total input material cost. Animal labor cost was Tk 60.76 per hectare and .073 percent of total cost. The total cost of thresher of boro rice producers was Tk. 151.91 per hectare which is 0.182 percent of total material input cost. The charge of irrigation water for producing boro rice is Tk 39864.07 and 47.80 percent of total cost. The total costs of pesticides of boro rice and jute production for per hectare were Tk 5802.83, Tk3488.84 and their percentages were 6.95 and 7.97 percent respectively. It was Tk 30000 for both boro rice producers and jute producers, 13.88 percent of total boro rice production cost and 20.98 percent of total jute production cost. Per hectare interest on operating costs were estimated as Tk 2863.16, 1.32 percent of total cost of boro rice production and Tk 1669.82, 1.17 percent of total production cost of jute. The variable cost of boro rice was Tk 183240.32 and jute was Tk 111321.57. Total fixed cost of boro rice was Tk 32863.16 and jute was Tk 31669.82. The gross return of boro rice and jute per hectare were Tk 235698.17 and Tk 161608.83 respectively. The estimated gross margin, net return and BCR of boro rice were Tk 52457.85, Tk 19594.69 and Tk 1.09 respectively, again estimated gross margin, net return and BCR of jute were Tk 50287.26, Tk 18617.44 and Tk 1.13.

The effect of different inputs on the profitability of boro rice and jute production was determined by the model of Cobb-Douglas production function. This model enables to analyze the production function easily. Seven independent variables such as human labor cost, power tiller cost, seed cost, fertilizer cost, manure cost, irrigation cost and pesticide cost were taken into consideration as they were likely to have an impact on gross return of boro rice production. All the variables except irrigation were also considered for jute production. The value of R^2 for boro rice and jute was 0.8710 and 0.8311 which means that 87.1% and 83.11% variation in the gross return of boro rice and jute was explained by the independent variables included in the model respectively. The value of adjusted R^2 were 0.8618 and 0.8131 for boro rice and jute respectively which means that after taking into account the degrees of freedom (df), independent variables in the model still explained 86.18% and 81.31% of the variation in the gross return of boro rice and jute respectively. The F values for boro rice and were estimated 105.4178 and 51.7977 both were highly significant at 1% level

indicating the good fit of the model. The elasticity of boro rice and jute were estimated individually and all were inelastic. The return to scale of boro rice and jute were estimated as 1.0115, was greater than 1 and 0.8616, less than 1. They implied that boro rice had increasing return to scale and jute had decreasing return to scale. That explain that boro rice producers were operating in the increasing zone of production (stage I) and jute farmers were operating in the rational zone of production (stage II). In this case for boro rice and jute, if all the variables specified in the production function were increased by one percent, gross return would increase by 1.0115 and 0.8616. The boro rice and jute producers faced some problems during production. Those problems were identified and ranked according to farmers report. High input cost was the main problem of jute producers according to their opinion and lack of storage facility was main problem of boro rice producers. Lack of capital, attack of pest, natural disaster etc. was major problems according to their report.

8.2 Conclusion

The socio-demographic profile indicates that most of the boro rice producers were old aged and also jute farmers their age rages were 51-60 and 41-50.All farmers were male of the study area female of this area were not involved in farming. After study it was found that nearly most of the boro rice producers were married, larger numbers of jute producers were married. The illiterate rate of farmers both boro rice and jute were lower, between them jute farmers were more illiterate than boro rice producers. The primary (1-5) education level of both jute and boro rice farmers were higher percent than others, it was unable to found any producer in level of education was more than 12, it is not good news for our agriculture sector. Higher educated producers can search the new opportunities and also can create scope for agricultural products, which can increase our economy. The study reveals that jute producers made more profit than boro rice producers. The estimated gross margin, net return and BCR of boro rice were per hectre Tk 52457.85, Tk 19594.69 and Tk 1.09 respectively, again estimated gross margin, net return and BCR of jute were per hectreTk 50287.26 per hectre, Tk 18617.44 and Tk 1.13. Lack of storage facilities, lack of capital, poor agronomic practice, attack of pests, natural disaster were top five problems of boro rice producers high input cost, shortage of labor and high wage rate, attack of pests,

natural disaster and lack of storage facilities were top five problems of jute production according to producers.

8.3 Recommendations

On the basis of experience, observation and conclusions drawn from the findings of the study some recommendations have been prescribed to the concerned authorities, planners and executioners. These recommendations are-

1. All boro farmers of the study area complained that they had no storage facilities. As a result they could not store their products as seed for next year and they had to buy seed every year for cultivation. Government should focus on the problem and provide them proper storage facility.

2. Shortage of human labor was a major problem for the boro rice and jute farmers of the study areas. Availability of new technology and machinery can reduce this problem. Government and other authorities should take initiative for lessen these problem.

3. Government should take necessary measures to lower the price of inputs like seeds; fertilizers, manure cost and reduce the fake crisis during cultivation season. These inputs seeds and fertilizer cost have positive significant impact on boro rice and fertilizers and manure cost have positive significant impact on jute production. It will increase the net benefit of Boro and jute production.

4. Adequate training on recommended fertilizer doses, insecticides, use of good seed, intercultural operations, etc., should be provided to the Boro rice and jute farmers which will enhance production as well as technical efficiency by improving the technical knowledge of the farmers.

5. Lack of operating capital is a problem for the resource poor farmers of the study areas. Favorable 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.

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APPENDICES

APPENDIX- I

English Version of the Interview Schedule of Boro rice

Department of Agribusiness and Marketing
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Interview Schedule on

A PRODUCTIVITY ANALYSIS WITH COMPARISON ON BORO RICE AND JUTE PRODUCTION IN SHIBCHAR UPAZILLA OF MADARIPUR DISTRICT

Name of the crop: …… Sample no:

Study area: Village: ……. Upazilla: ……..

District: …….

Respondent name: ……..

A. Socio Economic information:

1. What is your gender? (Please put (√) on the following information)

a. Male b. Female

2. What is your material status? (Please put (√) on the following information)

a. Married b. Unmarried c. Widow/Widower

3. What is your age? (Please put (√) on the following information)

a.21 – 30 years b. 31-40 years c. 41-50 years d. 51-60 years e. 61 years and above

4. What is your educational status? (Please put (√) on the following information)

a. Illiterate b. 1 to 5 c. 6 to 10 d. 10 to 12 e. More than 12

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

a. 1-10 years b. 11-20 years c. 21-30 years d. 31-40 years e. 41-60 years

6. How many family members do you have?

Male…….. Female……

7. Farmers occupation source:

Please put (√) on the following occupational source:

Occupation	Main	Subsidiary
1.Agriculture		
2.Business		
3.Service		
4.Wage labor		
5.Rickshaw or van pulling		

8. What is your farm size? (Please put (√) on the following in formation)

a .2-249 decimals b. 250-749 decimals c. 750 decimals and above

B. Profitability of Boro rice production:

1. Material inputs: (per hector)

Inputs	Quantity	Unit price (Tk)	Total (Tk)
Seed			
Fertilizers			
Urea			
TSP			
MOP			
Manure			
Pesticide			
Irrigation			
Thresher			
Animal labor			
Power tiller			
Transportation			

2. Human labor requirement (Man/day):

Operation	Labor (man-days)		Unit Cost (Tk.)	Total Cost (Tk.)
	Family Labor	Hired labor		
Land preparation				
Transplanting				
Weeding				
Fertilizer and				

insecticide				
Harvesting				
Threshing				

3. Land use information:

Name of crop	Land area under cultivation (decimals)	Rantal price (Tk)
Boro		

4. Profitability situation of Boro rice:

Source of income	Quantity(mounds)	Price (Tk/mounds)	Total income (Tk)
Main product			
Rice straw			

C. Problems in boro rice production and marketing:

Problems	Please put (√) if you agree
1.Low price of output	
2. Shortage of labor high wage rate	
3 High transportation cost	
4. High input cost	
5. High irrigation cost	
6. Lack of extension service	
7. Lack of storage facilities	
8. Poor agronomic practice	
9.Natural disaster	
10.Attack of pests	
11.Financial constraints	

Date: ……..

Name of interviewer: ……

APPENDIX- II

English Version of the Interview Schedule of Jute

Department of Agribusiness and Marketing
Sher-e-Bangla Agricultural University
Sher-e- Bangla Nagar, Dhaka-1207
Interview Schedule on

A PRODUCTIVITY ANALYSIS WITH COMPARISON ON BORO RICE AND JUTE PRODUCTION IN SHIBCHAR UPAZILLA OF MADARIPUR DISTRICT

Name of the crop: ……. Sample no: …….

Study area: Village: ……. Upazilla: ……..

District: …….

Respondent name: ……..

A**. Socio Economic information:**

1. What is your gender? (Please put (√) on the following information)

a. Male b. Female

2. What is your material status? (Please put (√) on the following information)

a. Married b. Unmarried c. Widow/Widower

3. What is your age? (Please put (√) on the following information)

a.21 – 30 years b. 31-40 years c. 41-50 years d. 51-60 years e. 61 years and above

4. What is your educational status? (Please put (√) on the following information)

a. Illiterate b. 1 to 5 c. 6 to 10 d. 10 to 12 e. More than 12

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

a. 1-10 years b. 11-20 years c. 21-30 years d. 31-40 years e. 41-60 year

6. How many family members do you have?

Male…….. Female……

7. Farmers occupation source:

Please put (√) on the following occupational source:

Occupation	Main	Subsidiary
1.Agriculture		
2.Business		
3.Service		
4.Wage labor		
5.Rickshaw or van pulling		

8. What is your farm size? (Please put (√) on the following in formation)

a .2-249 decimals b. 250-749 decimals c. 750 decimals and above

B. Profitability of Jute production:

1. Material inputs: (per hector)

Inputs	Quantity	Unit price (Tk)	Total (Tk)
Seed			
Fertilizers			
Urea			
TSP			
MOP			
Manure			
Pesticide			
Irrigation			
Transportation			
Power tiller			

2. Human labor requirement (Man/day):

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

3. Land use information:

Name of crop	Land area under cultivation (decimals)	Rantal price (Tk)
Jute		

4. Profitability situation of Jute:

Source of income	Quantity(maunds)	Price (Tk/maunds)	Total income (Tk)
Jute			
Jute sticks			

C. Problems in Jute production and marketing:

Problems	Please put (√) if you agree
1.Low price of output	
2. Shortage of labor high wage rate	
3. High transportation cost	
4. High input cost	
5. High irrigation cost	
6.Lack of extension service	
7. Lack of storage facilities	
8. Poor agronomic practice	

9.Natural disaster	
10.Attack of pests	
11.Financial constraints	

Date: ……..

Name of interviewer: ……

APPENDIX-III

Summary output of socio-economic analysis of boro rice and jute

Table 4.1 Distribution of sample farmers according to age group

Farmers age (Years)	Boro rice growers		Jute growers		All farmers	
	No of Farmer	%	No of Farmer	%	No of Farmer	%
21-30	3	7.5	2	5	5	6.25
31-40	7	17.5	5	12.5	12	15
41-50	11	27.5	13	32.5	24	30
51-60	15	37.5	11	27.5	26	32.5
61and above	4	10	9	22.5	13	16.25
All groups	30	100	30	100	60	100

(Source: Field survey, 2020)

Table 4.4 Educational status of the respondents

Educational status	Boro rice growers		Jute growers		All farmers	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Illiterate	2	6.67	6	20	8	13.33
1-5	13	43.33	12	40	25	75
6-10	15	50.00	11	36.7	26	43.33
11-12	0		1	3.3	1	1.67
More than 12	0	0	0	0	0	0
Total	30	100	30	100	60	100

(Source: Field survey, 2020)

Table 4.8 Distribution of sample farmers according to farming experience

Years of experience	Boro rice growers		Jute growers	
	Frequency	Percent	Frequency	Percent
1-10	6	20	10	33.33
11-20	10	33.33	8	26.67
21-30	4	13.33	2	6.67
31-40	3	10	4	13.33
41-60	7	23.33	6	30
Total	30	100	30	100

(Source: Field survey, 2020)