A COMPARATIVE ECONOMIC ANALYSIS ON PROFITABILITY OF BORO RICE AND JUTE PRODUCTION IN RAJOIR UPAZILA OF MADARIPUR DISTRICT

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BY

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CERTIFICATE

This is to certify that the thesis entitled, **"A COMPARATIVE ECONOMIC ANALYSIS ON PROFITABILITY OF BORO RICE AND JUTE PRODUCTION IN RAJOIR UPAZILA OF MADARIPUR DISTRICT" submitted to the** Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE in Agribusiness and Marketing,** embodies the result of a piece of bona fide research work carried out by **Tahmina Islam,** Registration No. 11-04418 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:

Dhaka, Bangladesh

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BELOVED PARENTS

ABSTRACT

The present study was conveyed to compare the profitability of boro rice and jute in Rajoir upazila of Madaripur district. In this study, a total of 80 farmers were used as sample and data were collected by using a structured questionnaire during March-April 2019. In this study, Cobb-Douglas production function was used for analyzing data. From this study, it was estimated that the average per hectare cost for boro rice and jute production was Tk. 95482.41 and Tk. 89909.82 respectively. Additionally, per hectare total gross return of boro rice and jute was found to be Tk. 105420 and Tk. 136701.5 respectively. The net return per hectare from jute (Tk. 46791.68) was found higher than boro rice (9937.62) production. Moreover, gross margin of jute (Tk. 56052.5) was found to be higher than boro rice (Tk. 19289.7). Furthermore, the benefit cost ratio of jute (1.52) was found higher than boro rice (1.10). The result revealed that jute was more profitable than boro rice in the study area. The result also revealed that power tiller, seed and fertilizer showed positive and significant effect on gross return whereas human labor and irrigation had negative but significant effect on gross return of boro rice. Additionally, jute seed and fertilizer showed positive and significant effect whereas human labor and power tiller showed negative but significant effect on gross return of jute production. The present study identified some problems faced by the farmers. The major problems faced by the farmers of boro rice and jute were high input cost, shortage of labor and high wage rate, low price of output, lack of storage facilities and lack of capital. Eventually, giving subsidy on input price, initiatives to attract labor more on agricultural sector, ensuring fare price, building more storehouse and giving agricultural loan at low interest rate were suggested to uplift the profitability and management practices of boro rice and jute production.

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ACRONYMS AND ABBREVIATIONS

BBS : Bangladesh Bureau of Statistics

BCR : Benefit-Cost Ratio

BRRI : Bangladesh Rice Research Institute

BINA : Bangladesh Institute of Nuclear Agriculture

DAM : Department of Agricultural 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

1.1 Background of the study

Bangladesh is a small developing country with mostly an agro-based economy. Agricultural sector plays an important role in the overall economic development and food security of this highly populated country. Historically, agricultural sector is prominent for a long time in Bangladesh (Molla *et al.*, 2015*).* The agricultural sector (crops, animal farming, forests and fishing) contributes 14.23% to the country's total GDP and it remains as the largest employment sector in Bangladesh economy with about 40.6% of the labor force engaged in agriculture (BBS, 2017). Agriculture is a major source of rural jobs in Bangladesh as over 87% rural people derive at least some income from agriculture (BBS, 2017). The contribution of agriculture to the GDP of Bangladesh is presented in table 1.1.

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

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Agriculture	17.6	17.1	17	16.81	16.18	15.49	15.35	14.78	14.05	13.41

(Source: BBS, 2017)

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). Rice and wheat are mainly grown for domestic consumption whereas jute and tea is grown for export purpose. Bangladesh is the fourth biggest rice producer in the world after China, India and Indonesia (DAM, 2017). Rice production is one of the main sources of revenue for the country’s economy whereas jute and jute goods are one of the major export earners of agricultural sector in Bangladesh (Rahman, 2017). The significant contribution of rice and jute in Bangladesh economy makes these crops very important among all agricultural crops.

1.2 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). Bangladesh is the 4th top rice producing countries around the world with 3,265,000 MT of rice production (DAM,

2017). Rice is the staple food of about 167 million people in Bangladesh (BBS, 2017). It gives almost 40.6% of provincial work, around two-third of absolute calorie supply and around one-portion of the complete protein admission of a normal individual in the nation (Rahman, 2017). In Bangladesh, rice sector contributes to one-half of the agricultural GDP and one-sixth of the national income (Elahi, 2017). Almost all of the 15 million farm families of the country grow rice (Ghosh *et al.*, 2017). Rice is grown on about 15.4 million hectares which has remained almost stable over the past three decades (BBS, 2017). Rice is planted on about 75% of the total cropped area and over 80% of the total irrigated area (BBS, 2017). Thus, rice plays a major role in the livelihood of the people of Bangladesh.

1.3 Economic importance of boro rice in Bangladesh

Rice plays an important role in all spheres of life in Bangladesh and when it comes to food security of the rural farmers it is the most significant commodity in terms of livelihood and food. Bangladesh is trying to achieve self- sufficiency in food production from the time of independence (Rahman, 2017). According to government estimates, Bangladesh is self-sufficient in food production at present which is the result of increased rice production (Rab, 2017). The increased rice production has been possible due to the adoption of 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). Agriculture plays 13.41% to GDP in 2017 whereas the crop sub-sector contribution to GDP is about 7.37% alone (DAM, 2017). Bangladesh produces 3,265,000 MT rice (BBS, 2017). The highest share of rice production comes from boro varieties (BBS, 2017). Boro rice is considered as the most important and single largest crop in Bangladesh in respect of volume of production (Hoque and Haque, 2014). Around 4,472,000 MT land is cultivated under boro season and boro rice varieties contribute to 54.56% of total rice production in Bangladesh (BBS, 2017). Thus, boro rice plays a big part not only in the economy and livelihood of agriculture based farmers but also in the total production, GDP and food security in Bangladesh. In the following table, share of boro rice in the total rice production is given below.

Table 1.2. Share of aus, aman and boro rice production to the total production

Year	Area ('000,hactors)			Production ('000.MT)			% of total production		
	Aus	Aman	Boro	Aus	Aman	Boro	Aus	Aman	Boro
2011-12	1120	5850	4750	2300	12800	18600	6.91	37.98	55.19
2012-13	1150	5750	4750	2400	12800	18800	7.06	37.64	55.29
2013-14	1200	5850	4700	2500	13200	18500	7.30	38.60	54.09
2014-15	1045	5530	4841	2328	13190	19192	6.71	38	55.29
2015-16	1018	5590	4773	2288	13484	18938	6.59	38.85	54.56
2016-17	1098	5900	4750	2338	13350	18890	6.76	38.61	54.63
2017-18	1100	5700	4472	2350	12500	17800	7.20	38.28	54.52

(Source: Bangladesh Economic Review, 2017)

1.4 Jute production in Bangladesh

Bangladesh is rated as second in the production of jute fiber worldwide (Hassan *et al.*, 2018). The major locations where best quality jute i.e. the jat type is produced are Kushtia, Jessore, Khulna, Rajshahi, Pabna and Dhaka 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. Sowing for the most part begins toward the finish of February and proceeds up to the finish of May. Jute strands are utilized in hessians and gunnies, rug and floor coverings, paper, canvas, covering and painstaking work. Dundi (UK), Belgium, Italy, USA, South America are the purchasers of unrivaled quality jute particularly high class white and tossa jute (Molla *et al.*, 2015). Bangladesh exports about 70% of their harvested jute and this makes it one of the leading jute producing countries in the world (DAM, 2017). The yearly generation of jute in Bangladesh is assessed to be 80.20 lakh tons which is comparable to 42% of the worldwide production (BBS, 2017). Jute production has increased on average by 8.87% every year from 2015 to 2017 (DAM, 2017). Owing to reasonable market prices, favorable weather conditions, and availability of water, jute cultivation increased remarkably over the last few years.

Table 1.3. Year wise area, production and yield of jute in Bangladesh

Fiscal Year	Area (lakh hectares)	Production (lakh tons)
2015-16	7.21	77.95
2016-17	7.38	82.47
2017-18	7.89	80.20

(Source: BBS, 2017)

1.5 Economic importance of jute in Bangladesh

Bangladeshi jute is popular around the world due to its excellent fiber quality. Bangladesh is the second largest jute producer in the world. The yearly production of jute in Bangladesh is assessed to be 80.20 lakh tons which is comparable to 42% of the worldwide production (BBS, 2017). Bangladesh exports about 70% of their total harvested jute and this makes it one of the leading jute producing countries in the world (Hassan *et al.*, 2018). Dhaka controls over 62% of the global jute market and earns Tk. 2,012.5 crore by exporting jute products (Rahman, 2017). The total demand for jute products in the international market have been estimated at 7.50 lakh tons (Rahman, 2017). Bangladesh earned Tk. 2,939.5 crore by exporting raw jute and jute products in the fiscal year of 2017-18 (BBS, 2017). At present 160,000 people are directly employed in jute mills (Sarkar, 2018). The value addition of export is almost 100% and the farmers are beneficiary of export (Sarkar, 2018). Jute plant also improves soil condition as a result of its huge leaf fall and root multiplication in the field. Per ton jute fiber can bring $3,000-$10,000 to the economy of Bangladesh by enhancing the quality of jute items (Rahman, 2017). Jute is a noteworthy money crop for 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). Jute is accounted for 4.9% to the gross domestic product (GDP) in FY 2017-18 (BBS, 2017). It is one of only a handful couple of harvests which can be developed in the monsoon season, and can be pivoted with rice to reestablish the richness and structure. The leaves of jute plants enrich the fertility of the soil for sustained agriculture, and have good nutrition value as vegetables (Rab, 2017). Jute fiber is 100% bio-degradable and recyclable and along these lines naturally well disposed (Siddique, 2011).

1.6 Present status of jute production in Bangladesh

Jute is being cultivated from the ancient times in Bangladesh. In Bangladesh, sacks and saris made of jute were commonly used in the middle age (Sinha *et al.*, 2014). The leaves and roots of jute are utilized as a natural drug and vegetable by the neighborhood individuals. Bangladesh used to enjoy almost a monopoly of jute production and marketing commercially during 1950 and 1960s (Hoque *et al.*, 2014). After the independence in 1971, Bangladesh government took over all the abandoned jute mills and nationalized under BJMC those owned by the citizen's (*Sikder et al.*, 2009). In the early 80's, over 50% of the mills (35 out of 66) were privatized again (Mandal, 2014). Its share in the export market was 80% in 1947-48 but in 1975-76 it fell to only 25% which caused a big financial loss (Mandal, 2014). In 1993, government focused on the jute sector problems by taking a restructuring program supported by World Bank's JSRP and this program included closing the 9 out of 29 worst performing mills but the losses continued (Nahar *et al.*, 2017). In 2002, Government closed Adamjee jute mills that decreased BJMC's losses from tk.3.9 billion to tk. 2.1 billion in 2003 but his led to a loss of 25000 permanent jobs and 5000 temporary jobs (Nahar *et al.*, 2010). In the fiscal year of 2016-17 the production rose over 82 lakh bales and Bangladesh earned $962.42 million from jute exports as compared to $918 million in FY 2015-16 (BBS, 2017). The country spent $701 million on the import of jute pulp in 2017 (Hassan *et al.*, 2018).The increased production came mostly from better breeds and farm management of jute rather than acreage expansion. While jute acreage increased marginally over the past four decades, the yield remarkably rose due to better crop management, inputs, better breeds and quality seeds. Bangladesh is currently producing 42% of the total jute in the world and exports 70% of the raw jute produced (Hassan *et al.*, 2018).

1.7 Prospect of jute in Bangladesh

Jute is one of the major cash crops in Bangladesh (DAM, 2017). Bangladesh is under challenge from other producers such as India, China, Uzbekistan, and Nepal (Molla *et al.*, 2015). However, it is still the second largest producer of jute and jute goods with around 42% of the total world production (BBS, 2017). Globally, people are becoming conscious about the consequences of using artificial and synthetic products like polythene, poly-propylene etc. One of the environmental friendly ways to replace these artificial fibers is using jute products. Individuals worldwide are maintaining a strategic distance from hurtful polythene in their day by day lives

while business visionaries in the nation are contributing on jute and jute products. As a result, the demand for jute goods is increasing. Although jute is branded as the 'golden fiber', it was not documented as the agricultural product in the past (Rab, 2017). The present government has at this point announced jute and jute items as agrarian items with the goal that the maker could get government subsidy (Bepari *et al.*, 2018). Bangladesh government has already made jute sacks use mandatory for packing major items like rice, wheat, fertilizer, sugar (Bepari *et al.*, 2018). The world market for jute bags will reach $2.6 billion in 2022 and Bangladesh can use this opportunity (Bepari *et al.*, 2018).The administration gave out endowment on broadening of jute merchandise. The development of "GENOME SEQUENCE" by Maksudul Alam has opened another gateway for jute production (Hoque *et al.*, 2014). It is helping to invent new varieties of jute with better quality and production. Bangladesh should go for more research on diversified products of jute with collaboration of private sector entrepreneurs. Furthermore, government of Bangladesh may also shut down the non-viable and sick jute mills in both government and private sector and encourage setting up new jute mill with advanced technology for diversified jute products.

1.8 Rationale / justification of the study

Rice and jute are the main cultivated crops all over Bangladesh. Rice is the major cereal crop in Bangladesh and highly related with food security. Jute was once called “the golden fiber” of Bangladesh. However, many substitute like polythene and plastic have reduced the demand of jute production. In recent years, international community is very conscious about global warming caused by these 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 coming back to jute production as the price of jute is increasing day by day. The market of jute is expanding widely. Thus, it would be interesting to study boro rice and jute production and make comparison of their profitability in Bangladesh.

1.9 Objectives of the study

The specific objectives of this study are-

i. To document the socio-economic characteristics of farmers growing boro rice and jute;
ii. To compare the costs, returns and profitability of boro rice and jute production;
iii. To estimate the major factors affecting profitability of boro rice and jute production;
iv. To identify the major problems and constraints faced by the farmers;
v. To suggest some policy recommendations.

1.10 Structure of the study

The study consists of five chapters which have been organized in the following sequence. First chapter gives a brief introduction of the study. Chapter two presents a brief review of literatures related to the study. Chapter three gives an insight of the methodology used to complete the study. Chapter four describes the results of the study. Lastly, chapter five presents the summary, conclusion and recommendation.

CHAPTER- 2

REVIEW OF LITERATURE

Review of literature is a crucial part as it gives an insight of the previous research work which provides knowledge and information related to proposed research. This information and knowledge give a guideline in designing and validating the future problems and existing findings. Past literature works related to the present study have been reviewed for this purpose in this chapter.

2.1 Profitability of rice production

2.1.1 Profitability of Boro Rice Production

Islam (2001) studied on economic potential of Bina-6 rice production in Mymensingh district with a sample of 55 farmers considering Cobb-Douglas production function and found that BINA-6 rice production was profitable because the total return was much higher than total cost of production. Kana (2011) studied on economic analysis of salt tolerant Binadhan-8 and HYV BRRI Dhan28 rice production in Satkhira district with a sample of 60 respondents using Cobb-Douglas production function and found that total return of Binadhan-8 was greater than total return of BR-28. Akter (2011) studied on profitability and resource use efficiency of BRRI Dhan29 in old Brahmaputra floodplain area of Tangail district with a sample of 60 farmers using Cobb-Douglas production function and found that total return of BRRI Dhan29 was higher than total cost.

Above literatures show that in all cases, boro rice production was profitable as it produced higher total return than total cost.

2.1.2 Profitability of aman rice production

Siddiqui (2008) studied on economic profitability of BRRI Dhan33 and BR-11 rice production in Kurigram district with 60 farmers using Cobb-Douglas production function and found that gross return for BRRI Dhan33 was higher than BR-11. Kamruzzaman (2011) studied on economic potential of BRRI Dhan-51 and BR-11 rice production in Rangpur district with a sample of 60 farmers considering Cobb Douglas production function and found that BRRI Dhan-51 had higher gross return than BR-11.

The above literatures show that a comparison was made between different Aman varieties and it was found that profitability differed in varieties.

2.1.3 Profitability of different hybrid boro rice varieties

Hanifa (2009) studied on economic analysis of BR-29 and Hybrid Hira rice production in Netrokona district with a sample of 80 farmers using Cobb-Douglas production function and found that total returns from Hybrid Hira rice per hectare was higher than BR-29. Banu (2011) studied on economic analysis of BR-28, BR-29 and Hybrid Hira rice production in Kurigram district with a sample of 90 farmers considering Cobb-Douglas production function and found that Hybrid Hira was more profitable than BR-28 and BR-29 rice as the net return was much higher than BR-28 and BR-29.

The above literatures show that hybrid Hira rice was more profitable than other boro rice varieties as it earned higher total return than boro rice.

2.1.4 Profitability of hybrid and local boro rice varieties

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. Shamsuddula (2004) studied on comparative economics of local Boro and Hybrid rice production in terms of profitability and efficiency in Mymensingh district with 160 samples of rice developing farmers using Cobb Douglas production function and found that net return from Hybrid rice was much higher than local boro rice.

These above literatures show that Hybrid boro rice was more profitable than local Boro varieties as the net return of hybrid boro rice was higher than local boro rice.

2.1.5 Profitability of aromatic and fine rice production

Anik (2003) studied on economic and financial profitability of aromatic and fine rice production in Dinajpur and Sherpur district with a sample of 100 farmers using Cobb-Douglas production function and found that aromatic rice was more profitable than fine rice as the net return was higher than fine rice. Ullah (2008) studied on comparative profitability and technical efficiency

of aromatic and non-aromatic aman rice production in Dinajpur district with a sample of 60 farmers using stochastic frontier analysis and found that profitability of BRRI Dhan 34 (aromatic) was much higher than BR-11 rice (non-aromatic) as the total return from BRRI Dhan 34 was higher than BR-11.

Above literatures show that aromatic rice was economically profitable than fine rice as the gross return of aromatic rice was higher than fine rice.

2.2 Profitability of jute production

2.2.1 Profitability based on types of farmer

Sheheli and Roy (2014) studied on profitability, constraints and opportunities of raw jute production in Kishoregonj district with a sample of 100 farmers using Cobb-Douglas production function and found that jute cultivation was profitable and medium farmers had the highest profit than small and large farmers. Siddique (2011) studied on profitability analysis of jute growing farmers in Mymensingh district with a sample of 60 farmers considering Cobb-Douglas production function and found that jute production had higher gross return than total cost and medium farmers had the highest profit than small and large farmers. Kundu (2011) studied on profitability of jute production and value addition activities of jute products in Madaripur district with a sample of 73 jute farmers using Cobb-Douglas production function and found that jute cultivation was profitable and medium farmers had the highest profit.

These above literatures show that jute cultivation was profitable and medium farmers had higher net return than small and large farmers.

2.2.2 Profitability Based on Varieties of Jute

Kumar *et al.* (2014) studied on system productivity, profitability and resource use efficiency of white and tossa jute production in the eastern Indo-gangetic plain in India with a sample of 120 farmers using Cobb-Douglas production function and found that tossa jute had the highest profitability, system productivity and energy productivity than white jute. Chakraborty and Bera (2014) studied on the economic viability of white and tossa jute production in West Bengal with a sample of 60 farmers using Cobb-Douglas production function and found that tossa jute had higher total return than white jute. Khatun (2010) studied on economic analysis of white and

tossa jute production in Sirajgonj district with a sample of 60 farmers using Cobb-Douglas production function and found that tossa jute had higher net return than white jute production.

The above literatures show that tossa jute had higher profit than white jute production as the net return from tossa jute was higher than white jute.

2.3 Factors affecting profitability of boro rice and jute production

2.3.1 Factors affecting profitability of boro rice production

Hoque and Haque (2014) studied on the economic profitability of boro rice production in Jamalpur, Gazipur and Manikgonj district with a sample of 211 respondents by using Cobb-Douglas production function and found that factors like cost of irrigation, insecticide, seed and human labor showed significant effect on profitability. Chowdhury (2012) studied on the economic potential of BR 28 and BR 29 in Rangpur district with a sample of 80 respondents by using Cobb-Douglas production function technique and found that cost of irrigation, seed, human labor and insecticide showed significant impact on BR 28 whereas cost of human labor, seed, irrigation and insecticides showed significant impact on BR 29. Rahman and Nargis (2015) studied on economic potential of BRRI Dhan29 with a sample of 60 respondents by using Cobb-Douglas production function technique and found that cost of human labor, power tiller, seed, fertilizer and irrigation showed significant impact on the crop.

These above literatures show that the most common factors affecting profitability of rice production were cost of irrigation, seed and human labor.

2.3.2 Factors affecting profitability of jute production

Dev and Bairagi (2008) studied on profitability and marketing of jute in 12 jute producing districts with a sample of 360 jute farmers by considering Cobb-Douglas production function and found that cost of labor, pesticide, power tiller and fertilizer showed significant impact on profitability of jute production. Islam *et al.* (2009) undertook a study on genetic diversity and relationships of different jute species in Kushtia with a sample of 130 jute farmers by considering Cobb-Douglas production function and found that human labor, fertilizer, insecticides and power tiller showed significant impact on jute production. Yasmin (2009) studied on profitability and value addition activities of jute production in Jessore district with a

sample of 60 jute farmers by considering Cobb-Douglas production function and found that cost of seed, fertilizer, human labor and power tiller showed significant effect on profitability of jute.

The above studies show that the most common factors affecting profitability of jute production were labor cost, cost of fertilizers and power tiller cost.

2.4 Major problems in producing boro rice and jute

2.4.1 Problems in boro rice production

Mandal (2014) studied on economic analysis, problems and prospects of boro rice in Tangail district with a sample of 60 jute farmers by considering Cobb-Douglas production function and found that lack of capital, lack of storage facilities, high cost of insecticides, high wage of labor, high cost of transportation and low prices of output were the main problems of boro rice production. Khan *et al.* (2011) studied on resource use efficiency and profitability of boro rice production in Mymensingh district with a sample of 120 boro farmers by considering Cobb-Douglas production function and revealed that the main problems were lack of capital, attack of pests, high wage rate, lack of storage facilities, high cost of irrigation, low prices of output, high transportation cost and lack of extension service.

The above studies show that lack of capital, high transportation cost, low price of output, lack of storage facilities, high wage of labor were the major problems in boro rice production.

2.4.2 Problems in jute production

Rahman and Bala (2009) studied on ecological and environmental sustainability of jute production system in Bangladesh by using life cycle assessment method with a sample of 130 jute farmers and found that high input cost, lack of storage facilities, high transportation cost, high labor cost were the major obstacles of jute production. Sinha *et al.* (2014) studied on crop diversification for profitability in jute and allied fiber crops in Jessore district by considering Cobb-Douglas production function with a sample of 80 jute farmers and found that high transportation cost, high labor cost, lack of storage facilities, natural disaster, high input cost and attack of pests were the major problems.

These above literatures show that the most common problems of jute production were high input cost, high labor cost, high transportation cost and lack of storage facilities.

2.5 Comparison of profitability of rice and jute production

Forman (2011) studied 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. Hasan (2015) studied on 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. 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.

The above literatures show that jute was more profitable than aus rice as the net return from jute was higher than aus rice.

2.6 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 Bangladesh. 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 economic analysis of rice and jute. 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

METHODOLOGY

3.1 Introduction

Farm management research depends on the implementation of appropriate methodology and the accuracy of the primary data. The objectives of the study determine the nature of primary data to be collected. There are various methods of data collection. Survey method was used in this study for collecting primary data for the following reasons.

- Survey method is relatively easy to administer.
- Can be created in less time contrasted with other information gathering techniques.
- Cost-effective, practical and has extensive applicability.
- Equipped for gathering information from a large number of respondents.

This method of data collection has some drawback like the investigator has to rely on the memory of farmers which create some problem. Most farmers are illiterate and they do not keep any record of information. Repeated visit was made to the study area and to the farmers to obtain the missing information and to reduce the severity of any misinformation. The methodology involved in this study is described below in chronological order.

3.2 Selection of the study area

Farm level research requires selection of an area where the research data is collected and the research is done. This research was conducted in Rajoir upazilla of Madaripur district considering the researcher familiarity and easy access to the local farmers. Four villages namely Isibpur, Badarpasha, Kabirajpur and Hossainpur under Rajoir upazila were selected. The farmers were randomly selected for data collection purpose. The main reasons for selecting the area for data collection purpose were-

a. There was not any study done on this research topic in that area.
b. The main crop of the area was boro rice and jute.
c. The selected villages had similar physical characteristics like- topography, soil and climatic conditions for producing jute and boro rice.

d. As most of the farmers were involved in jute and boro rice production, it was expected that reliable data would be successfully obtained from that area.
e. Easy accessibility and good communication facilities in the area.

3.3 Sampling technique and sample size

Two factors were considered in selecting samples for a study area. The sample size should be large enough to follow for adequate degrees of freedom in the statistical analysis. Administration of field research, processing and analysis of data should be manageable within the limited resource available. It was impossible to include all the farmers in Rajoir upazilla because they were randomly scattered in a huge area. Money and time was also limited for the study. Total 80 farmers were selected randomly where 40 farmers were growers of boro rice and 40 farmers were growers of jute by simple random sampling technique.

3.4 Preparation of the survey schedule

A draft questionnaire was prepared for collecting data from the sample respondents by keeping the objectives in mind. The questionnaire was pre-tested by interviewing some farmers who cultivated boro rice and jute. Necessary modifications, additions and alternations were made and then the draft questionnaire was finalized. The final questionnaire had three categories of information. The first part was prepared to collect socio-economic information. The second part contained information about costs and returns of jute and boro rice. The third part contained questions related to constraints and problems faced by the farmers in producing boro rice and jute in the selected area.

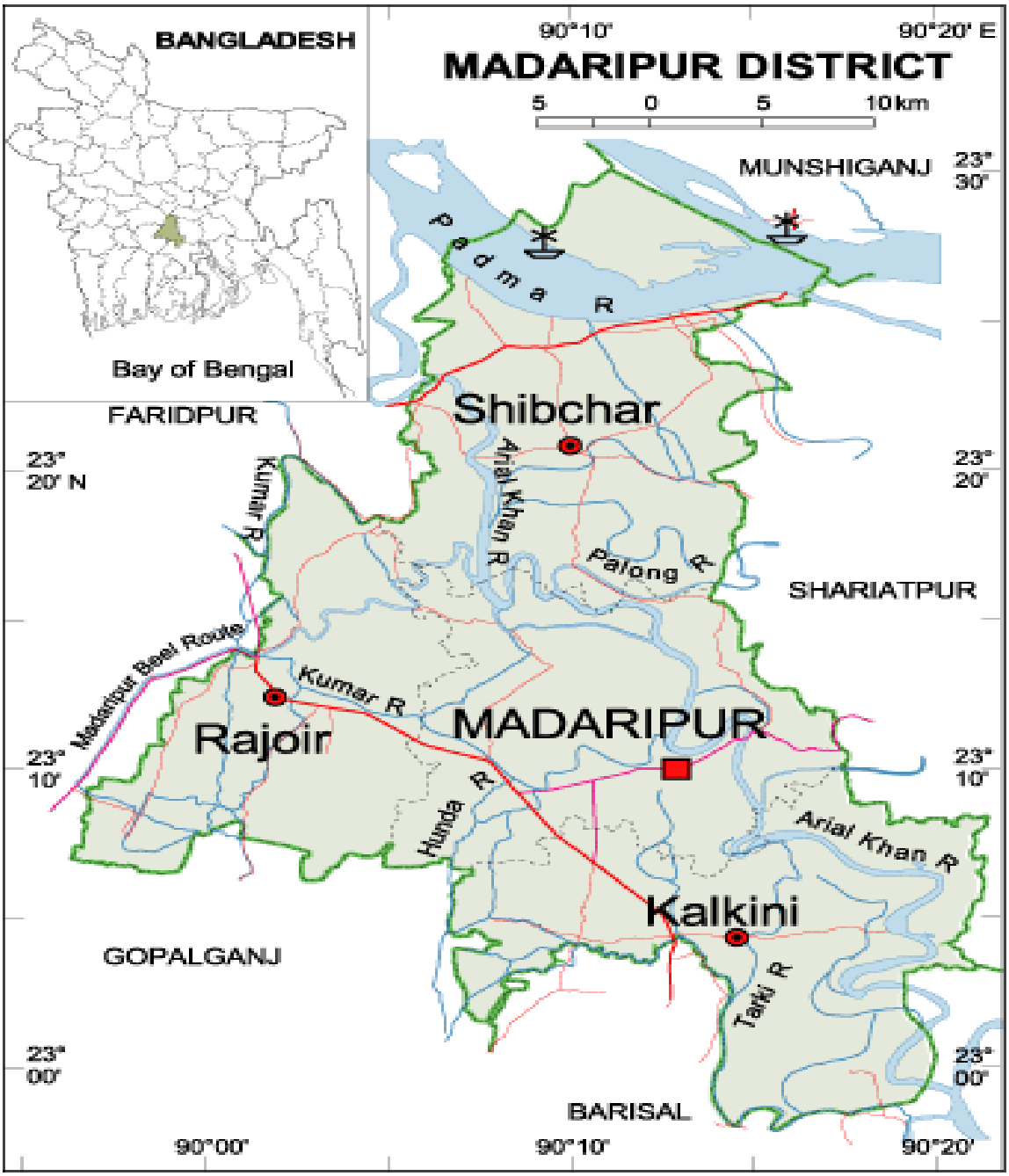


Figure 3.1. A map of Madaripur district showing Rajoir upazila

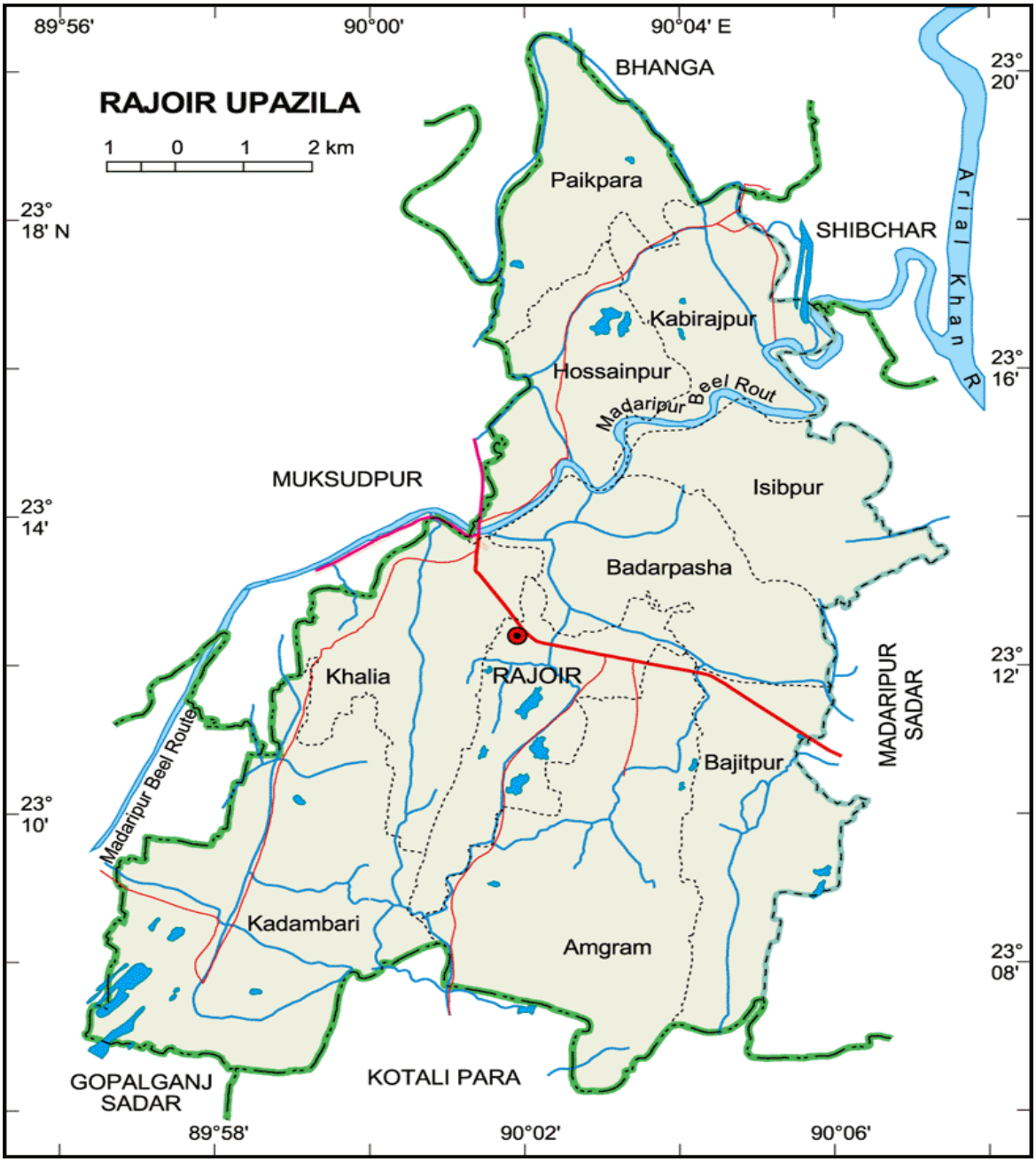


Figure 3.2. A map of Rajoir upazila showing study area

3.5 Period of the study

Data were collected during the period of March to April in 2019 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

Required data were collected through field survey by interviewing the jute and boro rice growers. The relevant information was collected from the jute and boro rice farmers who were selected. The selected farmers were contacted first so that they could be interviewed according to their convenient time. During interview, the researcher systematically asked questions and explained the purpose of the study for better understanding. The interviewer told the farmers the study was properly academic. When interview was over, the interview schedule was rechecked to ensure that each of the required information was collected properly.

3.7 Processing, tabulation and analysis of data

The collected data were coded and edited manually. After that all the collected data were scrutinized and summarized very carefully. Data entry was done in computer and analysis was done accordingly in computer. The information was first collected in local units and then it was converted into international standard units.

3.8 Analytical technique

Several analytical techniques were used to meet particular research objectives. The collected data was analyzed using Microsoft Excel and SPSS because they are very popular and widely used. Eventually, econometric technique such as Cobb-Douglas production function was used to examine the effects of the independent variables on the dependent variables in the production function of boro rice and jute. Thus analysis of data was categorized in two parts -

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 Cobb-Douglas production function

Cobb-Douglas production function that was used to estimate the effects of major factors in the returns of boro rice and jute production was as follows:

$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}X_6^{b6}X_7^{b7}e^{ui}$

The function was transformed into the following log linear form

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

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

u_i = Error term

ln = Natural logarithm

3.8.3 Elasticity of production (Ep)

The elasticity of production is defined as the percentage change in output with the change of percentage in input, if other factors remain constant. The Cobb-Douglas production function is very useful in calculating the elasticity of production. The elasticity of production can be conveyed as-

Elasticity of production, $E_p = b_i$

If Ep = 1, Production elasticity is unity

Ep> 1, Production is elastic, and

Ep<1, Production is inelastic.

3.8.4 Return to scale (RTS)

The return to scale can be obtained by summing up the regression coefficients of all explanatory variables in Cobb-Douglas production function. This can be conveyed 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

This present study was conducted regarding boro rice and jute production and the data was collected in rural areas. There were some problems during data collection. Some of the problems were-

a. Researcher had to conduct this study in a limited time period which was not enough to conduct an in-depth study.
b. Researcher also did not have any funding for this research. For this reason, it was not possible to cover big area.
c. During the interview, the researcher found it difficult to avoid the interruption of others as interviews took place in farmer's field or in their houses.

3.10 Ethical issues

Researcher tried to follow all the ethical issues related to the study. Researcher booked an appointment before interviews of the farmers and farmers were well informed about the purpose of the study. Additionally, farmers were ensured that their information would be used only for the completion of thesis paper and would not be used for other purposes. The collected data were preserved in a password protected device.

CHAPTER- 4

RESULTS AND DISCUSSION

4.1 Socio-economic characteristics of boro rice and jute farmers

The socio-economic characteristics of the sample farmer are an essential part of research because these characteristics can affect their production decision and production pattern. There was a lot of difference in the socio-economic characteristics of rice and jute farmers in the selected areas. The socio-economic characteristics of the sample farmers that was considered in the study area involved farmers age, family size and composition, education status, marital status, occupation level, farming experience and farm holdings of the farmer.

4.1.1 Age structure of the sample farmers

The respondents of boro rice and jute growers were classified into five categories such as 21-30 years, 31-40 years, 41-50 years, 51-60 years, 61years and above. Table 4.1 shows that out of total boro rice growers 7.5% fall into 21-30 years, 17.5% are between 31-40 years, 27.5% fall into 41-50 years, 37.5% fall into 51-60 years and 10% farmers belong to between 61 years and above age group. Table 4.1 also shows that out of total jute growers 5% fall into 21-30 years, 12.5% are between 31-40 years, 32.5% fall into 41-50 years, 27.5% fall into 51-60 years and 22.5% farmers belong to between 61years and above age group. It was obvious from Table 4.1 that majority of boro rice growers fell into 51-60 years age group which was 37.5% whereas majority of the jute growers were between 41-50 years age group which was 32.5%.

Table 4.1. Distribution of sample farmers according to age group

Farmers age (Years)	Boro rice growers		Jute growers		All farmers	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
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	40	100	40	100	80	100

(Source: Field survey, 2019)

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 4.2 shows that 100% farmers of jute and boro growers are male among the sample respondent.

Table 4.2. Gender of Boro rice and jute growers

Gender	Boro rice growers		Jute growers	
	Frequency	% of total	Frequency	% of total
Male	40	100	40	100
Female	0	0	0	0
Total	40	100	40	100

(Source: Field survey, 2019)

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 4.3 shows that 95% boro growers are married, 2.5% are unmarried and 2.5% fall into widow/ widower category in the study area. Table 4.3 also shows that 92.5% jute growers are married, 5% are unmarried and 2.5% fall into widow/widower category in the study area. It was obvious from table 4.3 that boro rice growers were married more in number than jute growers.

Table 4.3. Marital status of the respondent

Marital status	Boro rice growers		Jute growers	
	Frequency	% of total	Frequency	% of total
Married	38	95	37	92.5
Unmarried	1	2.5	2	5
Widow/Widower	1	2.5	1	2.5
Total	40	100	40	100

(Source: Field survey, 2019)

4.1.4 Educational status of the respondents

Education helps individuals to develop the capacity of understanding their environment and improve rational insight of life. Education influences farmers to adopt the modern technology and use scarce resources efficiently which contribute in earning higher profit. The farmers were classified into four categories such as illiterate, primary, secondary, higher secondary and graduate/post graduate for research purpose. Literacy of farmers were coded for analyzing purpose as Illiterate = 1, primary = 2, Secondary = 3, Higher secondary = 4, Graduate/post graduate = 5. Table 4.4 shows that among boro farmers 25% are illiterate, 42.5% have primary education, 25% have secondary education an, 7.5% have higher secondary education but no farmers have graduate or post graduate degree. Table 4.4 also shows that among jute farmers 15% are illiterate, 47.5% have primary education, 32.5% have secondary education and 5% have higher secondary education but no farmer has graduate/ post graduate degree. It was obvious

from Table 4.4 that majority of farmers of both boro rice and jute had primary level education which was 45%. This table revealed that boro rice farmers were more illiterate in number than jute farmers.

Table 4.4. Educational status of the respondents

Educational Status	Boro rice growers		Jute growers		All farmers	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Illiterate	10	25	6	15	16	20
Primary	17	42.5	19	47.5	36	45
Secondary	10	25	13	32.5	23	28.75
Higher Secondary	3	7.5	2	5	5	6.25
Graduate/Post graduate	0	0	0	0	0	0
Total	40	100	40	100	80	100

(Source: Field survey, 2019)

4.1.5 Family size and composition

Family is an important social institution which creates a strong social bond between family members. Family size plays crucial role in the social and economic life of farmers. In this study, family size has been defined as the total number of person living together under the administration of the head of the family. Family size includes farmer himself, children, wife, father, mother, sisters and brothers. A large family has more labor to earn through different activities but it requires higher costs to fulfill the daily needs of the family members. Table 4.5 shows that out of total boro rice growers 37.5% families consist of 1-5 members, 52.5% have 6-8 members and 10% have above 8 family members. Table 4.5 also reveals that out of total jute grower 32.5% families consist of 1-5 members, 62.5% have 6-8 members and 5% have above 8 family members. It was obvious from Table 4.5 that most of the boro rice growers and jute growers had 6-8 members.

Table 4.5. Distribution of the farmers by family size

No. of family members	Boro rice growers		Jute growers	
	Frequency	Percentage	Frequency	Percentage
1-5	15	37.5	13	32.5
6-8	21	52.5	25	62.5
Above 8	4	10	2	5
Total	40	100	40	100

(Source: Field survey, 2019)

Table 4.6 shows that out of total 246 family members of boro farmers 133 are male and 113 are female. The male female ratio was 1.18 in boro grower family (Table 4.6). Table 4.6 also shows that out of total 238 family members of jute farmers, 128 are male and 110 are female. The male-female ratio was 1.16 in jute farmer families (Table 4.6). It was obvious from Table 4.6 that boro rice farmers (50.96%) had more male members than jute farmers (49.04%).

Table 4.6. Male-female ratio of sample farmers family

Categories	Male		Female		Male-female ratio	Total
	Frequency	Percent	Frequency	Percent		
Boro rice Farmers	133	50.96	113	50.67	1.18	246
Jute farmers	128	49.04	110	49.33	1.16	238
Total	261	100	223	100	1.17	484

(Source: Field survey, 2019)

4.1.6 Occupational structure

In the study area, farmers were engaged in various types of occupation like crop cultivation, private service, public job, small business, poultry and livestock rearing and fish culture. Farmers were classified for research purpose into five groups such as agriculture, business, service, wage labor, van/rickshaw pulling as almost all farmers were involved in at least one of these

categories. The agriculture category consists of crop cultivation, fish culture, fishing, poultry and livestock rearing. The occupation of respondents was also classified into two broad groups such as main and subsidiary. Farmers were coded as agriculture = 1, business = 2, service = 3, Wage labor = 4, Rickshaw/van pulling = 5. Table 4.7 shows that 77.5% of boro rice producers are involved in agriculture, 15% into business and 7.5% into service as their main occupation. Table 4.7 also reveals that 85% of jute producers are involved in agriculture, 10% into business and 5% in service as their main occupation. It was obvious from Table 4.7 that the main occupation of the respondents of both boro rice and jute farmers was agriculture as 81.25% were involved in agriculture.

Table 4.7. Occupational status of the sample farmers

Occupation	Boro rice		Jute growers		All groups	
	Main	Subsidiary	Main	Subsidiary	Main	Subsidiary
Agriculture	31 (77.5%)	9	34 (85%)	6	65 (81.25%)	14
Business	6 (15%)	9	4 (10%)	14	10 (12.5%)	14
Service	3 (7.5%)	0	2 (5%)	2	5 (6.25%)	2
Wage labor	0	5	0	4	0	9
Van / Rickshaw Pulling	0	1	0	0	0	1
Total	40 (100%)	24	40 (100%)	26	80 (100%)	40

(Source: Field survey, 2019)

4.1.7 Farming experience

Experience is a vital tool for operating agricultural activities. An experienced farmer knows how to till land correctly, spray pesticide and optimum doses of fertilizers than an inexperienced farmer. The farmers in the study area were divided into five groups based on their year of farming experience. Table 4.8 shows that out of total boro growers 7.5% farmers have 1-10 years, 27.5% have 11-20 years, 37.5% have 21-30 years, 17.5% have 31-40 years and 10% have 41-50 years of experience. Table 4.8 also reveals that out of total jute growers 5% farmers have 1-10 years, 22.5% have 11-20 years, 42.5% have 21-30 years, 22.5% have 31-40 years and 7.5% have 41-50 year experience. From Table 4.8, it was obvious that most of the respondents of both boro farmers and jute farmers had 21-30 years of experience who were related with agricultural activities.

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	3	7.5	2	5
11-20	11	27.5	9	22.5
21-30	15	37.5	17	42.5
31-40	7	17.5	9	22.5
41-60	4	10	3	7.5
Total	40	100	40	100

(Source: Field survey, 2019)

4.1.8 Farm holdings of the respondents

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. It was found from Table 4.9 that out of total boro rice farmers, 57.5% were small farmers, 32.5% were medium and 10% are large farmers. Table 4.9 also shows that out of total jute growers, 47.5% are small, 40% are

medium and 12.5% are large farmers in the study area. Based on Table 4.9, it was obvious that farmer of boro rice with small farm size was higher in percentage than jute growers.

Table: 4.9 Classification of the respondents according to farm holding size

Land holding	Farm size (acre)	Boro rice growers		Jute growers	
		Frequency	Percent	Frequency	Percent
Small farmers	0.02-2.49	23	57.5	19	47.5
Medium farmers	2.50-7.49	13	32.5	16	40
Large farmers	7.50-above	4	10	5	12.5
Total		40	100	40	100

(Source: Field survey, 2019)

4.2 Profitability analysis of boro rice and jute production

The costs, returns and profitability of producing boro rice and jute are briefly described in this chapter. The variable and fixed costs were considered to estimate the total cost of production of boro rice and jute. Variable costs include cost of human labor, power tiller, animal labor, mechanical labor, seed, fertilizer, manure, pesticide and irrigation. Fixed costs include land use cost and Interest on operating capital. The total return includes return from main product and by product.

4.2.1 Estimation of variable costs

Variable costs include the costs of using all variable inputs. There are some costs that vary with the level of production such as cost of seed, fertilizer, human labor, manure, irrigation, power tiller and insecticide. These inputs are essential in production. Thus, the costs have to be estimated for calculating the total production costs. Variable costs for Boro rice and jute production are discussed below.

4.2.2 Cost of human labor

Human labor is the most vital input for producing boro rice and jute. Human labor includes both family labor and hired labor. Table 4.10 shows that total labor requirements per hectare for boro rice is 111.89 man-days of which 28.2 man-days are family labor and 83.69 man-days are hired labor. Average wage rate was estimated as Tk. 373.33 in the study area during data collection. It was estimated that the total cost of human labor for boro rice was Tk. 43353.3 per hectare (Table 4.10). Human labor cost for land preparation, transplanting, weeding, fertilizer and insecticide, harvesting and threshing was estimated as 12.27%, 15.78%, 16.43%, 3.46%, 27.40% and 24.66% of total labor cost respectively.

Table 4.10. Per hectare operation wise average human labor cost for boro rice 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	3.5	13.13	16.63	320	5321.6	12.27
Transplanting	4.5	16.88	21.38	320	6841.6	15.78
Weeding	3.4	20.35	23.75	300	7125	16.43
Fertilizer and Insecticide	3.8	1.2	5	300	1500	3.46
Harvesting	5.8	17.95	23.75	500	11875	27.40
Threshing	7.2	14.18	21.38	500	10690	24.66
Total	28.2	83.69	111.89		43353.2	100

(Source: Field survey, 2019)

In case of jute production, Table 4.11 shows that the total labor requirement per hectare is 152 man-days in which 42.4 man-days are family labor and 109.6 man-days are hired labor. Average wage rate was estimated as Tk. 412.5 at the time of data collection in the study area. Table 4.11 also shows that per hectare total labor cost is estimated as Tk. 63175 per hectare for jute

production. This table also showed that labor cost for land preparation and sowing seeds; weeding and fertilizing; harvesting and carrying; retting, washing and drying was 4.51%, 31.58%, 22.57% and 41.34% of total labor cost respectively.

Table 4.11. 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 sowing seeds	2.1	7.4	9.5	300	2850	4.51
Weeding and fertilizing	18.3	48.2	66.5	300	19950	31.58
Harvesting and carrying	9.6	18.9	28.5	500	14250	22.57
Retting, washing and drying	12.4	35.1	47.5	550	26125	41.34
Total	42.4	109.6	152		63175	100

(Source: Field survey, 2019)

4.2.3 Cost of seed/seedlings

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. Table 4.12 and Table 4.13 shows that farmers of boro rice and jute use 38.02 kg and 9.5 kg seed per hectare. Per unit cost of seed for boro rice was Tk. 60 and Tk. 150 respectively during data collection. Total cost of seed for boro rice and jute was estimated as Tk. 2281.2 and Tk. 1425 per hectare in which seed cost of boro rice was 5.33% and seed cost of jute was 8.15% of total material input costs.

Table 4.12. 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	38.02	60	2281.2	5.33
Fertilizer	Kg				
Urea	Kg	223	18	4014	
TSP	Kg	174	30	5220	
MOP	Kg	124.3	15	1988.8	
Total fertilizer cost	Tk.			11222.8	26.24
Manure	Kg	423.44	2	846.88	1.98
Pesticide	Tk.			1800	4.21
Animal labor	Tk.			1000	2.34
Power tiller	Tk.			6175	14.44
Thresher	Tk.			4631.25	10.82
Irrigation	Tk.			14820	34.64
Total				42777.13	100

(Source: Field survey, 2019)

4.2.4 Cost of fertilizer

Farmers of boro rice and jute used fertilizers such as Urea, TSP and MOP which were required for cultivation. Table 4.12 shows that per hectare total fertilizer cost of boro rice is estimated as Tk.11222.8 and it is 26.24% of the total material input cost. Table 4.13 shows that per hectare cost of fertilizers required for jute production is estimated as Tk. 4248 and it is 24.31% of the total material input cost.

Table 4.13. Per hectare cost of material inputs for jute production

Various inputs	Units	Quantity	Unit price (Tk.)	Total Cost (Tk.)	% of total Cost
Seed	Kg	9.5	150	1425	8.15
Fertilizer	Kg				
Urea	Kg	95	18	1710	
TSP	Kg	51	30	1530	
MOP	Kg	63	16	1008	
Total fertilizer cost	Tk.			4248	24.31
Manure	Kg	933	2	1866	10.68
Power tiller	Tk.			7175	41.06
Transportation	Tk.			2100	12.02
Pesticide	Tk.			660	3.78
Total Cost				17474	100

(Source: Field survey, 2019)

4.2.5 Cost of manure

Most farmers in the study area had their own cow and for this reason they did not have to buy manures for using in the field. The farmers were able to use manures from their own supply. Table 4.12 shows that per hectare cost of manure for boro rice production is Tk. 846.88 which is 1.98% of total material input cost. Table 4.13 shows that per hectare manure cost for jute production is Tk.1866 which is 10.68% of total material input cost.

4.2.6 Cost of animal labor and thresher

Animal labor was used for mainly land preparation of boro rice production. The cost of pair of bullocks was considered as animal labor. Table 4.12 shows that total animal labor cost for boro rice production is Tk. 1000 per hectare which is 2.34% of total material input cost. Thresher was needed for threshing boro paddy after harvesting. Table 4.12 shows that total cost of thresher is Tk. 4631.25 per hectare which is 10.82% of total material input cost.

4.2.7 Cost of irrigation and transportation

Irrigation is very important for any agricultural production. Boro rice field needed a huge amount of water from land preparation to harvest whereas 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. However, jute farmers had free access to water source like closed water bodies that cost farmers no charge. Besides, jute was generally cultivated in rainy season, so the farmers did not have to provide extra water for irrigation. Farmers of boro rice had to depend on machine supplied water as there was a lack of water at the time. Table 4.12 shows that the charge of irrigation water for producing boro rice is Tk. 14820 per hectare which is 34.64% of total material input cost. After harvesting of jute, van, rickshaw was used for carrying jute fiber and stick to their home and to local market. Table 4.13 shows that the transportation cost for jute is estimated as Tk. 2100 per hectare and it is 12.02% of total material input cost.

4.2.8 Cost of pesticide

There are several types of insects that can cause damage in the 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. Farmers had to use insecticides to control pests in the study area. Table 4.12 shows that the estimated cost per hectare for boro rice is Tk. 1800 which is 4.21% of total material input cost. Table 4.13 shows that the estimated cost per hectare for jute production is Tk. 660 which is 3.78% of total material input cost.

4.2.9 Estimation of fixed costs

Fixed costs are those expenses that are not dependent on the level of output and does not change with an increase or decrease with the level of output change. The producers have to bear the expense even if the production is not undertaken. Fixed costs include land use cost and interest on operating capital which is described below.

4.2.10 Land use cost

Most of the farmers in the study area had own land for producing boro rice and jute. Land use cost was a fixed cost for the producers. Table 4.14 shows that the land use cost per hectare is estimated at Tk. 7916.67 which is similar for boro rice and jute production. The land use cost for boro rice and jute was 8.29% and 8.81% of total production cost respectively.

4.2.11 Interest on operating capital (IOC)

Interest on operating capital was calculated for 4 months for both boro rice and jute. Interest rate of 10% per annum for both crop were considered for calculation. Interest on operating capital was calculated based on this formula-

Interest on Operating Capital (IOC) = AI*i*t

Where,

AI = (Total investment)/2

i = Rate of interest

t = Length of crop period in months

Table 4.14 shows that interest on operating capital calculated for boro rice is Tk. 1435.41 and for jute is Tk. 1344.15 per hectare. IOC of boro rice was 1.50% and 1.49% of total production cost respectively.

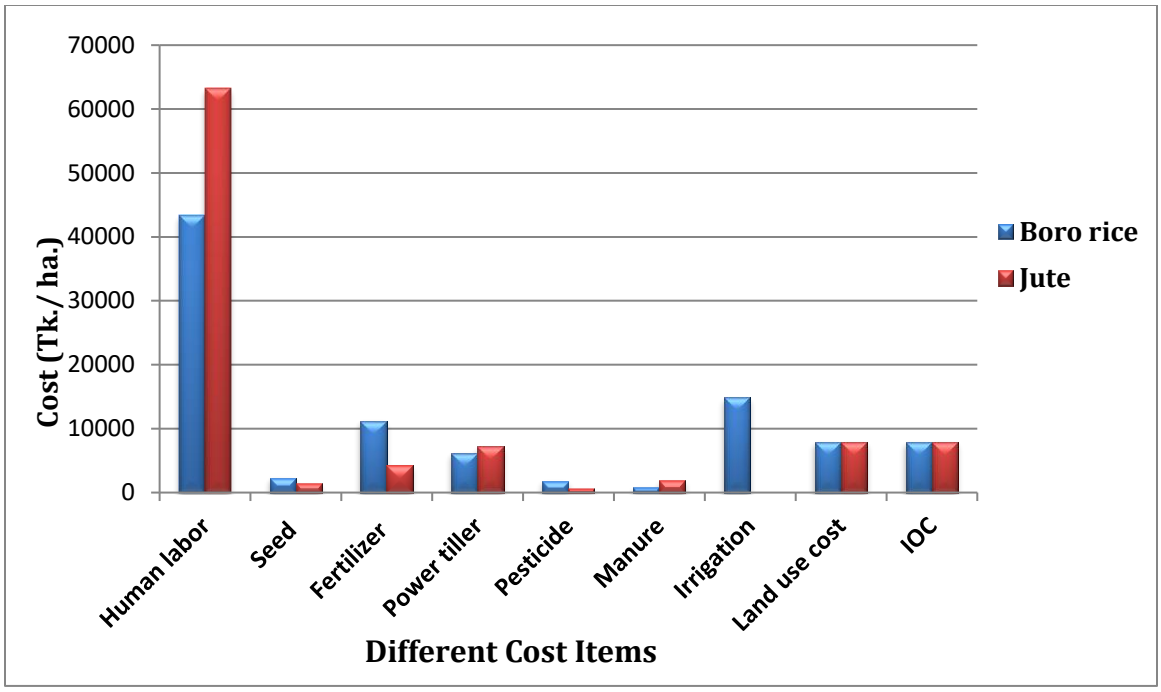
4.2.12 Total cost

The total cost was estimated by summing up the variable and fixed cost for both boro rice and jute production. Table 4.14 shows that total variable cost for boro rice and jute is Tk. 86130.33 (90.20% of total cost) and Tk. 80649 (89.69% of total cost) respectively. Table 4.14 also shows that total fixed cost for boro rice and jute was Tk. 9352.08 (9.8%) and Tk. 9260.82 (10.31%) respectively. The total cost per hectare estimated for boro rice and jute production was Tk. 95482.41and Tk. 89909.82 (Table 4.14).

Table 4.14. 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				
Human labor cost	43353.2	45.40	63175	70.26
Seed cost	2281.2	2.39	1425	1.58
Fertilizer cost	11222.8	11.75	4248	4.72
Power tiller	6175	6.47	7175	7.98
Animal labor	1000	1.05	-	-
Pesticide	1800	1.89	660	0.74
Thresher	4631.25	4.85	-	-
Transportation	-	-	2100	2.34
Manure	846.88	0.89	1866	2.08
Irrigation	14820	15.52	-	-
Total Variable Cost	86130.33	90.20	80649	89.69
B. Fixed Cost				
Land use cost	7916.67	8.29	7916.67	8.81
Interest on operating Capital	1435.41	1.50	1344.15	1.49
Total Fixed Cost	9352.08	9.8	9260.82	10.31
Total Cost (A+B)	95482.41	100	89909.82	100

(Source: Field survey, 2019)



(Source: Field survey, 2019)

Fig. 4.1 Per hectare costs of various inputs of boro rice and jute production

4.2.13 Gross return

Gross return is the total revenue earned from the production which includes return from the main product and by-product. Table 4.15 shows that per hectare return from main and by-product of boro rice is Tk. 90600.03 and Tk. 14820 respectively. Table 4.15 also shows that the return from main and by-product of jute is Tk. 121331.5 and Tk. 15370 respectively. The total gross return per hectare was estimated as Tk. 105420.03 for boro rice and Tk. 136701.5 for jute (Table 4.15).

Table 4.15 Per hectare gross returns from boro rice and jute

Name of the crops	Value of Main product			Value of the by-product (Tk.)	Gross Return (Tk./ha)
	Quantity (kg/ha)	Price (Tk./kg)	Value (Tk.)		
Boro rice	5634.32	16.08	90600.03	14820	105420.03
Jute	2270	53.45	121331.5	15370	136701.5

(Source: Field survey, 2019)

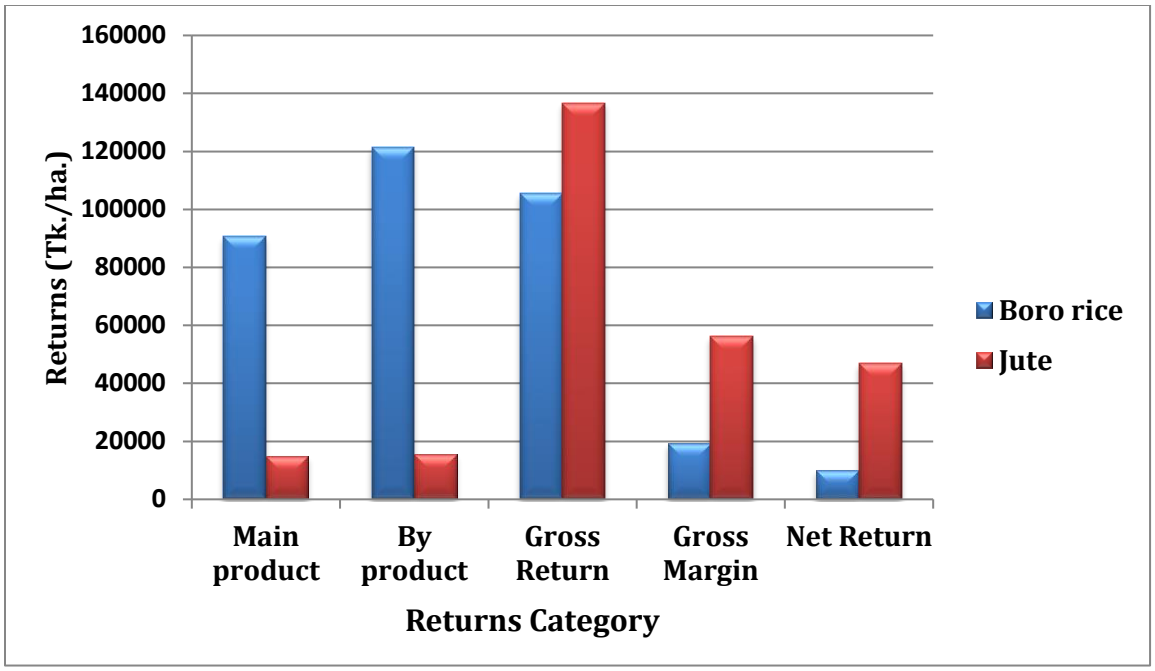
4.2.14 Profitability of boro rice and jute production

The profitability of boro rice and jute cultivation is presented in the Table 4.16. The gross return per hectare from boro rice was estimated as Tk. 105420.03, total variable cost per hectare was Tk. 86130.33 and total fixed cost per hectare was Tk. 9352.08. The total cost of boro rice per hectare was Tk. 95482.41. The gross margin of boro rice per hectare was estimated as Tk. 19289.7 and net return per hectare was Tk. 9937.62. The benefit cost ratio of boro rice was 1.10 which means that by investing Tk. 1.00, farmers would earn Tk. 1.10 in return. Table 4.16 also shows that the total gross return per hectare of jute is Tk.136701.5, total variable cost per hectare is Tk. 80649, fixed costs per hectare is Tk. 9260.82. The total cost per hectare of jute was estimated at Tk. 89909.82. Gross margin per hectare of jute was estimated at Tk. 56052.5 and net return per hectare was Tk. 46791.68. The benefit cost ratio of jute was 1.52 which means that by investing Tk. 1.00, farmers would earn Tk. 1.52 in return. It was clear from table 4.16 that jute production earned higher gross return and net return than boro rice per hectare.

Table 4.16. Profitability of per hectare boro rice and jute production

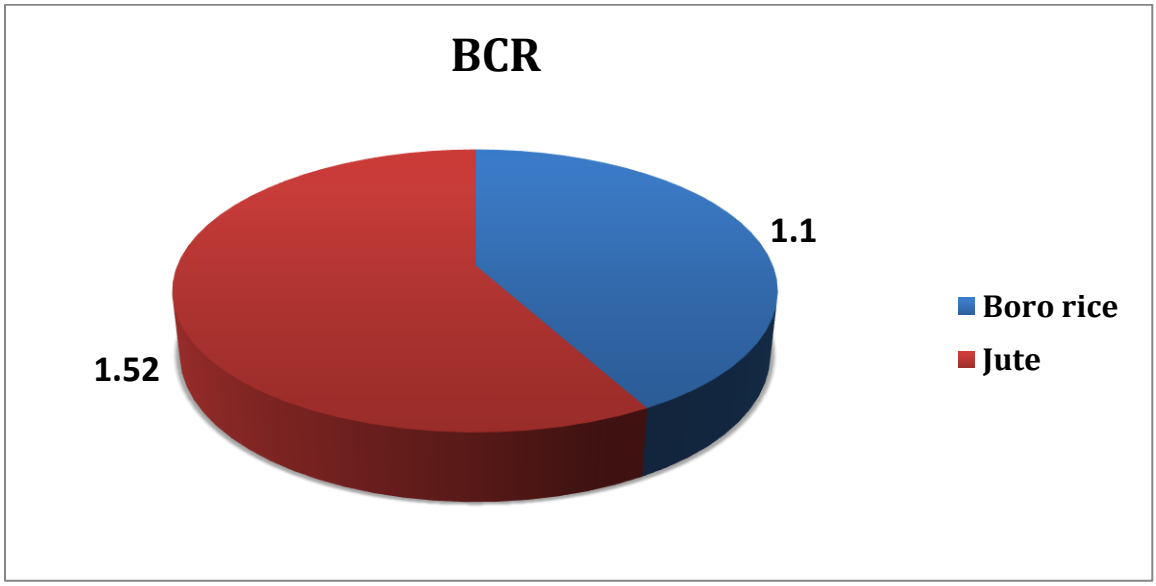
Items	Boro rice (Tk.)	Jute (Tk.)
A. Gross Return	105420.03	136701.5
B. Total Variable Cost	86130.33	80649
C. Total Fixed Cost	9352.08	9260.82
D. Total Cost	95482.41	89909.82
E. Gross Margin (A-B)	19289.7	56052.5
F. Net Return (A-D)	9937.62	46791.68
G. BCR (A/D)	1.10	1.52

(Source: Field survey, 2019)



(Source: Field survey, 2019)

Figure 4.2. Per hectare gross and net returns from boro rice and jute production



(Source: Field survey, 2019)

Figure 4.3. Benefit- Cost Ratio of boro rice and jute.

4.3 Factors affecting the profitability of boro rice and jute production

Cobb-Douglas production function model was chosen to determine the effects of different inputs on the profitability of boro rice and jute production 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.

4.3.1 Estimation of boro rice and jute production function

Cobb-Douglas production function model was chosen to determine the effects of different inputs for the production of boro rice and jute because of its best fit and significant effects of using various inputs on returns from boro rice and jute cultivation. The estimated values of co-efficient and related statistics were shown in Table 4.17.

4.3.2 Interpretation of the results

Seven variables such as human labor cost, power tiller cost, seed cost, fertilizer cost, pesticide cost, manure cost and irrigation cost 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.

4.3.3 Human labor cost (X_1)

Table 4.17 shows that the regression coefficient of human labor cost for boro rice is -0.107 which is negative and significant at 5% level. It indicates that considering all other factors constant, 1% increase in the cost of human labor would decrease gross return by 0.107%. Table 4.17 also shows that the regression coefficient of human labor cost for jute is -0.021 which is

negative and significant at 5% level. It indicates that considering all other factors constant, 1% increase in the cost of human labor would decrease gross return by 0.021%.

Table 4.17. 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	9.51	6.018	6.057	4.932
Human Labor Cost (X_1)	-0.107**	-1.202	-0.021**	-1.235
Power tiller Cost (X_2)	0.025***	1.562	-0.015**	-3.75
Seed Cost (X_3)	0.109***	2.595	0.361***	2.074
Fertilizer Cost (X_4)	0.136**	2.566	0.067**	1.914
Pesticide Cost (X_5)	0.171	1.266	0.072	1.469
Manure Cost (X_6)	0.325	3.869	0.258	1.697
Irrigation Cost (X_7)	-0.042**	-0.807	-	-
R^2	0.791		0.783	
Adjusted R^2	0.723		0.742	
F-value	17.29***		19.88**	

(Source: Field survey, 2019)

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

4.3.4 Power tiller cost (X_2)

Table 4.17 shows that the regression coefficient of power tiller cost for boro rice is 0.025 which is positive and significant at 1% level. It indicates that considering all other factors constant, 1% increase in the cost of power tiller would increase gross return by 0.025%. Table 4.17 also shows that the regression coefficient of power tiller cost for jute is -0.015 which is negative and significant at 5% level. It indicates that considering all other factors constant, 1% increase in the cost of power tiller would decrease gross return by 0.015%.

4.3.5 Seed cost (X_3)

Table 4.17 shows that the regression coefficient of seed cost for boro rice is 0.109 which is positive and significant at 1% level. It indicates that considering all other factors constant, 1% increase in the cost of seed would increase gross return by 0.109%. Table 4.17 also shows that the regression coefficient of seed cost for jute is 0.361 which is positive and significant at 1% level. It indicates that considering all other factors constant, 1% increase in the cost of seed would increase gross return by 0.361%.

4.3.6 Fertilizer cost (X_4)

Table 4.17 shows that the regression coefficient of fertilizer cost for boro rice is 0.136 which is positive and significant at 5% level. It indicates that considering all other factors constant, 1% increase in the cost of fertilizer would increase gross return by 0.136%. Table 4.17 also shows that the regression coefficient of fertilizer cost for jute is 0.067 which is positive and significant at 5% level. It indicates that considering all other factors constant, 1% increase in the cost of fertilizer would increase gross return by 0.067%.

4.3.7 Pesticide cost (X_5)

Table 4.17 shows that the regression coefficient of pesticide cost for both boro rice and jute is 0.171 and .072 respectively which are positive but insignificant. This indicates that pesticide cost had no significant effect on the gross return of boro rice and jute.

4.3.8 Manure cost (X_6)

Table 4.17 shows that the regression coefficient of manure cost for boro rice is 0.325 which is positive but insignificant. Table 4.17 also shows that the regression coefficient of manure cost for jute is 0.258 which is positive but insignificant. This indicates that manure cost had no significant effect on the gross return of boro rice and jute.

4.3.9 Irrigation cost (X_7)

Table 4.17 shows that the regression coefficient of irrigation cost for boro rice is -0.042 which is negative and significant at 5% level. It indicates that considering all other factors constant, 1% increase in the cost of irrigation would decrease gross return by 0.042%.

4.3.10 Overall performance of the model (R^2, adjusted R^2 and F value)

The coefficient of determination (R^2) is the summary of how well the sample regression line fits the data. Table 4.17 shows that the R^2 value for boro rice and jute is 0.791 and 0.783 which means that 79.1% and 78.3% 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 0.723 and 0.742 for boro rice and jute respectively. This means that after taking into account the degrees of freedom (df), independent variables in the model still explained 72.3% and 74.2% of the variation in the gross return of boro rice and jute respectively. The F value for boro rice was found 17.29 which were highly significant at 1% level indicating the good fit of the model (Table 4.17). The F value for jute was found 19.88 which were highly significant at 5% level indicating the good fit of the model (Table 4.17).

4.3.11 Elasticity of production (Ep)

The elasticity of production function is defined as the percentage change in output in relation to the percentage change in input. The coefficients of the various inputs of boro rice and jute production functions show the elasticity of the respective production function which 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 4.18. It was obvious from Table 4.18 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 4.18. Elasticity of production and return to scale

Inputs	Boro Rice	Jute	Remarks
Human Labor cost	-0.107	-0.021	Inelastic
Power tiller Cost	0.025	-0.015	Inelastic
Seed Cost	0.109	0.361	Inelastic
Fertilizer Cost	0.136	0.067	Inelastic
Pesticide Cost	0.171	0.072	Inelastic
Manure Cost	0.325	0.258	Inelastic
Irrigation Cost	-0.042	-	Inelastic
Return to Scale ($\sum b_i$)	0.617	0.722	Decreasing return to scale

(Source: Field survey, 2019)

4.3.12 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 4.18 shows that the return to scale for boro rice and jute is 0.617 and 0.722 respectively which is less than 1. It was obvious that both boro rice and jute had decreasing return to scale. It implied that both boro rice and jute farmers were operating in the rational zone of production (stage 2). It implies that an increase in all the variables would lead to a less than proportional increase in gross return. From Table 4.18 it was obvious that if all the variables were increased by 1%, the gross return of boro rice and jute would increase by 0.617% and 0.722% respectively.

4.4 Problems faced by the Boro Rice and Jute farmers

There were many problems in the study area that affected production as well as profitability of boro rice and jute production. Farmers were asked about the important problems they face often during production of boro rice and jute production. Those problems were then ranked and arranged in order based on the priority of the problem. The problems faced by the respondents of boro rice and jute farmers which were arranged in descending order are shown in Table 4.19.

Table 4.19. Rank order of the problems faced by boro rice and jute growers

Problems	Boro rice		Jute	
	Percent	Rank	Percent	Rank
a. High input cost	91.57	1	92.41	1
b. Shortage of labor and high wage rate	82.38	2	87.73	2
c. Low price of output	79.61	3	70.06	4
d. Lack of storage facilities	75.49	4	74.28	3
e. Lack of capital	64.53	5	68.31	5
f. High irrigation cost	61.42	6	48.94	10
g. High transportation cost	59.46	7	66.49	6
h. Poor agronomic practice	51.62	8	50.26	9
i. Attack of pests	50.27	9	54.82	7
j. Natural disaster	43.86	10	52.57	8
k. Lack of extension service	40.57	11	45.64	11

(Source: Field survey, 2019)

Table 4.19 shows that 'high input cost' ranks first for producing both boro rice (91.57%) and jute (92.41%). 'Shortage of labor and high wage rate' was ranked as second for both boro rice (82.38%) and jute (87.73%) production. Table 4.19 also shows that the top five major problems for boro rice and jute production are 'high input cost', 'shortage of labor and high wage rate', 'low price of output', 'lack of storage facilities' and 'lack of capital'. Other problems which were also found for producing boro rice and jute were 'high irrigation cost', 'high transportation cost', 'poor agronomic practice', 'attack of pests', 'natural disaster' and 'lack of extension service'.

CHAPTER- 5

SUMMARY, CONCLUSION AND RECOMMENDATIONS

In this chapter, major findings, conclusion and policy recommendations are highlighted. The findings and observation of both boro rice and jute growers on various issues related to the production like costs, returns and profitability along with the socio-economic condition of farmers are presented briefly in this chapter.

5.1 Summary

Bangladesh is a developing country with mostly an agro-based economy. The agricultural sector contributes 14.23% to the country's total GDP and it remains the largest employment sector in Bangladesh economy with about 40.6% of the labor force engaged in agriculture. Rice production is one of the main sources of revenue for the country's economy whereas jute and jute goods are one of the major export earners of agricultural sector in Bangladesh. Bangladesh is the 4^{th} top rice producing country around the world. Rice division contributes one-portion of the rural GDP and one-sixth of the national salary in Bangladesh. Almost all of the 15 million farm families of the country grow rice. On the other hand, jute is a major cash crop for over three million small farm households, the largest industry, producing about one-third of manufacturing output, and the largest agricultural export commodity in Bangladesh. Bangladesh is appraised second in the generation of jute fiber around the world. Because of the high financial significance of rice and jute, the present examination entitled "A comparative economic analysis on profitability of boro rice and jute production in Rajoir upazila of Madaripur district" was endeavored to explore the relative good position of producing boro rice and jute. The present study had some specific objectives like analyzing the socio-economic characteristics, identifying major problems and comparing profitability of boro rice and jute producing farmers.

Keeping the objectives in mind, the present study was carried out in four villages namely Isibpur, Badarpasha, Kabirajpur and Hossainpur under Rajoir upazila of Madaripur district. Required data were collected through field survey by interviewing the jute and boro rice growers. In total 80 farmers were randomly selected in which 40 were boro rice farmers and 40 were jute farmers. The data were collected by the researcher herself during March-April 2019. Then all the collected data was stored and scrutinized. The Cobb-Douglas production function was used to analyze the effects of the independent variable on the dependent variable.

Firstly, the socio-economic condition of farmer was analyzed. Different characteristics of farmer like- age, gender, marital status, education, family size, occupation, farming experience and farm holdings were taken under consideration during analyzing the socio-economic condition of farmers. It was seen that majority of boro rice growers (37.5%) fell into 51 to 60 years age group where majority of jute growers (32.5%) were between 41-50 years age group. All the boro rice and jute farmers were found male. Majority of boro rice growers (95%) and jute growers (92.5%) were found married. The study revealed that majority of farmers of both boro rice (42.5%) and jute (47.5%) had primary level education and boro rice farmers (25%) were more illiterate in number than jute farmers (15%). Moreover, most of the boro rice growers (52.5%) and jute growers (62.5%) were found to have 6-8 members in their family. Most of the respondents (81.25%) were found to have agriculture as their main source of occupation. The study revealed that most of the farmers of boro rice (37.5%) and jute (42.5%) had 21-30 years of farming experience. Additionally, it was also found in the study that farmer of boro rice (57.5%) having small farm was higher than jute (47.5%)

Costs and returns were estimated to find out the profitability of boro rice and jute production in the study area. Several variable input cost like- human labor, power tiller, animal and mechanical labor, seed, fertilizer, manure, pesticide and irrigation cost was computed for boro rice and jute production. The human labor cost was found as the most important factor because it had the highest percentage of total cost. Human labor cost per hectare for boro rice and jute was Tk. 43353.2 (45.40%) and Tk. 63175(70.26%). Per hectare seed cost for boro and jute was Tk. 2281.2 and Tk. 1425 respectively. Fertilizer cost per hectare for boro rice and jute was Tk. 11222.8 and Tk. 4248 respectively. Power tiller cost per hectare was found to be Tk. 6175 and Tk. 7175 respectively. Animal labor cost was Tk. 1000 for per hectare boro rice production. Per hectare pesticide cost was estimated as Tk. 1800 and Tk. 660 for boro rice and jute respectively. Transportation cost for jute was Tk. 2100 for carrying jute after harvest. Manure cost per hectare was Tk. 846.88 and Tk. 1866 for boro rice and jute production. Irrigation cost per hectare was found Tk. 14820 for boro rice production. Land use cost per hectare for both boro rice and jute was fixed and it was Tk. 7916.67. Interest on operating capital for per hectare boro rice and jute was Tk. 1435.4 and Tk. 1344.15 respectively. The average per hectare cost for boro rice and jute was Tk. 95482.41 and Tk. 89909.82 for boro rice and jute respectively.

The average per hectare yield of boro rice was 5634.33kg which was valued at Tk. 90600.03 and jute was 2270kg which was valued at Tk. 121331.5. The total gross return of jute per hectare (Tk. 136701.5) was higher than boro rice (Tk. 105420). Gross margin per hectare for jute (Tk. 56052.5) was found higher than boro rice (Tk. 19289.7). Net return from jute was Tk. 46791.68 which was also higher than boro rice that was Tk. 9937.62. The benefit cost ratio of jute was 1.52 which was also higher than boro rice that was 1.10. From this above results, it was found that jute was more profitable than boro rice in the study area.

In this study, Cobb-Douglas production function model was used to determine the effects of independent variables on the gross return or output from boro rice and jute. The independent variables that was considered was human labor cost, power tiller cost, seed cost, fertilizer cost, manure cost and pesticide cost. From the result, it was found that power tiller, seed and fertilizer showed positive and significant effect where human labor and irrigation showed negative but significant effect on gross return of boro rice. Pesticide and manure showed insignificant effect on gross return of boro rice production. In case of jute seed and fertilizer showed positive and significant effect where human labor and power tiller showed negative but significant effect on gross return of jute production. Pesticide and manure showed insignificant effect on gross return of jute production. The R^2 value for boro rice and jute was 0.791 and 0.783 which means that 79.1% and 78.3% 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 0.723 and 0.742 for boro rice and jute respectively. This means that after taking into account the degrees of freedom (df), independent variables in the model still explained 72.3% and 74.2% of the variation in the gross return of boro rice and jute respectively. The F value for boro rice was found 17.29 which were highly significant at 1% level indicating the good fit of the model. The F value for jute was found 19.88 which were highly significant at 5% level indicating the good fit of the model. The elasticity of production was estimated for some inputs and it was found that all inputs were individually inelastic both for boro rice and jute production. The return to scale for boro rice and jute production was 0.617 and 0.722 respectively which was less than 1. It was obvious that both boro rice and jute had decreasing return to scale. It implied that both boro rice and jute farmers were operating in the rational zone of production (stage II). In this case, if all the variables specified in the production function were increased by 1%, gross returns would decrease by 0.617% and 0.722% for boro rice and jute respectively.

The present study identified some problems faced by the farmers in the study area. The top five major problems were high input cost, shortage of labor and high wage rate, low price of output, lack of storage facilities and lack of capital.

5.2 Conclusion

The present study was conducted to compare the profitability of the boro rice and jute growers. The socio-economic characteristics of the farmer revealed that majority of the farmers of both boro rice and jute had primary level of education and boro rice farmers were more illiterate in number than jute farmers. It was found that most of the farmers of boro rice and jute had 21-30 years of farming experience. Additionally, it was also found in the study that the percentage of farmers of boro rice having small farm was higher than jute. The study also revealed that the gross return, net return and gross margin of jute was higher than boro rice. Furthermore, the benefit cost ratio of jute was found higher than boro rice. The result revealed that jute was more profitable than boro rice in the study area. The top five major problems found in the study were high input cost, shortage of labor and high wage rate, low price of output, lack of storage facilities and lack of capital.

5.3 Recommendations

The following recommendations can be suggested to overcome the constraints of boro rice and jute cultivation faced by the farmers.

a. Majority of the respondents reported that costs of inputs of producing boro rice and jute were high. For this reason, they could not provide the recommended dose of inputs during plantation of boro rice and jute. Government should provide all possible help to supply required amount of inputs and capital to the farmers. Inputs like seed, fertilizer and insecticides should be provided at subsidized rate.
b. Majority of farmers reported that labor was scarce in the rural area as they are gathering in Dhaka city and other urban areas for more earning. As a result, the wage rate was high which made the cultivation cost high. Government can take initiatives to make the rural sector more attractive to reduce the migration of labor. If the availability of labor in rural area becomes high, the wage rate will automatically reduce.
c. Many farmers reported that they did not receive fair price of the output. To ensure the fair price and control fluctuation of price of boro rice and jute, the government should intervene in the procurement and marketing process of boro rice and jute. Government should take action against stock keepers.
d. Farmers had to sell their produce at low price to middleman because they had no storage facilities. Government can make storehouse in rural areas near farmers field which may help them to store their produce during off season and sell it when they get reasonable price.
e. Many farmers faced the problem of lack of capital. For this reason, they could not provide the recommended dose of inputs during plantation of boro rice and jute. Government can encourage private banks to provide loan at low interest rate to farmers.
f. The high irrigation cost was another problem faced by the farmers. This is due to high electricity bill and fuel cost. Government can give subsidy on the electricity and fuel cost on the agricultural sector by reducing the charge.
g. Many farmers also faced the problem of high transportation cost. Unfavorable roads and transportation system was the reason for this high cost. More infrastructure development like building new and construction of poor road and culvert can reduce the problem.

h. Farmers had lack of knowledge on modern agronomic practice. The agricultural extension officers should provide more training and information by field visit, arranging agricultural program. They can encourage farmers to apply new technologies and new method of cultivation by demonstrating directly to the farmers and telling the benefits of it.
i. Government should arrange more programs about controlling pest infestation by providing information about effective method of application of pesticide.

5.4 Scope for further research

This present study provides useful information for farmers, researchers and policy makers. However, there were some limitations of time, fund and resources. For this reason, researcher had to consider small sample size. The researcher could not represent any generalized view of economic analysis on profitability of boro rice and jute production. Thus, further research can be undertaken by considering more sample size and make a generalized comment on this sector.

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APPENDICES

APPENDIX- I

English Version of the Interview Schedule of boro rice

Department of Agribusiness and Marketing

Sher-e-Bangla Agricultural University

Sher-e- Bangla Nagar, Dhaka-1207

Interview Schedule on

"**A COMPARATIVE ECONOMIC ANALYSIS ON PROFITABILITY OF BORO RICE AND JUTE PRODUCTION IN RAJOIR UPAZILA OF MADARIPUR DISTRICT"**

Name of the crop: Boro rice Sample no ……..

Study area:

Village …… Upazilla……. District ……

Respondent name: ……

A. Socio economic information

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

   a. Male b. Female

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

   a. Married b. Unmarried c. Widow/widower

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

   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 option)

   a. Illiterate b. Primary c. S.S.C d. H.S.C e. Graduate/Post Graduate

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

a. 01-10 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 occupational sources

Please put (√) on your occupational source:

Occupation	Main	Subsidiary
Agriculture		
Business		
Service		
Rickshaw or van pulling		
Wage labor		

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

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

B. Profitability analysis of Boro rice production

1. 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				

2. Per hectare material inputs used

Various Inputs	Quantity	Unit price (Tk.)	Total (Tk.)
Seed			
Fertilizer			
Urea			
TSP			

MOP			
Manure			
Pesticide			
Animal labor			
Power tiller			
Thresher			
Irrigation			

3. Land use information

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

4. Profitability situation of Boro rice

Sources of income	Quantity (maunds)	Price (Tk./maunds)	Total income (Tk.)
Main product			
Rice straw			

C. Problems in boro rice production and marketing

Problems	Put (√) if you agree
a. Low price of output	
b. Shortage of labor high wage rate	
c. High transportation cost	
d. High input cost	
e. High irrigation cost	
f. Lack of extension service	
g. Lack of storage facilities	
h. Poor agronomic practice	
i. Natural disaster	
j. Attack of pests	
k. Financial constraints	

Date ……..

Name of the 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 COMPARATIVE ECONOMIC ANALYSIS ON PROFITABILITY OF BORO RICE AND JUTE PRODUCTION IN RAJOIR UPAZILA OF MADARIPUR DISTRICT"**

Name of the crop: Jute Sample no ……..

Study area:

Village …… Upazilla……. District ……

Respondent name: ……

A. Socio economic information

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

   a. Male b. Female

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

   a. Married b. Unmarried c. Widow/widower

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

   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 option)

   a. Illiterate b. Primary c. S.S.C d. H.S.C e. Graduate/Post Graduate

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

   a. 01-10 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 occupational sources

Please put (√) on your occupational source:

Occupation	Main	Subsidiary
Agriculture		
Business		
Service		
Rickshaw or van pulling		
Wage labor		

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

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

B. Profitability analysis of jute production

1. Human labor requirement (man/day)

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

2. Per hectare material inputs used

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

Pesticide			

3. Land use information

Name of the crop	Land area under cultivation (decimals)	Rental price (Tk.)
Jute		

4. Profitability situation of jute

Sources of income	Quantity (maunds)	Price (Tk./maunds)	Total income (Tk.)
Jute fiber			
Jute stick			

C. Problems in jute production and marketing

Problems	Put (√) if you agree
a. Low price of output	
b. Shortage of labor high wage rate	
c. High transportation cost	
d. High input cost	
e. High irrigation cost	
f. Lack of extension service	
g. Lack of storage facilities	
h. Poor agronomic practice	
i. Natural disaster	
j. Attack of pests	
k. Financial constraints	

Date ……..

Name of the interviewer ……..

APPENDIX-III

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

Socio-economic analysis output from SPSS for Boro rice

Frequencies

		Age Groups	Gender	Marital status	Education status	Family size	Main Occupation	Subsidiary Occupation	Farming experience	Farm Size
N	Valid	40	40	40	40	40	40	24	40	40
	Missing	0	0	0	0	0	0	16	0	0

Frequency Table

Age Groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-30	3	7.5	7.5	7.5
	31-40	7	17.5	17.5	25.0
	41-50	11	27.5	27.5	52.5
	51-60	15	37.5	37.5	90.0
	61 and above	4	10.0	10.0	100.0
	Total	40	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	40	100.0	100.0	100.0

Marital status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	38	95.0	95.0	95.0
	Unmarried	1	2.5	2.5	97.5
	Widow/ Widower	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

Education status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Illiterate	10	25.0	25.0	25.0
	Primary	17	42.5	42.5	67.5
	Secondary	10	25.0	25.0	92.5
	Higher Secondary	3	7.5	7.5	100.0
	Total	40	100.0	100.0	

Family size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-5	15	37.5	37.5	37.5
	6-8	21	52.5	52.5	90.0
	8-18	4	10.0	10.0	100.0
	Total	40	100.0	100.0	

Main Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agriculture	31	77.5	77.5	77.5
	Business	6	15.0	15.0	92.5
	Service	3	7.5	7.5	100.0
	Total	40	100.0	100.0	

Subsidiary Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agriculture	9	22.5	37.5	37.5
	Business	9	22.5	37.5	75.0
	Wage labor	5	12.5	20.8	95.8
	Rickshaw / van pulling	1	2.5	4.2	100.0
	Total	24	60.0	100.0	
Missing	System	16	40.0		
Total		40	100.0		

Farming experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-10	3	7.5	7.5	7.5
	11-20	11	27.5	27.5	35.0
	21-30	15	37.5	37.5	72.5
	31-40	7	17.5	17.5	90.0
	41-60	4	10.0	10.0	100.0
	Total	40	100.0	100.0	

Farm Size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Small farmers	23	57.5	57.5	57.5
	Medium farmers	13	32.5	32.5	90.0
	Large farmers	4	10.0	10.0	100.0
	Total	40	100.0	100.0	

Socio-economic analysis output from SPSS for Jute

Frequencies

		Age Groups	Gender	Marital status	Education status	Family size	Main Occupation	Subsidiary Occupation	Farming experience	Farm Size
N	Valid	40	40	40	40	40	40	26	40	40
	Missing	0	0	0	0	0	0	14	0	0

Frequency Table

Age groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	21-30	2	5.0	5.0	5.0
	31-40	5	12.5	12.5	17.5
	41-50	13	32.5	32.5	50.0
	51-60	11	27.5	27.5	77.5
	61 and above	9	22.5	22.5	100.0
	Total	40	100.0	100.0	

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	40	100.0	100.0	100.0

Marital status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	37	92.5	92.5	92.5
	Unmarried	2	5.0	5.0	97.5
	Widow/widower	1	2.5	2.5	100.0
	Total	40	100.0	100.0	

Education status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Illiterate	6	15.0	15.0	15.0
	Primary	19	47.5	47.5	62.5
	Secondary	13	32.5	32.5	95.0
	Higher Secondary	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

Family size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	32.5	32.5	32.5
	2	25	62.5	62.5	95.0
	3	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

Main Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agriculture	34	85.0	85.0	85.0
	Business	4	10.0	10.0	95.0
	Service	2	5.0	5.0	100.0
	Total	40	100.0	100.0	

Subsidiary Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agriculture	6	15.0	23.1	23.1
	Business	14	35.0	53.8	76.9
	Service	2	5.0	7.7	84.6
	Wage labor	4	10.0	15.4	100.0
	Total	26	65.0	100.0	
Missing	System	14	35.0		
Total		40	100.0		

Farming experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-10	2	5.0	5.0	5.0
	11-20	9	22.5	22.5	27.5
	21-30	17	42.5	42.5	70.0
	31-40	9	22.5	22.5	92.5
	41-60	3	7.5	7.5	100.0
	Total	40	100.0	100.0	

Farm Size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Small farmers	19	47.5	47.5	47.5
	Medium farmers	16	40.0	40.0	87.5
	Large farmers	5	12.5	12.5	100.0
	Total	40	100.0	100.0	

APPENDIX- IV

Summary output of Cobb- Douglas production function of boro rice and jute

Cobb-Douglas production function output from SPSS for Boro rice

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	lnX1, lnX2, lnX3, lnX4, lnX5, lnX6, lnX7[b]	.	Enter

a. Dependent Variable: lnY

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.889[a]	.791	.723	1.01445

a. Predictors: (Constant), lnX1, lnX2, lnX3, lnX4, lnX5, lnX6, lnX7

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1585.014	7	226.431	17.293	.006[b]
	Residual	419.019	32	13.094		
	Total	2004.033	39			

a. Dependent Variable: lnY

b. Predictors: (Constant), lnX1, lnX2, lnX3, lnX4, lnX5, lnX6, lnX7

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.510	1.580		6.019	.004
	lnX1	-.107	.089	.106	-1.202	.035
	lnX2	.025	.016	.018	1.562	.001
	lnX3	.109	.042	.131	2.595	.008
	lnX4	.136	.053	.052	2.566	.031
	lnX5	.171	.135	.019	1.266	.325
	lnX6	.325	.084	.153	3.869	.427
	lnX7	-.042	.052	-.031	-.807	.026

a. Dependent Variable: lnY

Cobb-Douglas production function analysis for Jute

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	lnX1, lnX2, lnX3, lnX4, lnX5, lnX6[b]	.	Enter

a. Dependent Variable: lnY

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.885[a]	.783	.742	2.03722

a. Predictors: (Constant), lnX1, lnX2, lnX3, lnX4, lnX5, lnX6

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1849.531	6	308.255	19.878	.025[b]
	Residual	511.733	33	15.507		
	Total	2361.264	39			

a. Dependent Variable: lnY

b. Predictors: (Constant), lnX1, lnX2, lnX3, lnX4, lnX5, lnX6

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	6.057	1.228		4.932	.006
	lnX1	-.021	.017	-.014	-1.235	.018
	lnX2	-.015	.004	-.013	-3.750	.037
	lnX3	.361	.174	.254	2.074	.004
	lnX4	.067	.035	.028	1.914	.046
	lnX5	.072	.049	.037	2.057	.285
	lnX6	.258	.152	.125	1.697	.372

a. Dependent Variable: lnY