

**IMPACT OF CREDIT RATIONING ON RICE PRODUCTIVITY IN
BANGLADESH**

BY

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BANGLADESH**

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This is to certify that thesis entitled, “**Impact of Credit Rationing on Rice Productivity in Bangladesh**” submitted to the Department of Agricultural Finance and Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **Master of Science in Agricultural Finance and Management**, embodies the result of a piece of Bonafede research work carried out by **Umaiya Khanam**, Registration **No. 21-010012** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

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**Dedicated
to my
beloved parents**

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LIST OF ABBREVIATION AND ACRONYMS

DAE	= Department of Agricultural Extension
HYVs	= High Yielding Varieties
BRKB	= Bangladesh Rice Knowledge Bank
BADC	= Bangladesh Agricultural Development Corporation
BARI	= Bangladesh Agricultural Research Institute
BBS	= Bangladesh Bureau of Statistics
BKB	= Bangladesh Krishi Bank
cm	= Centimeter
CDP	= Crop Diversification Programmers
DAM	= Department of Agricultural Marketing
<i>et al.</i>	= et alia (and others)
etc.	= et cetera
gm	= Gram
GOEP	= Government of East Pakistan
ha.	= Hectare
HYV	= High Yielding Varieties
i.e.	= That is
Kg	= Kilogram
m. tons	= Metric Tons
MS	= Master of Science
No.	= Number
pp.	= Pages
Tk.	= Taka (Bangladeshi currency)
USDA	= United States Department of Agriculture

Impact of Credit Rationing on Rice Productivity in Bangladesh

ABSTRACT

Bangladesh, a predominantly agricultural country, has a significant agricultural sector that contributes 11.22% of the country's GDP. This study aims to investigate socio-economic characteristics of *Boro* rice growers, factors influencing credit rationing, and the effect of credit rationing on *Boro* rice productivity in Kushtia district, one of the highest rice producing upazilas in the country. The study used a simple random sample strategy and a field survey to gather data on rice production and agricultural credit use. About 210 households were selected as sample households, with 120 farmers being credit constrained and 90 farmers unconstrained. The data was analyzed using descriptive statistics and a logit model with marginal impact. The Cobb-Douglas production function was used to assess the contribution of agricultural credit rationing to *Boro* rice production. Among the sample population, 22.40% of farmers were aged 0-35 years, 29.50% were 36-45 years, and 48.10% were above 46 years. Notably, 74.30% of the farmers' spouses were 0-35 years old, 17.10% were 36-45, and 8.60% were above 46. Educationally, 22.40% of the farmers were illiterate, 27.60% had primary education, 21% had secondary education, and 20% had higher secondary education. In contrast, 24.80% of the spouses were illiterate, 27.60% had primary education, 3.80% had secondary education, and 16% had higher secondary education. Land possession classified 7.10% of farmers as small, 59.50% as medium, and 33.30% as large. Financially, 21% of farmers had annual savings between BDT 100,000 and 50,000, while 75.70% saved more than BDT 50,000 annually, and 3.30% saved less than BDT 10,000. Agriculture was the primary income source for 90.50% of farmers, with only 9.50% relying solely on agriculture. Key determinants of credit rationing were identified, including age (coefficient 0.197, $p=0.013$), farm size (coefficient 0.703, $p=0.095$), and distance to the bank (coefficient 0.280, $p=0.000$). The model explained 52.5% of the variability in credit rationing outcomes. Credit rationing significantly impacted yield, with fertilizer cost (coefficient 0.845, $p<0.001$) being a crucial factor, while credit rationing itself negatively affected yield (coefficient -0.087, $p=0.001$). The study highlights critical constraints such as high collateral requirements (99.50% concern), distant financial institutions (100% concern), and fear of loan repayments (98.60% concern). Additionally, 89.50% of farmers acknowledged liquidity issues, and 100% linked credit constraints to technology adoption. These findings suggest a need for improved credit policies and support systems to enhance *Boro* rice production and alleviate financial constraints for farmers in Kushtia district.

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CHAPTER 1

INTRODUCTION

1.1 Background of the study

Bangladesh is largely an agricultural country. Agriculture is 163.65 million people's main source of food. The BBS report 2023 states that during the fiscal year FY 2021–2022, the agriculture sector contributed 11.22 % of the country's GDP, with an agricultural GDP growth rate of 2.61 %. The economy's single greatest producing sector is agriculture. Furthermore, this industry employs roughly 37.09 % of all workers (BBS, 2023). The country's GDP growth in FY 2021–2022 was 6.03 %, demonstrating a considerable increase despite the Covid-19 pandemic (BBS, 2023). Although the agriculture sector's annual GDP contribution has been gradually declining due to the rise of other productive sectors, particularly textiles and manufacturing, the sector is nevertheless essential to the country's economic development. Currently, the nation's primary source of income and employment, agriculture plays a crucial role in achieving food self-sufficiency, reducing rural poverty, and promoting sustainable economic growth.

In Bangladesh, rice, jute, sugarcane, vegetables, wheat, tea, and maize are the principal crops farmed. Rice production has long been the focus of Bangladeshi farmers (BBS, 2023). Farmers have been more interested in growing import substitute crops like maize, oilseed, pulses, and spices in recent years due to the extensive marketing campaigns for Bangladesh Bank's specialized agricultural credit (SAC) program, which offers farmers a 4 percent interest rate on the aforementioned crops (BBS, 2023). In Bangladesh, over 65% of rural residents earn a living through agriculture, making it a significant source of jobs for those living in remote areas (BBS, 2023). The contribution of agriculture to the GDP of Bangladesh is presented in Figure 1.1.

Bangladesh is the fourth-largest producer of rice in the world, behind China, India, and Indonesia (DAM, 2020). Rice farming is one of Bangladesh's main agricultural industries' revenue streams (Rahman, 2017). As the most important crop in Bangladesh, rice helps the country's population grow while ensuring food security and plays a major role in the country's economy. In Bangladesh, rice is an indispensable item in many spheres of life; for farmers in rural areas, it is their primary source of sustenance.

Bangladesh has made efforts to become a self-sufficient food producer since attaining independence (Rahman, 2017). Government estimates indicate that because of increasing rice output, Bangladesh is currently self-sufficient in food production (Rab, 2017). The use of contemporary, high-yielding rice varieties has made the rise in rice production feasible.

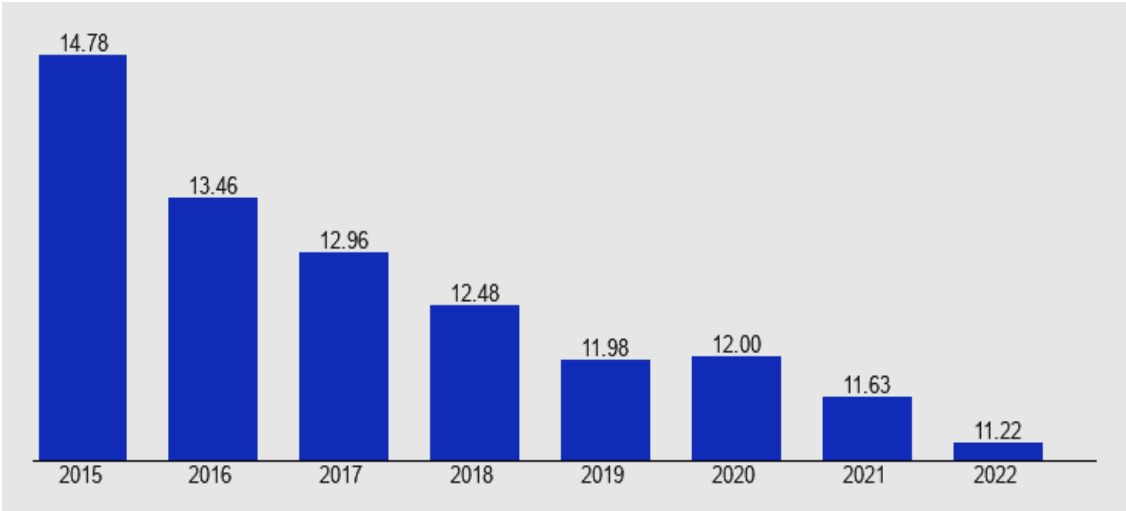


Figure 1.1: Share of agriculture to GDP (%) of Bangladesh

P= provisional (Source: BBS, 2023)

In Bangladesh, rice is the most significant crop due to its higher nutritional value, wider range of applications, and larger output compared to other cereal crops. Rice farming has the potential to improve household income and lessen poverty (Emaga, et al., 2018). Bangladesh has the eighth-highest population in the world (167.2 million), with a population growth rate of 1.37% (BER, 2021) and a density of 1134.54 people per square kilometer (BER, 2021). These factors are driving up the country's daily demand for rice.

Bangladesh's rice production has doubled since attaining independence, according to official figures. Due to the introduction of modern rice-producing technology, the nation's rice production climbed from 10.59 million metric tons in 1971 to 37.4 million metric tons in 2020. This output was result in a 6.9 MMT, 10.29 MMT, and 13.65 MMT increase in 2030, 2040, and 2050, respectively, above the production target of 40.40, 43.80, and 47.20 MMT. Rice production has been discouraged by growing labor and material costs, despite the fact that rice has been more profitable overall in recent years (Papademetriou *et al.*, 2000). Yield and profitability are strongly associated, and higher yields have made rice growing more profitable, especially in Bangladesh after 2005. When making decisions about planting rice, farmers typically compare the expected

returns to the cost of production (Neumann *et al.*, 2010). While this is a very positive development, rising market prices, the high cost of fertilizer, irrigation, seed, and land preparation, along with Bangladeshi rice farmers' accustomed inconsistent revenues, make the industry susceptible to shocks.

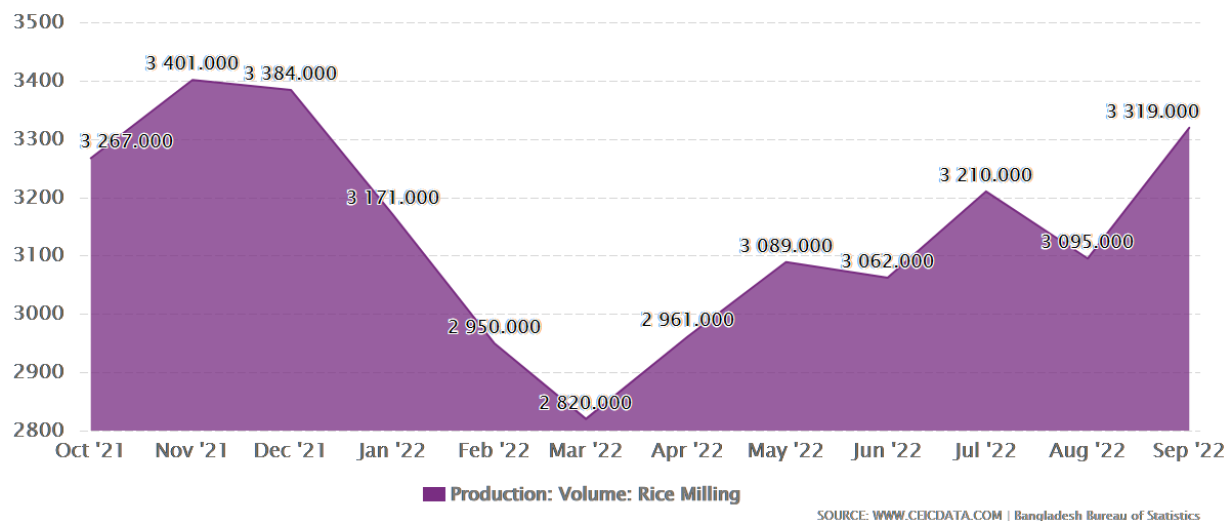


Figure 1.2: Domestic production of rice in Bangladesh (2018- 2022)

Reducing revenue volatility and increasing profitability is a critical first step toward improving the social welfare sustainability of rice production. To design effective policy interventions, it is essential to analyze the costs, yields, profitability, and challenges related to rice cultivation under different agricultural situations, including locations, varieties, input applications, irrigation water sources, and planning dates. These analyses are based on primary and secondary data sources from the statistical yearbook. This study provides a thorough analysis of the socioeconomic characteristics, financial sustainability, and difficulties related to irrigated rice production. It is based on in-depth fieldwork among 100 Bangladeshi rice farmers conducted throughout one season (2022–2023).

1.2 Contribution of rice in our economy

The primary crop in Bangladesh is rice, which contributes around 4% of the country's GDP on its own (BBS, 2022). Like in many other countries, rice provides almost all of "food security" (BRRI, 16). According to government estimations, Bangladesh's food production is currently self-sufficient due to rising rice output (Rab, 2012). Bangladesh

produced 10.59 million tons of rice overall in 1971, while the country's population was just about 70.88 million. But the country is currently producing about 25.0 million tons to feed its 135 million residents. This implies that the rate at which rice output increased surpassed the rate at which the population expanded. The adoption of contemporary rice varieties on roughly 66% of the rice acreage, which accounts for around 73% of the nation's total rice production, has made this enhanced rice production possible. In Bangladesh, the country's population increase and total food grain output are primarily attributable to rice. It follows that Bangladesh's GDP was undoubtedly be among the three fastest expanding in the world between now and 2050. The government has pledged to double the productivity of the agriculture sector, which includes rice, in order to meet the SDG target.

Bangladesh's output is predicted to rise by 36 million metric tons, placing it third in the world's rankings of rice production. The most recent World Agricultural Production report from the US Department of Agriculture (USDA) projects that Bangladesh was produce 36 million metric tons of rice in 2022, with Indonesia producing 34.9 million, India producing 118 million, and China producing 149 million. Rice production has tripled since Bangladesh was set free. Bangladesh came in fourth, Indonesia third, India second, and China first in terms of the world's rice production. Based on this year's projected output of 204.360 lakh metric tons, rice production could rise by 4.5 lakh metric tons. The USDA report said a good weather condition and increased yield due to further cultivation of hybrid and high yield varieties (HYV) lead to increase such production in Bangladesh. Rice is cultivated on 71 percent of the total 1.54 crore hectares of cropland in the country.

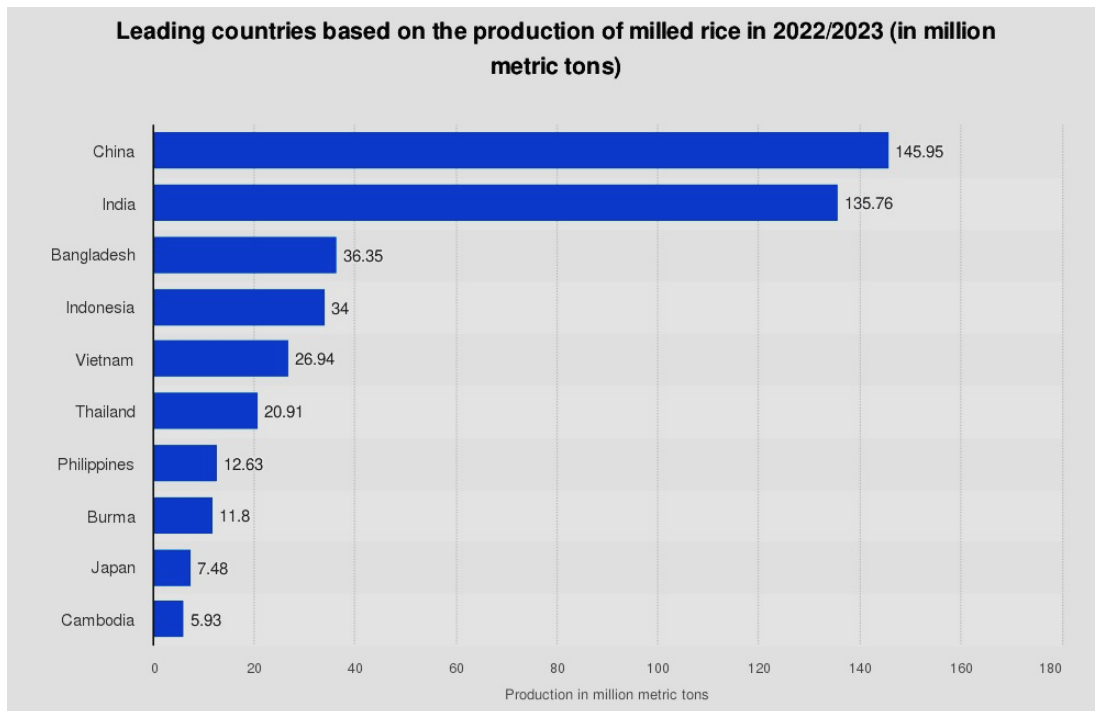


Figure 1.3: Bangladesh's position in rice production (2023)

Source: (BBS, 2023)

1.3 Agricultural credit rationing

Credit is a tool for enabling investment by resolving a liquidity problem. The liquidity issue stems from the fact that investment-related expenses come before (anticipated) future profits. Agricultural credit rationing definitions are similar to those used in financial markets. Farmers have limited access to credit when their credit demand is partially or completely unmet, even if they agree to make higher interest payments. Limiting the amount of credit is a non-price constraint, as credit rationing eliminates the possibility of market equilibrium of credit supply and demand based on price.

Agricultural credit rationing relates to limited credit access for farmers at a price stated by the lenders. Agricultural credit rationing shows mainly in two forms; Farmers receive credit, but to a less extent or they are rejected for a loan. Latruff and Fraser (2002) stated that rural credit rationing occurs if some farmers have limited access to credit or individuals get a loan, but some are restricted in the amount they can borrow. Agricultural credit rationing is divided to

External, in cases when farmers apply for a loan, but do not get it; and

Internal rationing, when farmers due to a various reasons do not apply for a loan, although they wish to.

Further distinguishing of agricultural credit rationing is considering a potential borrower as credit-rationed if his private demand for credit persistently exceeds the loan amount offered by the lender.

Agricultural credit rationing influences farmers' adoption of agricultural technology and, as a result, the drive toward sustainable agricultural intensification, particularly in least developed nations. However, proper credit has the potential to influence agricultural technology adoption (Tadesse, 2014). Farmers' access to adequate financing has an impact on food security, household welfare, and poverty reduction (Reyes and Lensink, 2011). Credit restriction limits farmers' ability to buy farm inputs and make farm-related investments (Reyes and Lensink, 2011). It also influences the risk behavior of farmers (Nielsen *et al.*, 2013). A farmer that is credit rationed was undertake investments in less risky and less productive technologies, rather than in more risky, productive ones (Dercon, 1996). In addition to agricultural productivity, credit rationing could affect rural development by preventing households from taking up off-farm activities, which are critical for structural transformation, and increasing the potential to move out of poverty (Jia *et al.*, 2010).

1.4 Justification of the study

Bangladesh wants to become food self-sufficient by utilizing the appropriate management technology. However, the cost of producing rice is increasing due to the rising cost of inputs, even though the price of the finished product has not kept up with these expenditures. Farmers usually use different amounts of inputs, depending on how profitable it is for them to grow rice. Consequently, resources are often not used efficiently.

Credit is the cornerstone of all economic activity, including agriculture. It is said that removing financial barriers to farming enterprises enables farmers to invest in state-of-the-art methods for farming operations like production, marketing, and storage. One way that the availability of adequate agricultural financing influences crop productivity is through farmers' capacity to obtain modern, essential farm inputs at planting time (Chandio *et al.*, 2017). Moreover, credit has the ability to improve the living conditions of impoverished farmers and help them escape poverty (Saboor *et al.*, 2009). Agricultural

finance is one of the most important components in empowering farmers to increase food security and alleviate poverty by utilizing modern technologies, allocating resources more wisely, and using inputs more economically (WB, 2003).

Nonetheless, the general consensus is that the primary barrier stopping impoverished farmers from realizing their full economic potential is a lack of finance for agricultural initiatives. Rural farmers' limited ability to obtain credit severely restricts their ability to save, invest, create jobs, and engage in other consumption-related activities. However, research on the effects of agricultural credit rationing on the production of agricultural crops has been conducted in Bangladesh rather sparingly. Therefore, this study aims to analyze the influence of credit rationing on rice productivity and also measure the determinant factors of access to credit to indicate potential for increasing rice production by using current production inputs more efficiently and enlighten the limiting factors of access to credit. This paper also suggests to restructure Govt. financial policy and private institutions to minimize the supply and demand gap in terms of credit constraints.

1.5 Objectives of the study

In light of the aforementioned issues, the following particular objectives have been devised to provide the research with correct direction:

- i. To investigate the Socio-economic characteristics of *Boro* rice grower;
- ii. To investigate factors influencing credit rationing;
- iii. To identify effect of credit rationing on *Boro* rice productivity.

1.6 Limitation of the study

Considering the time, money and other necessary resources available to the researcher and to make the study manageable, the researcher had to impose several limitations, including the following:

The researcher had to deal with comparatively modest sample numbers due to time and other resource restrictions.

Only a small number of the numerous traits of rice cultivators were chosen for further examination in this study.

Since the farmers did not keep written records of their on-farm operations throughout the production and selling, the researcher was forced to depend solely on the farmers' recollections for the crucial information.

CHAPTER 2

REVIEW OF LITERATURE

In this chapter, an attempt has been made to review of pertinent literature keeping in view the problem entitled, “Impact of credit rationing on rice productivity in Bangladesh”. Once more, while some of these studies might not be totally pertinent to the current study, the results, analysis techniques, and recommendations made in them have a significant impact on it. A review of a few papers that are pertinent to the current investigations is covered below.

2.1 General studies on rice production

A study on “Resource use efficiency in rice production under SRI and conventional method in Assam, India.” conducted to meet the rising demand for rice, the staple food in Assam, the production of rice has to be increased by many folds. Increasing productivity is the only way to boost production given the shrinking amount of arable land. It has been observed that the System of Rice Intensification (SRI) significantly increases rice yield. Concerning this strategy, though, is whether the state's traditional rice growers will embrace it. Furthermore, a systematic study of SRI's resource use status in Assam has not yet been conducted. The current analysis on SRI resource consumption has demonstrated that more resources are required for the state to produce more rice (Parasar *et al.*, 2016).

A study was conducted by Long (2015) to measure and compare resource use efficiency and relative productivity of farming under Organic rice and Conventional rice production in Mekong Delta of Vietnam. One hundred twenty randomly selected farms, 60 from each system, were surveyed. The study explored differences in efficiency and productivity between production systems. The Cobb-Douglas production function analysis was performed to determine resource utilization efficiency. The regression coefficients for expenditure on seed, organic manure, and bio-fertilizers in organic rice cultivation, as well as expenditure on herbicide and machine labor in conventional rice cultivation, were shown to be significant. For organic rice production, the efficiency of seed, organic manure, machine labor, and bio-fertilizer exceeded one. In traditional rice agriculture, herbicides and machine labor were unused resources. The findings indicated that the number of these resources was less than optimal, and that there is still room for

them to be used more effectively. Other resources were overused, such as human labor and bio-pesticide in organic rice farming, and seed, chemical fertilizer, pesticide, and human labor in conventional rice production.

Devi and Singh (2014) measured the cost and return structure and technical efficiency in rice production has been reported in different regions as well as in the state of Manipur to show different regions have adopted the latest technology. Primary data have been collected from the sample rice farms with the help of pre-tested scheduled through personal interview with farmers. The technical efficiency of individual farms has been calculated using stochastic production function analysis. The entire cost of cultivation on small farms was significantly higher than on larger farms. Imputed rental value for owned land was the most expensive item for all farms. On average, the majority (40%) of rice farmers were operating at a technological efficiency level of (99-100%) in relation to the frontier output level. Gross return and net return per hectare were found to be highest in group I, followed by category II. Most farms have been seen to have the ability to enhance production and productivity, increasing technical efficiency, as the majority has performed with increasing returns to scale.

A study on “Productivity and resource use efficiency of aromatic rice production”. This study was attempted to measure and compare resource use efficiency and relative productivity of farming under different tenure conditions in an area of Bhola district. A random sampling technique was used in the study. Sample farmers were classified as owner, crop share tenant and cash tenant farmers. A total of 90 samples, 30 from each class were selected on the basis of random sampling technique. The study explored the difference in the efficiency and productivity among owner, cash tenant and crop share tenant. Total cash expenses and total gross costs for Aromatic rice production were highest on owner farms and lowest on crop share tenant farms. When individual inputs were considered, it was discovered that expenses for human labor accounted for a significant amount of expenses in the production of Aromatic rice, with owner operators employing more hired labor than other groups. However, cash tenant farmers performed better than owner and crop share tenant farmers. Due to a limited resource basis, crop share renters were unable to invest in contemporary farm inputs. In Bangladesh, share cropping is the most common rental structure, which is inefficient in comparison to cash tenancy (Majumder *et al.*, 2009).

A study was done to compare the profitability and technical efficiency of aromatic BRRI dhan 34 and non-aromatic BR11 rice cultivars transplanted in two adjacent upazilas of Dinajpur District. The study indicated that the yield of BRRI dhan34 was lower than that of BR11 rice. However, the gross return on BRRI dhan34 rice (Tk.82467/ha) is significantly higher than that of BR11 rice (Tk.66455/ha). BRRI dhan 34 had a larger gross margin (Tk.58869/ha) compared to BR11 rice (Tk.39013/ha). BRRI dhan 34 and BR11 rice yielded Tk. 1.87 and Tk. 1.37, respectively, in terms of return on investment (BCR) (Arif, 2008).

A case study was conducted in Chhattisgarh about aromatic rice. Farmers, scientists, legislators, and environmentalists have expressed considerable worry in recent years about the ongoing depletion of genetic diversity of rice cultivars in Chhattisgarh, which has traditionally been renowned as the "bowl of scented rice" in central India. Given India's potential competitiveness in the global aromatic rice market, it is critical to understand the dynamics of domestic aromatic rice commerce. This study investigates the marketing and price-spread trends of aromatic rice in the state of Chhattisgarh. Several policy interventions have been proposed to promote aromatic rices in the state (Dinesh *et al.*, 2007).

A study was undertaken on the "Economic efficiency and competitiveness of Pakistan's rice production systems in Punjab". The findings suggest that increasing Basmati rice production could result in an increase in exports. The production of IRRI in Pakistan's Punjab province is marked by a lack of economic efficiency, meaning an inefficient use of resources to manufacture the product. According to the investigation, the current incentive structure has a negative impact on farmers. A negative difference between private and societal profits indicates that the net effect of governmental intervention is to diminish the farm level profitability of both rice production systems in Punjab (Akhtar *et al.*, 2007).

A study was conducted on "Economic and financial profitability of aromatic and fine rice production in Bangladesh". The study used primary and secondary data to assess the economic and financial viability of aromatic and fine rice farming. Domestic Resource Cost (DRC) ratios revealed that Bangladesh had a comparative advantage in producing aromatic and fine rice, both in terms of export and import substitution, with the exception of the Nizershail variety, which was marginally unprofitable under the export proposition. The study also revealed some of the challenges farmers encounter while

growing aromatic and fine rice. Lastly, certain policy guidelines were proposed (Anik and Talukder, 2003).

The growth rates of yield and production of Aromatic and HYV Aman rice were also computed for the nineties. During the period of ten years in nineties, yield and production growth rates of Aromatic were positive and significant. The growth parameters of Aromatic were significantly different in early nineties and late nineties but in case of HYV Aman growth parameters were not significantly different between the two sub periods of nineties (Khan *et al.*, 2002). Rahman (2002) used stochastic production and cost frontier models in rice production in Bangladesh. He identified 14%, 7%, and 20% technical inefficiencies at the aggregate level in Aromatic, Aus, and Aman rice crops, respectively. Aromatic, Aus, and Aman rice crops had mean economic efficiency values of 79%, 72%, and 71%, respectively. This suggested that, without changing output, the production costs of Aromatic, Aus, and Aman rice may be lowered by 21%, 28%, and 29%, respectively. The average economic efficiency predicted from Translog stochastic normalized cost frontiers for Aromatic, Aus, and Aman rice crops were 80%, 60%, and 74%, respectively. He discovered that when farm owners' education levels increased, so did economic inefficiencies. Farmers with more expertise had less technical inefficiencies than farmers with less experience.

A study was conducted to find out the level of input uses and input output relationship with respect to Aromatic and HYV Aman rice cultivation. The result showed that the amount of human labour, animal labour, and fertilizer used per hectare of Aromatic were 197.17 man-days, 43.38 pair-days and 321.22 kg and for HYV Aman were 153.68 man days, 44.13 pair-days and 176.14 kg respectively, per hectare real cost of seed, irrigation, and pesticides of Aromatic were Tk 1818.93, Tk4591.33, and Tk 536.34 respectively. Human and animal labor are positively significant, whereas irrigation costs are adversely significant in the production of aromatic rice. Human labour has a detrimental impact on HYV Aman rice production, whereas animal work and seed have a beneficial impact. To achieve maximum efficiency, the use of human labor, animal labor, seed and fertilizer of Aromatic, animal labor, seed and pesticide of HYV Aman should be increased, pesticide of Aromatic should be decreased, and the additional use of the irrigation water of Aromatic, human labour, and fertilizer of HYV Aman should be decreased (Khan *et al.*, 2002).

A study revealed that in general, farmers did not use their resources efficiently. Farmers had ample opportunities to increase return from Aromatic rice production by using resources efficiently. The study also identified some major issues that farmers faced when producing HYV rice, such as high insecticide prices and a lack of cooperation from block supervisors, a shortage of hired labor at critical stages, a high wage rate for hired animals or power tillers, and a lack of capital, seed, and irrigation facilities (Bhuayan, 2000). Aromatic rice generates higher profit than non-aromatic rice. The study indicated that the gross return for kataribhog, Kalijira/Chinigura, Shama, and Pajam/BR types was Tk. 37466.88, Tk. 32291.63, Tk 29881.00, and Tk. 30860.97 per hectare, respectively. The highest gross return came from aromatic (Kataribhog) rice (Tk. 37466.88 per hector), followed by nonaromatic rice (Pajam/BR types) (Tk. 30860.97 per hectare) (Kabir, 2000).

Basmati and C'hiniatab had gross returns of Tk.54513 and Tk. 38903 per hectare, respectively, while their production costs were Tk.26040 and Tk.12337 per hectare. In the Barind Tract area, the average Basmati and C'hiniatab yields were 4.3 ton/ha and 2.14 ton/ha, respectively (Mustafi et al., 2000). The technical efficiency varied greatly (from 46.5% to 96.7%) across the sample farm and was time dependent. The mean technical efficiency was calculated to be 82%, implying that the realized output could be raised by 18% on average without the use of extra resources. The existing gap between realized and prospective production underlined the need to improve farmers' practices through extension service and training programs (Mythili and Shanmugam, 2000).

On average, sample farmers showed 12% technical inefficiency with aromatic rice.9% for Australian rice; 19% for Aman rice. This meant that the output per farm could be greatly boosted without incurring additional costs. The coefficients of age and experience were both negative and significant for Aromatic rice, whereas the coefficient of experience was also negative and significant for Aus rice. Farmers with larger farms were technically more efficient than those with smaller enterprises (Rahman et al., 2000). Farmers experienced some issues for Kataribhog rice marketing, such as low market price during harvesting, lack of financing, lack of suitable storage facilities, and rising market tolls (Tasnoova, 2000).

2.2 Impact of agricultural credit on agricultural production

The government's crop diversification program, loan supply, extension activities, research, and input distribution policies are all delivering beneficial effects. According to the report, Bangladesh is on the verge of becoming self-sufficient in food grain production (BBS, 2021). Credit access and use in the production process can boost crop productivity and total profitability for farmers. Therefore, secure and timely provision of crop-specific loans can enable farmers employ inputs in a timely and suggested manner, hence increasing crop output (Chandio *et al.*, 2021).

The short run and the long run relationships exist between the agricultural credit and agricultural productivity while the productivity of the agricultural sector also influenced by other dynamic variables like inflation, interest rate, and government expenditure on agriculture. He remarked that giving agricultural financing to poor farmers (small, marginal, and landless farmers) through institutional credit sources can help to ensure a timely and sufficient supply of agricultural inputs, hence promoting food production and improving poor farmer livelihoods. One of the most essential development goals for a developing country like Bangladesh is to boost agricultural production and ensure food security. Thus, in his analysis, he suggested that agricultural credit growth should expand to promote agricultural productivity, which would undoubtedly be beneficial in supporting economic growth in Bangladesh (Islam, 2020).

Agricultural finance has a favorable and highly significant influence on wheat productivity, with the short-term loan having a greater impact than the long-term loan. In their survey, they determined that the reasons for the phenomena could be the much larger use of agricultural inputs such as enhanced variety seeds and fertilizers, which can be converted into wheat production in the same year. However, long-term loan (LTL) users make much higher investments in land preparation, irrigation, and plant protection, which may contribute to increased wheat output in the following years (Chandio *et al.*, 2018).

Agriculture credit plays an important part in agricultural development. Every developing country has established financial institutions to address credit issues in agricultural practices (Khan, 2018). In rural Pakistan, particularly Sindh, the majority of farmers are resource-limited and face capital difficulties while purchasing vital commodities.

Therefore, given these circumstances, they indicated that agriculture loan is needed to develop the following crop (Saqib *et al.*, 2018).

The smallholder farmers' access to agricultural credit in Sindh province of Pakistan using the probit model. Their study revealed that a number of socio-economic factors including household size, farming experience, off income and availability of collateral significantly influenced on smallholder farmers' access to agricultural credit. They reported off-farm income and land availability as the foremost collateral determinants of access to credit (Chandio *et al.*, 2017). Agriculture sector is the back bone of agrarian economies and it is the primary source of food and income in these economies like Pakistan. Their research findings demonstrated that food production in the agricultural sector requires a variety of resources, but credit is one aspect that aids in risk aversion and risk management. One of the most significant challenges farmers encounter when carrying out farming activities is a lack of financing availability. Agricultural finance is significantly helping to reduce food insecurity, whereas non-institutional agricultural credit yields unanticipated benefits. As a result, it was highly advised to give institutional agricultural financing to alleviate food insecurity in the country (Iftikhan and Mahmood, 2017). Agricultural credit has a favorable effect on household income and GDP growth rates. The conclusions of their investigation demonstrated that credit recipient farmers harvest spices with a greater yield, resulting in higher farm income (Khatun *et al.*, 2017).

Access to formal credit in Pakistan is completely squeezed and inequitable. Large farmers enjoy more access and use to formal credit due to greater reliable collateral availability. Sarker, (2016) studied to determine the role of banks in the agricultural development of Bangladesh and the findings of his study confirmed significant role of banks in agricultural development through agricultural credit disbursement (Saqib *et al.*, 2016). Using the ARDL technique, we examined the relationship between agricultural loans and economic growth in Nigeria from 1986 to 2014. Their study's methodology and conclusions revealed that there are both short and long range correlations between agricultural loans and economic growth (Ayeomoni and Aladejana, 2016). Formal credit has a good and large impact on agricultural production. As a result, they determined that financing may assist increase farm output and the standard of living for small farmers. In their study, they advised that the lending system be simplified and flexible, and that the Pakistani government support small farmers through credit schemes with low interest rates. They also suggested that financial institutions should launch crop insurance scheme

in case of crop failure by flood, draught, pest attack, and heavy rains (Chandio *et al.*, 2016). Reduced lending interest rate should be implemented for facilitating the agricultural sector (Okosodo, 2016).

Small farmers are still in vulnerable situation due to limited access of institutional sources of credit and while in rural markets, the informal sources of credit are playing a dominating function (Yadav and Sharma, 2015). Microfinance is strongly correlated with agricultural productivity and has a considerable impact on output levels. In their analysis, they discovered that the main barriers to credit access include a lack of collateral assets, small loan amounts, and delays in the disbursement of agricultural loans. They also discovered that the most significant difficulty with credit administration is farmers' lack of awareness of the loan acquisition process. In their study, they suggested forming active farmer-based groups, educating farmers about the loan acquisition process, encouraging farmers to save, and urging Microfinance Institutions (MFIs) and other development partners to effectively finance agriculture. They argued such efforts have the potential to reduce income inequality thus contributing towards the achievement of the goal of poverty reduction as found by their paper (Sulemana *et al.*, 2015). Narayanan (2015) analyzed the relationship between agricultural credit supply and agricultural GDP in India by using state-level data for the period of 1995-96 to 2011- 12. The findings of the study concluded that an increase in amount of agricultural credit supply is highly responsive to the increase in agriculture production.

The primary means to ensure food security in Bangladesh is to develop the agriculture sector and rural economy to support and enhance the livelihoods of poor and vulnerable groups. The agriculture sector can play the most direct role through ensuring the availability of food and maintaining low prices domestically. Moreover, the development of the agriculture sector with its high multiplier effects can results in increased agricultural income which is a driver of rural growth and thus instrumental in improving access to food in rural areas. Multiple regression analyses were carried out by them using the field survey data to determine the impact of credit on rice production and calorie intake in household and individual levels. It is revealed from their study that credit has a positive impact on the rice production. Furthermore, they discovered that, while the Bangladesh Krishi Bank gave the loan for rice cultivation, only 44.77 percent of it was used for rice production and 5.71 percent for food consumption. Furthermore, the results of their investigation demonstrated that credit had a good effect on calorie consumption.

Thus, they recommended that, in order to increase rice production and food security in rural Bangladesh, government and nongovernmental organizations, specialized banks, and other financial institutions extend agricultural loans to small and marginal farmers (Rahman et al., 2014). Agricultural finance has had a beneficial and considerable impact on Nepal's agricultural GDP. He proposed extending and expanding the financial service sector in rural areas, as well as facilitating agricultural finance (Sharma, 2014).

Alauddin and Biswas (2014) discussed the impact of agricultural credit on growth, including trends, patterns, and problems using descriptive features and concluded with suggestions that agricultural credit can minimize the gap of agricultural credit disbursement and the actual demand of the needy farmers. The Banking Development and Research Unit of Nepal Rastra Bank (2014) conducted a case study on agricultural credit and its impact on farm productivity, as well as an investigation into the issues associated with agricultural loan procurement and use by farmers in Nepal's Kailali district. The study examined the impact of credit on farmers' technical efficiency and output. The findings of their survey revealed that agricultural financing helps to increase the agricultural production of farmers in the studied area. Timely provision of suitable amount of credit to farmers is beneficial for the development of agricultural output since it enables them to acquire high yielding variety seeds, fertilizers, and pesticides (Rahman *et al.*, 2014).

Farmers with access to credit are better off compared to those who do not have such access to credit. Their study recommended that by increasing the size of the loan, efficient and sustainable technology can be made available to farmers to increase farm productivity and profits (Ibrahim and Bauer, 2013). Akram *et al.* (2013) observed that access to credit results in a higher level of technical efficiency of farmers. Their study was based on a sample survey of 152 farmers from Sargodha District of Punjab Province, Pakistan. Using stochastic frontier analysis (SFA), they concluded that agricultural credit in the study area helped the farmers reap the farm inputs in time, resulting in a higher level of technical efficiency.

High interest rates, bureaucratic bottlenecks, needless collateral requests, and loan approval delays are some of the most common impediments to agricultural lending from the formal sector. They proposed that banks and financial institutions develop lending instruments and services that are customized to the agriculture sector's risks and cash

flow patterns. Banks should create new branches in rural regions and eliminate superfluous loan conditions that deter farmers from borrowing (Ayegba and Ikani, 2013).

The small-scale farmers are facing severe challenges, including several economic, technical, and social issues. In particular, the high needs for farm inputs and low access to institutional credit are primary economic problems. Results of their study revealed that the landholding size is a substantial factor in the sugarcane growers' access of formal agricultural credit (Hussain and Thapa, 2012). Agricultural credit not only increased output but also improved the overall agricultural process in Andhra Pradesh, India. She discovered that after acquiring agricultural loan, there was a significant increase in the use of new seeds, fertilizers, and pesticides, all of which enhanced yield per acre and consequently farmers' income (Devi, 2012). Duy (2012) used quintile regression and Stochastic Frontier Analysis (SFA) approaches to investigate the impact of agricultural financing on farm productivity among 654 farmers in Pakistan's Mekong Delta region. In his study observed that technical efficiency and rice yield were positively influenced by access to credit, farm technology and education level. The researcher also demonstrates that access to formal credit sector had a larger effect on rice production than access to informal credit.

Rahman *et al.* (2011) explored the lenders' performance and assessed the relationship between credit and farm production in Bangladesh. This study discovered a high positive association between credit and production, and the performance of lending institutions has improved as a result of numerous policy modifications relating to non-public banks and agricultural loan operations. They discovered a strong association (.938; statistical significance 1 percent) between agricultural credit accessibility and increased agricultural production. In addition, food grain and fishery production have a higher correlation (.948), whilst livestock products such as milk, meat, and eggs have correlations of 0.772, 0.938, and 0.688, respectively, all of which are statistically significant at the 1% level.

The impact of agricultural credit on agricultural GDP in a specific district of Pakistan using a linear regression model based on Cobb-Douglass function. Their study concluded that the more supply of credit can enhance the agricultural production (Saleem and Jan, 2011). Credit availability to farmers is much more important than any other factors to enhance the resource use efficiency in agriculture sector. By employing Stochastic Frontier Production Analysis (SFA), they concluded that credit to agricultural sector has

more constructive and significant impact on the farmers' technical efficiency than other factors like education, farming experience, herd size and number of cultivation practices (Ayaz and Hussain, 2011).

Bayes and Hossain (2011) showed that the tenant farmers have restricted accessibility to formal credit sources due to various formalities and rigidities in terms and conditions. Their study also revealed that because of the collateral requirement of bank and other government institutions, small and landless farmers are deprived of credit. Agricultural credit under the government Action Plan has been successfully generated positive impact on cropping system and socio-economic condition (Huda *et al.*, 2011).

Dong *et al.* (2010) observed that production inputs, farmers' capabilities and education cannot be fully employed under credit constrained situation. Based on a survey of 511 households from Heilongjiang Province of Northeast China and employing endogenous switching regression model, they concluded that agricultural productivity in the study area can be accelerated by 31.6 percent with the elimination of credit constrained situation.

Agricultural loan requirements have also increased over time due to a variety of issues, including rising agricultural input prices, a lack of water, and inadequate irrigation systems. The study's findings revealed that agricultural credit plays an important role in facilitating agricultural transformation and increasing farmer participation in the production process, as well as a positive correlation between credit supply and the country's agricultural produce. As a result, institutional lending has a considerable impact on the development of the agriculture sector and, eventually, the economy. They determined that credit has a positive impact on agricultural productivity, hence raising the living standards of the rural poor (Bashir *et al.*, 2010).

Saboor *et al.* (2009) Credit was found to play a significant role in enhancing agricultural productivity. Farmers (including small and marginal farmers) benefit from timely and easy access to financing, allowing them to purchase the necessary inputs and machinery for farm operations and enhance production. The researchers also determined that credit has the potential to improve the living conditions of poor farmers and assist them escape poverty traps.

Waheed (2009) analyzed that to improve the well-being of rural poor farmers, micro finance is proposed to be primarily essential and commonly crucial for investment in

rural productive activities. Their study concluded that per capita credit to non-poor was better than per capita credit to poor farmer. Bashir *et al.* (2009) explored the impact of credit disbursed by commercial banks on the productivity of wheat in Faisalabad district, Pakistan. They used Cobb-Douglas Production Function to calculate the impact of credit banks on the productivity of wheat and concluded that credit has a positive impact on productivity of wheat and hence it is an important tool for improving agricultural productivity. Abedullah *et al.* (2009) stated in their study that easy and cheap credit is the quickest way for boosting agricultural production and use of modern agricultural technology, thus increases demand for credit and results in increase in agricultural yield of small farmers.

Shah *et al.* (2008) According to their findings, money is considered the foundation of all economic activities, including agriculture. This is a particularly serious issue in economies where agriculture is subsistence. As a result, the government is responsible for supporting the agriculture industry. To this goal, the authorities should provide institutional credit to people who cannot afford to fully employ the current technology.

Nasir (2007) cited that agricultural credit played an important role in agriculture development. He revealed that, it helps smallholders to undertake new investments and adopt new agricultural technologies to enhance agricultural productivity. Lack of access to formal credit has a negative effect on farm production and well-being of the rural farmers.

Sriram (2007) supplied evidence of strong positive correlation between agricultural credit at reasonable costs and agricultural production. The importance of agricultural credits especially from the institutional resources is widely identified as affective device to enhance agricultural productivity. Keeping in mind the effective role of timely availability of financial capital to the farmers; their study was designed to analyze the impact of short-term credit on farm production. The main findings of the study suggested that short-term agricultural credit has positive impact on wheat, gram and livestock production. It is recommended in their study that, Bank should expand the short-term credit program and increase the credit limits so that larger number of farmers could benefit from the credit program of the bank. Their study concluded that, the availability of credit to small farmers has improved production per unit area.

However, the the amount of credit available to the farmers was not enough to fully meet the actual requirements of the farmers. Furthermore, the amount of credit was not sufficient to entertain all the applicants positively. Most of the potential farmers who were credit worthy, turned out to be unsuccessful due to unavailability of the credit amount anymore (Khan *et al.*, 2007).

Bashir *et al.* (2007) examined the impact of credit disbursed by commercial banks on the productivity of sugarcane in faisalabad district, Pakistan using Cobb Douglas production function. The findings of their investigation demonstrated that credit had a good impact on sugarcane production. According to their research findings, the coefficient of credit ($\ln \text{ credit}$) is 0.004, with a t-value of 2.220, which is significant at the 3% level of significance. This explains why a 1% increase in the inclination to take credit boosts sugarcane production by 0.4 %. Small farmers are hesitant to obtain financing from official institutions due to the difficult and time-consuming procedures. They choose to purchase the input at double prices payed after marketing their product (Chachar, 2007).

Iqbal *et al.* (2003) recommended that the formal financial institution should be encouraged to expand the agriculture loans for farming sector especially small-scale farmers. Their study also indicated that the institution should expend the loan for consumption in case of emergencies (flood and drought and many others). Their study's findings suggested that, in addition to crop insurance, other schemes be developed to offer farmers with protection against pest attacks, drought, high rains, and flood) for a low charge. Khandker and Faruquee (2003) discovered that agricultural loans disbursed to small-scale farmers are more effective and suitable for farm productivity than those disbursed to large farmers. Their research found that loans given to small-scale farmers are more productive than loans granted to large-scale farmers. They determined that it also played an essential influence in the development of small-scale farmers' lifestyles as well as in poverty reduction.

2.3 Research Gap

From several literature reviews, most of the studies evaluates that the farmers agricultural credit facilities to use their land resources more efficiently (Islam 2020; Khatun *et al.* 2017; Rahman *et al.* 2014; Huda *et al.* 2011). Additionally, literature explained different factors that affect access to agricultural credit. However, most studies considered only socio-economic status of different agricultural commodities such as, livestock, fisheries,

poultry (Huda *et al.* 2011; Saboor *et al.* 2009); and very few studies considered to analyzing the impact of agricultural credit rationing. Moreover, researcher consider others rice seasons, *Boro* rice production was founded less considerable in impact of agricultural credit-based research in Bangladesh. Therefore, the study was conducted to address the knowledge gap regarding the impact of agricultural credit rationing on *Boro* rice production.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Methodology describes the overall method used to successfully complete the research assignment. The methods section addresses two major questions: How were the data gathered or generated? How was it analyzed? It includes a theoretical analysis of the set of methods and concepts used to approach the research objectives in a scientific manner. A well-organized approach is essential for successful research, and all work must be completed in a specific order. A suitable approach should be developed for this. This chapter contains a sequential description of the approaches used to conduct the current investigation, organized under the following headings.

3.2 Selection of the study area

The study has been carried out conducted in Kushtia district. Due to fertile, flat alluvial soil in the delta of the Gorai and Kaliganga rivers, the district is rich in rice plantation. From this district, two upazilas was randomly selected for data collection. Based on the availability of agricultural credit rationing, as Kushtia district is the one of the highest rice producing upazila in the country.



Figure 3.1:Map of Bangladesh Showing Kushtia District

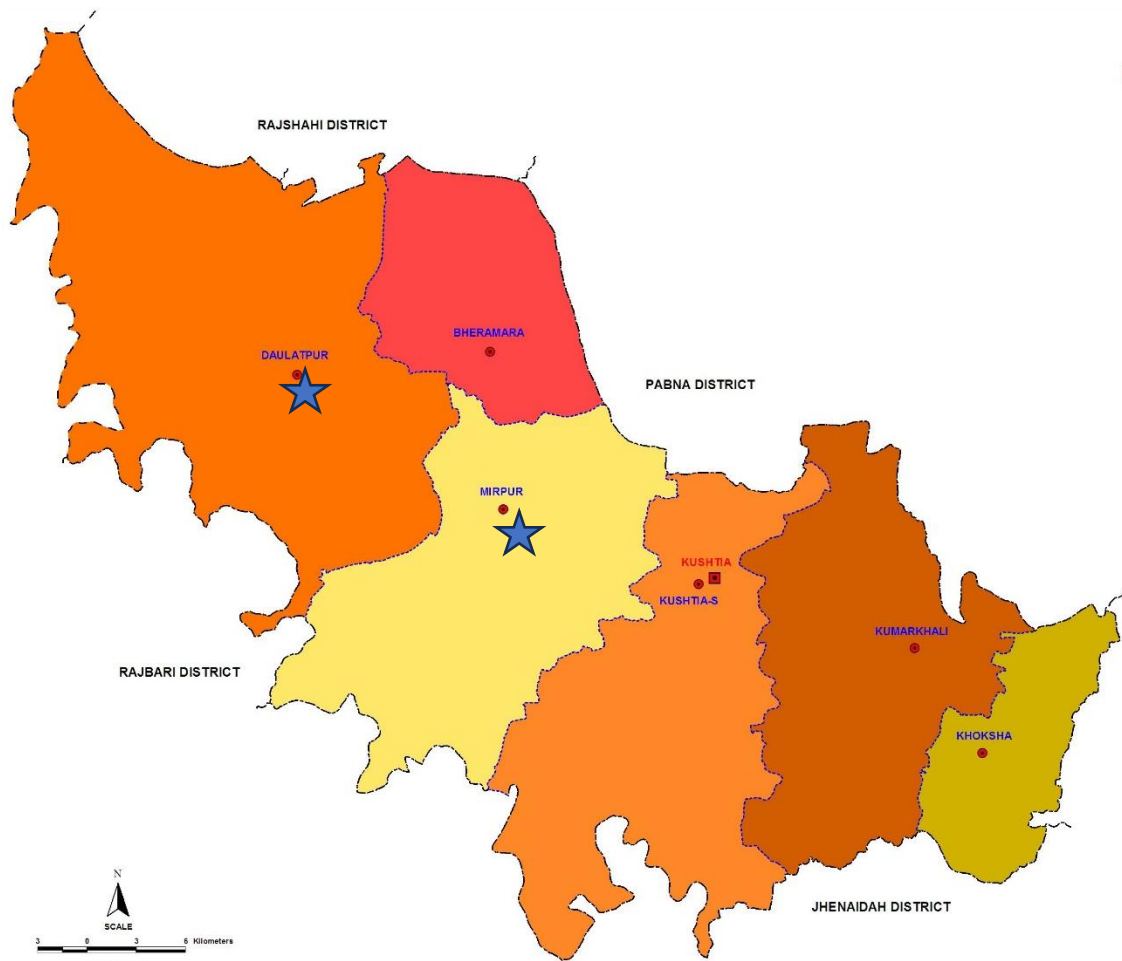


Figure 3.2: Map of Kushtia District Showing the Study Upazila

Source: Google earth engine

3.3 Sampling technique

The study utilized a simple random sample strategy to increase survey accuracy. A field survey was conducted in the study area to gather data on rice production and agricultural credit use. One of the most difficult aspects of designing a sample survey is establishing how large a sample is required for estimates to be accurate enough to achieve the survey objectives. A large sample size incurs significant costs in terms of people, materials, and time, whereas a small sample size invalidates the study's results. However, around 30 cases appear to be the bare minimum for research in which statistical data analysis is to be performed (Islam, 2011). However, in this study, considering the time and resource constraints, 210 farmers were selected as sample. At first list of credit receivers is collected from the local branch of the Bangladesh Krishi Bank and some local NGOs.

Sample determination formula was be

$$n = \frac{z^2 pq}{e^2}$$

$$n = \{(1.645)^2 \times 0.5 \times 0.5\} / (0.06)^2$$

$$= 187.92$$

Here,

n = sample size

p = population portion = 0.5; q = 0.5

e = acceptable sampling error ($e = 0.06$)

z = z value at reliability level or significance level. At reliability level of 90%; $z = 1.645$

Table 3.1: Sample distribution

District	Upazila	Sample size	Reserve list
Kusthia	Daulotpur	105	20
	Mirpur	105	20
Total	2	210	40

About 210 households were selected purposively as sample and from each upazila, sample households were selected to collect data. Where 120 farmers are credit constrained and 90 farmers are unconstrained. Face to face interview was be conducted to collect data and random sampling technique was be used to select the sample. Total of 40 sampled farmer are keep on reserve list so that in case any of response was not validating in validation process researcher can use from that list.

3.4 Data collection

Data collection is viewed as an important aspect of a survey since it has a substantial influence on the quality of the findings. Given its significance, the following precautions were taken throughout the development of the questionnaire as a data gathering tool:

3.5 Questionnaire design

A questionnaire is a strong data collecting instrument that uses multi-dimensional questions to acquire information. Generally, the aim is to obtain information suitable for the statistical analysis. A questionnaire without a defined objective and purpose would always ignore crucial topics and waste the time of enumerators and farmers by asking and responding to irrelevant questions. All of these issues were considered to the best of our ability in order to construct the survey questionnaire.

3.6 Pre-testing the questionnaire

The questionnaire is pre-tested to assess the amount of time required to finish the interview, its reliability (i.e., whether it elicited the desired information), and its consistency. The test also attempted to evaluate the logistical requirements for the survey's successful operation. Pre-testing was carried out in the Daulatpur upazila of Kushtia district from November 2023 to January 2024 to ensure the questionnaire's best performance in terms of data collection, processing, and analysis.

3.7 Finalization of the questionnaire

The questionnaire has been sent to my supervisor after I addressed all of the adjustments based on the pre-test suggestions. My supervisor also made a significant correction to the survey questionnaire. With the permission, the questionnaire is finally completed.

3.8 Method of data collection

Primary data was collected from selected farmers through face-to-face interviews using a pre-designed questionnaire, with the assistance of agricultural extension officers, local representatives, Bangladesh Krishi Bank (BKB) officials, and some local NGOs in the selected study areas, from November 2023 to January 2024. Rice growers' data includes demographic parameters such as age, education, and family size, as well as social variables such as farming experience, economic variables such as farm size, and contextual elements such as loan availability.

Moreover, regarding the cost of farming inputs, the cost of seed used, fertilizer cost, pesticide cost, labor cost, land preparation cost and irrigation cost were also collected from rice cultivators.

3.9 Data editing, coding and processing

Data editing refers to the practice of checking and purifying previously acquired field data. After speaking with the research supervisor, the collected information was manually updated and coded. Following that, all data is collated and properly analyzed. It should be noted that the information was initially acquired in local units and then changed to normal international units following the necessary verification. Editing and coding obtained data are key elements of the survey; both are required for data processing, and they should be completed before data processing begins. Data processing includes data input (using the Microsoft Excel application), appending and merging files, data validation (additional computer checking and editing), final judgment on mistakes, completion of data processing and production of data files, final documentations and storage of all files.

3.10 Analytical techniques

The data was analyzed using both descriptive and econometric approaches. To fulfill the first objective, descriptive statistics were utilized, as well as a logit model with marginal impact was utilized for factor influencing agricultural credit rationing measure. The Cobb-Douglas production function model was utilized to achieve the effect of credit rationing on *Boro* rice productivity. The analyses were carried out on a computer using the apps Microsoft Excel and STATA-16.

3.10.1 Binary logit model

To estimate the factor that associate with the credit rationing and its impact on the *Boro* rice farmers binary logit model has been implemented with marginal effect. Where marginal effects are a useful way to describe the average effect of changes in explanatory variables on the change in the probability of outcomes in logistic regression and other nonlinear models. For that, we estimated the marginal effect of independent variables in the logit model which can be obtained by differentiating the first and second order conditions as follows (Greene, 2012):

$$\partial E[U_i^*|X_i] / \partial X_i = \Phi(X_i'\gamma) \gamma$$

Marginal effects provide a direct and easily interpreted answer to the research question of interest. Following logit regression model was used;

$$\Pr (Y=1/x) = F (z) = b_0+b_1X_1+b_2X_2+.....+ b_nX_n + e_i(2)$$

Here,

F = is the logistic cumulative distribution function

e_i = Error term

$X_1, X_2, \dots, X_n$ = independent variables (Age, Education, Farm size, Annual income,..)

Marginal effect is a useful way to describe the average effect of changes in explanatory variables on the change in the probability of outcomes in logistic regression and other nonlinear models.

3.10.2 Cobb-Douglas production function

Previous studies of Nazir *et al.* (2013), Ahmed *et al.* (2014) and Chandio *et al.* (2021) the Cobb-Douglas type production function has been used for estimating the effect of different production input to the output. Cobb-Douglas form of the production function is selected to assess the contribution of agricultural credit rationing to *Boro* rice production since it can handle multiple inputs in its generalized form (Bashir *et al.*, 2010). The Cobb-Douglas production function was used in the study to assess which inputs influenced productivity. The Cobb-Douglas production function is likely the most often used form for fitting agricultural production data, owing to its mathematical properties, ease of interpretation, and computing simplicity (Fuss and Mcfadden, 1978).

The Cobb-Douglas approximation may be appropriate for manufacturing systems in which components are imperfect replacements over the entire range of input values. Furthermore, the Cobb-Douglas is generally uncomplicated to estimate because it is linear in parameters in logarithmic form and parsimonious in parameters (Beattie and Taylor, 1985). When two variables are used as inputs, for example, labor and capital, the function may be represented as:

$$Y = AL^{\beta_1}K^{\beta_2}e^{-u_i}$$

Where,

Y = level of output,

L and K = Labor and Capital are variable inputs,

A = multiplicative constant,

β_1 and β_2 are the coefficient of L and K and they represent elasticity of the respective factors of production, and

e = error term.

To solve the Cobb-Douglas production function using the ordinary least squares (OLS) technique, it was changed into the following logarithmic form formally, the production function can be written as:

$$\ln Y = \ln A + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 X_6 + u \dots\dots\dots(1)$$

Where,

Y = *Boro* rice yield (t/ha.)

X₁= Seed cost (Tk./ha)

X₂ = Fertilizer cost (Tk./ha)

X₃ = Labor cost (Tk./ha)

X₄ = Land preparation cost (Tk./ha)

X₅ = Irrigation cost (Tk./ha)

X₆ = Agricultural credit rationing

β_1 to β_6 = Co-efficient of related variables

u = Stochastic random error term

According to Elahi and Rahman (1995) Credit is not a direct input into production; rather, credit influences production via influencing demand and supply for inputs utilized in the manufacturing process. Agricultural credit rationing is included in the above equation because it can move farmers along the production surface more efficiently: firstly, the availability of adequate credit influences the efficient distribution of resources by overcoming constraints to purchase inputs and use them optimally, shifting the farmer along a given production surface to a more intensive input use; secondly, credit may help to purchase a new technological package including inputs (Carter, 1989).

3.11 Variables and their measurement

In research, a variable is an object, idea, or other attribute that can take any value that you want to measure. In analytical research, there are often two categories of variables. Independent variables are expected to influence dependent variables. The outcome of the independent variable is referred to as the dependent variable. A confounding variable, or confounder, influences the relationship between the independent and dependent

variables. The researcher extensively investigated and reviewed literature to broaden the spectrum of utmost understanding about the natures and scopes of the probable dependent and independent variables relevant to and chosen for this investigation.

3.12 Measurement of independent variable

Age

Actual years from their birth to the time of the interview was measured as age which was found on the basis of the verbal response of the *Boro* rice cultivating people (Rashid, 2014). A score of one (1) was assigned for each year of one's age. This variable appears in item number 1 in the interview schedule.

Education

Level of education was measured in terms of class (year of schooling) passed by rice cultivators of those areas. If a rice cultivator received education from any educational institute or recognized school or college or university, their education was expressed in terms of year of schooling, i.e. one (1) score was given for one year of schooling. Each illiterate person was given a score of zero.

Farm size

Farm size of a farmer referred to the total area of land on which his/her family carried out the farming operation, the area being in terms of full benefit to the family. The term refers to the cultivated area either owned by the farmer or cultivated on sharecropping, lease or taking from other including homestead area and measured using the following formula (Rashid, 2014):

$$FS = A + C + D + F + G - B - E$$

Where,

FS = Farm size,

A = Own land under own cultivation,

B = Land share out

C = Land share in

D = Land taken from others on lease,

E = Land given to others on lease,

F = Homestead land

G = Pond The data was first recorded in terms of local measurement unit i.e. hectare.

Annual income

The term annual family income referred to the total earning by the earning members of a farm family from agriculture, livestock, fisheries and other accessible sources (business, service, daily labour etc.) during a year. It was expressed in Thousand Bangladeshi Taka.

Training exposure

It was used to refer to the completion of an activity by the farmers which were offered by the government, semi-govt. or non-government organization (s) to improve the knowledge and skills of farmers for better performing an agricultural job. It was measured by the number of days of training received by the respondent.

Land preparation cost

Boro rice production is more labor intensive than many other crops cultivation. Here, cost of hired labor involved in *Boro* rice cultivation is considered for the calculation. Land preparation cost includes cost of labor from sowing of *Boro* rice seeds to transplanting of the seedlings in main field and harvesting of the *Boro* rice. Land preparation cost variable is measured in Tk./ha. Land preparation cost.

Seed cost

Seed is the most important and significant component in crop production. One of the most effective strategies to boost crop output is to cultivate it with high-quality seed. Quality seeds are thus the most crucial input on which all other inputs rely for effectiveness. Fertilizers, irrigation, manpower, and other inputs, as well as appropriate agronomic practices, all contribute significantly to improving produce output and quality. However, if high-quality seed is not used, the entire potential of these inputs and agronomic methods would be lost. Seed quality significantly affects farmers' profitability.

Farmers of the study area use many different types of seed for *Boro* rice cultivation: BARI dhan28 and BARI dhan29 was most common. Seed cost variable is measured in Tk./ha.

Fertilizer cost

Fertilizers deliver nutrients (such as potassium, phosphorus, and nitrogen) to crops, promoting plant development and increasing agricultural output to a certain extent. Farmers in the research area typically utilize urea, TSP, MoP, and gypsum for *Boro* rice growing. In this study, the fertilizer cost variable includes the cost of using various chemical fertilizers in *Boro* rice cultivation. The variable is measured in Tk./ha.

Irrigation cost

Irrigation is a vital component of *Boro* rice production. The optimal level of irrigation is determined by the soil condition and the season. Farmers in the study region reported taking extra measures with irrigation, particularly after seed sowing and shortly after transplanting seedlings into the main field. Because of its weak root system, *Boro* rice requires frequent irrigation. The irrigation cost variable covers the cost of irrigation after seed sowing (10-12 times) and after transplanting seedlings into the main field (4-5 times). The variable is measured in Tk./ha.

Agricultural credit rationing

The variable is measured on the basis of whether the farmers agricultural credit rationed in *Boro* rice production. This study followed a similar approach as in Simtowe *et al.* (2008) to identify credit rationed *Boro* rice farmers, i.e. *Boro* rice farmers who requested for loans but were denied or did not receive the required amount of credit, using data from *Boro* rice farmers who participated in agricultural credit rationing programs. Based on this approach, credit constraints can be defined as *Boro* rice farmers who did not apply, applied but were denied, or did not obtain the required amount were given a score of 1.

Table 3.2: Description of variables used in the models

Variables	Type	Description
Independent variables		
Age (Years)	Continuous	Age of the farmer [A score of one (1) was assigned for each year of one's age. This variable appears in item number 1 in the interview schedule]
Education (Years)	Continuous	Total number of years the farmer attended school [one (1) score was given for one year of schooling. Each illiterate person was given a score of zero]
Occupation	Dummy	Main occupation as primary source of income
Farm size (ha.)	Continuous	Total amount of cultivable land by the farmers [Large Farmer (3.04 and above) Medium Farmer (1.01 to 3.03) Small Farmer (0.02 to 1.00)]
Annual income (Tk)	Continuous	Total amount earned in a fiscal year
Annual savings (Tk)	Continuous	Savings from annual income after maintaining all expenditure
Off farm income source	Continuous	Off farm income generating activities as source of income
Livestock	Dummy	1 if the farmers have livestock, otherwise 0
Distance of bank from home	Continuous	Distance of Bank from home in km scale
Distance of NGO from home	Continuous	Distance of NGO from home in km scale
Seed cost (Tk./ha)	Continuous	Cost of seed per acre area was collected and converted into tk./ha.
Fertilizer cost (Tk./ha)	Continuous	Cost of fertilizer per acre area was collected and converted into tk./ha.
Labor cost (Tk./ha)	Continuous	Cost of labor per acre area was collected and converted into tk./ha.
Land preparation cost (Tk./ha)	Continuous	Cost of land preparation per acre area was collected and converted into tk./ha.
Irrigation cost (Tk./ha)	Continuous	Cost of irrigation per acre area was collected and converted into tk./ha.

Dependent variables		
Yield (t/ha.) of <i>Boro</i> rice	Continuous	Yield was recorded in ton per hector unit
Agricultural credit rationing	Dummy	1 Not applied, applied for credit but rejected or did not receive required amount of credit (Constraint); 0 if farmer received agricultural required credit (Unconstraint)

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Socio-economic characteristics of *Boro* rice grower in Bangladesh

This chapter summarizes the socio-economic features of *Boro* rice farmers. Socioeconomic data are critical components of the study and should be thoroughly evaluated. The socio-economic profile provides an overview of the farmers' age, educational attainment, employment status, income and savings information, and agricultural information. Additionally, the socio-economic profile assists in comprehending the farmers' behavior or traits.

4.1.1 Farmers age

The age of the farmer (household head) is defined as the duration of time in real years from his birth to the time of interviewing, measured in completed years. A score of one (1) is assigned for each year of age, as determined by the verbal responses of *Boro* rice farming farmers. Farmers were divided into three categories based on their documented age: young, middle, and old (MoYS 2012). 210 samples were collected from two upazilas in Kushtia district from both *Boro* rice growers and their spouses.

Table 4.1: Age of the farmers by study area

Age	Constrained	Unconstrained
	Frequency (percentage)	Frequency (percentage)
Middle aged (36-45)	34 (28)	28 (31)
Old aged (<46)	69 (58)	33 (37)
Young aged (0-35)	17 (14)	29 (32)

Source: Field survey, 2023

Table 4.1 presents the age distribution of farmers in the study area, categorized as constrained and unconstrained. The majority of farmers in constrained areas are old-aged (46 years and above), accounting for 58% (69 farmers), followed by middle-

aged farmers (36-45 years) at 28% (34 farmers), and young farmers (0-35 years) at 14% (17 farmers). In contrast, the unconstrained areas have a more evenly distributed age range, with 37% (33 farmers) being old-aged, 32% (29 farmers) being young, and 31% (28 farmers) being middle-aged.

4.1.2 Farmers education

Poddar's (2015) classification of respondents' educational qualifications was used. According to Table 4.2 shows the education levels of farmers by study area, divided into constrained and unconstrained categories. In constrained areas, 37% (44 farmers) have primary education (up to 5), 18% (21 farmers) are illiterate, and 18% (21 farmers) have secondary education (up to 10). A smaller proportion, 14% (17 farmers), can only sign their names, while 8.3% (10 farmers) have completed higher secondary education (12 and above). In contrast, the unconstrained areas show that 29% (26 farmers) are illiterate, 26% (23 farmers) have secondary education (up to 10), 17% (15 farmers) have higher secondary education (12 and above), and only 2.2% (2 farmers) can sign their names. As a result, the vast majority of people in each upazila have completed basic or secondary school.

Table 4.2: Education level of the farmers by study area

Education	Constrained	Unconstrained
	Frequency (percentage)	Frequency (percentage)
Can sign name only (1)	17 (14)	2 (2.2)
Higher secondary (12 and above)	10 (8.3)	15 (17)
Higher secondary (12 and above)	7 (5.8)	10 (11)
Illiterate (0)	21 (18)	26 (29)
Primary (up to 5)	44 (37)	14 (16)
Secondary (up to 10)	21 (18)	23 (26)

Source: Field survey 2023

4.1.3 Farmers occupation

Table 4.3 outlines the percentage distribution of farmers by occupation across constrained and unconstrained study areas. In the constrained areas, the majority of individuals, 92% (110 farmers), are primarily engaged in farming, followed by 6.7% (8 farmers) involved in business, and 1.7% (2 farmers) working in the service sector. None of the individuals in constrained areas are unemployed. Similarly, in unconstrained areas, 89% (80 farmers) are farmers, 6.7% (6 farmers) are involved in business, 3.3% (3 farmers) work in the service sector, and 1.1% (1 farmer) is unemployed.

Table 4.3: Percentage distribution of occupation of farmers by study area

Farmers occupation	Constrained	Unconstrained
	Frequency (percentage)	Frequency (percentage)
Business	8 (6.7)	6 (6.7)
Farmer	110 (92)	80 (89)
Service	2 (1.7)	3 (3.3)
Unemployed	0 (0)	1 (1.1)

Source: Field survey 2023

4.1.4 Farm size

Depending on the land possession the respondents were classified into three categories according to DAE (1999) as appeared in table 4.1.4. Farm size of a farmer referred to the total area of land on which his family carried out the farming operation, the area being in terms of full benefit to the family. Based on their total farm size, the farmers were classified into three categories as follows.

Table 4.4: Classification of the farmers according to farm size

Farm size	Constrained	Unconstrained
	Frequency (percentage)	Frequency (percentage)
Large Farmer (3.04 and above)	57 (48)	35 (39)
Medium Farmer (1.01 to 3.03)	55 (46)	48 (53)
Small Farmer (0.02 to 1.00)	8 (6.7)	7 (7.8)

Source: Field survey 2023

From Table 4.4 classifies farmers based on farm size in both constrained and unconstrained study areas. In the constrained areas, 48% (57 farmers) are large farmers with land sizes of 3.04 hectares and above, 46% (55 farmers) are medium farmers with land sizes between 1.01 and 3.03 hectares, and 6.7% (8 farmers) are small farmers with land sizes ranging from 0.02 to 1.00 hectares. In the unconstrained areas, 39% (35 farmers) are large farmers, 53% (48 farmers) are medium farmers, and 7.8% (7 farmers) are small farmers.

4.1.5 Annual farming income

Table 4.5 classifies farmers according to their annual farming income in both constrained and unconstrained study areas. In the constrained areas, 43% (52 farmers) have an income between 150,000 and 250,000, 39% (47 farmers) earn more than 250,000, and 18% (21 farmers) have an income of less than 150,000. In the unconstrained areas, 68% (61 farmers) have an annual income exceeding 250,000, 27% (24 farmers) earn between 150,000 and 250,000, and only 5.6% (5 farmers) have an income below 150,000.

Table 4.5: Classification of the farmers according to annual farming income

Annual income	Constrained	Unconstrained
	Frequency (percentage)	Frequency (percentage)
150000 to 250000	52 (43)	24 (27)
Less than 150000	21 (18)	5 (5.6)
More than 250000	47 (39)	61 (68)

Source: Field survey 2023

4.1.6 Farmers income and savings related information

Table 4.6 presents the percentage distribution of farmers by annual savings in both constrained and unconstrained study areas. In the constrained areas, 68% (82 farmers) have annual savings exceeding 50,000, 28% (33 farmers) have savings between 10,000 and 50,000, and 4.2% (5 farmers) have savings of less than 10,000. In the unconstrained areas, 86% (77 farmers) have annual savings of more than 50,000, 13% (12 farmers) save between 10,000 and 50,000, and only 1.1% (1 farmer) saves less than 10,000 annually.

Table 4.6:Percentage distribution of income and savings

Annual savings	Constrained	Unconstrained
	Frequency (percentage)	Frequency (percentage)
10000 to 50000	33 (28)	12 (13)
Less than 10000	5 (4.2)	1 (1.1)
More than 50000	82 (68)	77 (86)

Source: Field survey 2023

It is also seen that 90.50 percent of farmers were dependent on agriculture and allied activities for their income whereas, only 9.50 percent of farmers rely on only agriculture as their earning source.

4.2 Factor influencing agricultural credit rationing

4.2.1 Determination of factor influencing agricultural credit rationing

To identify the determinants influencing access to specialized agricultural loans, a binary logit model is developed by applying equation (1) to the estimated parameters and marginal impact. Overall, the model provides a decent fit with characteristics predicting adoption status among study homes. Furthermore, the majority of the model's explanatory variables were statistically significant and had the predicted sign. In regression analysis, P-values and coefficients describe whether associations in the model are statistically significant, as well as their nature. (Table 4.7)

4.3 Age

The coefficient for age is 0.197, indicating that as age increases, the likelihood of being credit rationed increases. This is statistically significant at the 5% level ($p = 0.013$). The marginal effect of 0.020 means that each additional year of age increases the probability of credit rationing by 2%.

4.4 Farm size

The coefficient for farm size is 0.703, indicating that larger farm sizes are associated with a higher likelihood of credit rationing. This is statistically significant at the 10% level ($p = 0.095$). The marginal effect of 0.070 suggests that an increase in farm size increases the probability of credit rationing by 7%.

Table 4.7: Factors influencing agricultural credit rationing

Independent variables (Binary logit model)	Coef.	Std. Err.	t-value	p-value	Marginal Effect	Sig
Age	0.197	0.08	2.48	0.013	0.020	**
Education	0.135	0.102	1.32	0.186	0.013	
Occupation	0.305	0.427	0.71	0.475	0.030	
Farm size	0.703	0.421	1.67	0.095	0.070	*
Annual income	-1.254	1.495	-0.84	0.402	-0.125	
Savings	0.454	0.658	0.69	0.490	0.045	
Off farm income	-0.266	0.557	-0.48	0.633	-0.027	
Have Livestock	0.776	0.504	1.54	0.124	0.077	
Distance of Bank	0.28	0.05	5.55	0.000	0.028	***
Distance of NGO	0.096	0.067	1.43	0.152	0.010	
Constant	-7.187	14.305	-0.50	0.615	0.020	
Mean dependent var		0.571	SD dependent var		0.496	
Pseudo r-squared		0.525	Number of obs		210	
Chi-square		150.554	Prob > chi2		0.000	
Akaike crit. (AIC)		158.268	Bayesian crit. (BIC)		195.086	
*** $p<.01$, ** $p<.05$, * $p<.1$						

Source: Authors own calculation

Note: Dependent variable: Agricultural Credit Rationing = [1 Applied for credit but rejected or did not receive required amount of credit (Constraint); 0 if farmer received agricultural required credit (Unconstraint)]

4.5 Distance of bank

The coefficient for the distance of the bank is 0.280, indicating that greater distance from a bank significantly increases the likelihood of credit rationing ($p = 0.000$). The marginal

effect of 0.028 suggests that an increase in the distance from a bank increases the probability of credit rationing by 2.8%.

Pseudo R-squared value of 0.525 indicates that approximately 52.5% of the variability in the credit rationing outcome is explained by the independent variables included in the model. This suggests a moderate to strong explanatory power, meaning that the model has a good fit and the variables included are useful predictors of credit rationing.

4.6 Impact of agricultural credit rationing for *Boro* rice production

It is critical to have a clear and realistic picture of the credit policy intervention and its outcome in order to ensure proper credit scheme implementation. The data reported in this chapter were to help policymakers determine the impact of specialized agricultural finance on *Boro* rice output. This chapter's findings may also be useful in encouraging *Boro* rice cultivators to use agricultural financing by explaining the comparative advantage of doing so. To estimate the effect of credit rationing in *Boro* rice farming Cobb-Douglas production function was implemented.

4.6.1 Agricultural credit sources and characteristics

The sources and characteristics of agricultural credit are presented in Table 4.8. Most borrowers (84%) had taken out a loan from a formal financial institution (Bangladesh Krishi Bank). About 16% of the borrowers had a loan from informal sources as NGOs operated in the study area.

Table 4.8: Agricultural credit sources and characteristics (Average)

Agricultural credit characteristics/Source	Agricultural bank	NGOs
Loan size (tk.)	66110.12	61818.19
Interest rate (%)	10.00	15.17
Duration (month)	15.08	14.50

Source: Field survey, 2023

Estimation of the Cobb-Douglas production model using equation (2) and the estimated results given below in table 4.9:

4.7 Fertilizer cost

The coefficient for fertilizer cost is 0.845, indicating a substantial and significant positive impact on yield. For every unit increase in fertilizer cost, the yield increases by 0.845 kg, holding other factors constant. This effect is highly significant with a p-value of less than 0.001, suggesting strong evidence that higher fertilizer costs are associated with higher yields.

Table 4.9: Impact of agricultural credit rationing on *Boro* rice production

Variable name (Cobb-Douglas production model)	Coef.	St.Err.	t-value	p-value	Sig
Land prep cost	.009	.08	0.11	.913	
Seed cost	-.01	.027	-0.37	.709	
Irrigation cost	.003	.012	0.30	.764	
Fertilizer cost	.845	.106	7.99	0	***
Pesticide cost	-.018	.032	-0.57	.567	
Labor cost	-.073	.096	-0.76	.449	
Credit rationing	-.087	.013	-6.73	0	***
Constant	3.125	1.04	3.01	.003	***
*** $p < .01$, ** $p < .05$, * $p < .1$					
Mean dependent var			8.956		
R-squared			0.586		
F-test			40.883		

Source: Authors own calculation

4.8 Pesticide cost

The coefficient for pesticide cost is -0.018, indicating a small negative relationship with yield, where an increase in pesticide cost is associated with a 0.018 kg decrease in yield. However, this effect is not statistically significant, as the p-value is 0.567, suggesting no strong evidence that pesticide cost affects yield.

4.9 Credit rationing

The coefficient for credit ration is -0.087, suggesting that productivity of credit rationing farms is significantly lower than non-rationing farms. This effect is statistically significant at the 0.001 level, indicating strong evidence that higher credit ration negatively impacts yield.

The R-squared value of 0.586 indicates that approximately 58.6% of the variance in yield can be explained by the independent variables in the model. The F-test is highly significant (p-value < 0.001), suggesting that the model as a whole is statistically significant.

CHAPTER 5

PROBLEMS RELATED TO AGRICULTURAL CREDIT RATIONING

Farmers had several difficulties in cultivating *Boro* rice. The issues were social and cultural in nature, as well as financial and technological in nature. This chapter was discussed some of the difficulties associated with the development of *Boro* rice. Farmers' issues were recognized based on their perspectives. The following sections highlight the primary issues associated with *Boro* rice cultivation:

5.1 Problems of Agricultural Credit Rationing for *Boro* Rice Production

5.1.1 Lack of information

During harvesting season, the majority of farmers were forced to sell a big amount of their crop to satisfy different commitments like as household needs and loan repayment. However, sufficient access to loan related information and government pushed schemes informed most of the farmers of the study area. As seen in Table 5.1, 100 % of *Boro* rice producers do not rate this as a serious concern.

5.1.2 Lack of collateral

The high collateral for agricultural credit was also a significant constraint for credits for *Boro* rice production in the research location. According to Table 5.1, almost 99.50 % of *Boro* rice producers rated this as a serious concern.

5.1.3 Financial institutions are too far

Around 100% of *Boro* rice farmers said that distance of financial institutions can be classified as a serious issue. (Table 5.1).

5.1.4 Lack of guarantors

Farmers claimed that lack of guarantors impeding their ability to get agricultural credit. According to table 5.1, around 49.50% of *Boro* rice producers cited this as a concern.

5.1.5 Complicated procedure

According to Table 5.1, around 46.20% of *Boro* rice producers rated this as a severe concern.

5.1.6 Religious matter

Lack of religious permission was a major issue for most of the Muslim *Boro* rice farmers in the study area as the credit and installment system is not permissible. From Table 5.1 it is evident that about 90 % *Boro* rice growers reported this as high problem.

5.1.7 Attitude of banking staff was not good

Despite the fact that new agricultural credit scheme has been implemented in the research region, a substantial proportion of farmers avoid formal banking institutions for unfriendly attitude of the support stuffs. This was an issue for around 38% of *Boro* rice producers. (Table 5.1).

5.1.8 Fear of losing property

The uncertainty of having good returns from the *Boro* rice or production failure due to any natural calamities leads farmers of the study are fear of losing their land mostly to the NGOs. As a result, 6.20% of sample farms reported having inadequate storage facilities. Although these issues are not common because of modern farming technologies, farmers somehow manage to recovers their production costs.

5.1.9 Fear of loan repayments

Several farmers claimed that they had gotten very limited time to loan repayment with higher instalments. Around 98.60% of *Boro* rice producers identified this as a significant issue (Table 5.1).

5.1.10 Rejection expected

In the studied locations, the majority of farmers lacked their own land which is mandatory for some credit rationing institutes. According to Table 5.1, almost 5.20% of *Boro* rice producers identified this as a serious concern.

Table 5.1: Non-recipient farmers' perceptions on reasons of not getting agricultural credit

Sl. No.	Reasons	Percentage of farmers	
		Yes	No
01	Lack of information	0.00	100.00
02	Lack of collateral	99.50	0.50
03	Financial institutions are too far	0.00	100.00
04	Lack of guarantors	49.50	50.50
05	Complicated procedure	46.20	53.80
06	Religious matter	90.00	10.00
07	Attitude of banking staff was not good	38.00	62.00
08	Fear of losing property	6.20	93.80
09	Fear of loan repayments	98.60	1.40
10	Rejection expected	5.20	94.80
11	Installments are too early	20.00	80.00
12	Installments amounts are too high	4.80	95.20

Source: Field survey, 2023

5.1.11 Instalments are too early

Numerous farmers have reported being dragged into short period agriculture credit due to higher production cost of *Boro* rice which made them pay installments within a very short period of time. As shown in Table 5.1, about 20% of *Boro* rice producers confronted this issue severely.

5.1.12 Instalments amounts are too high

For most of the NGOs involved in agriculture credit rationing their instalment were very high compared with government agricultural banks. As shown in Table 5.1, about 4.80% of *Boro* rice producers confronted this issue severely.

5.2 Agriculture credit/liquidity limitation relater problems

5.2.1 Agricultural credit or liquidity issues

For the *Boro* rice farmers of the study area agricultural credit or liquidity issues is a very serious one and 89.50 % of the respondents were moderately agreeing with these issues whereas 10.50 % farmers were disagreed with the following concern.

5.2.2 Agriculture credit constraint affect farm purchases

According to Table 5.2, 99.50 % of the *Boro* rice farmers in the study area agreed with that the agriculture credit constraint affect farm purchases.

5.2.3 Agricultural credit/liquidity limitation influencing choice of high-quality inputs

From Table 5.2, 90.50 % of the *Boro* rice farmers in the study area agreed with that the agricultural credit/liquidity limitation influenced their choice of high-quality inputs.

Table 5.2: Agriculture credit/liquidity limitation relater problems faced by the non-recipient Farmers (percentage)

Sl. No.	Problems	Strongly Agree	Moderately Agree	Agree	Disagree	Strongly disagree
01	Agricultural credit or liquidity issues	0.00	89.50	0.00	10.50	0.00
02	Agriculture credit constraint affect farm purchases	46.70	52.90	0.00	0.50	0.00
03	Agricultural credit/liquidity limitation influencing choice of high-quality inputs	90.50	0.00	9.50	0.00	0.00

04	link between credit/liquidity constraints and the adoption of new technology	56.70	43.30	0.00	0.00	0.00
05	Farmed land size reduced due to credit or liquidity issues	57.10	0.00	0.00	42.90	0.00

Source: Field survey, 2023

5.2.4 Link between credit/liquidity constraints and the adoption of new technology

100 percent of the *Boro* rice farmers in the study area agreed with that there was a link between credit/liquidity constraints and the adoption of new technology.

5.2.5 Farmed land size reduced due to credit or liquidity issues

As most of the NGOs involved in agriculture credit rationing their instalment were very high compared with government agricultural banks and if farmers failed to repay the loan in time, they have high chance to lose their mortgaged lands. Due to this reason 57.10 percent farmers thinks that their farmed land size reduced due to credit or liquidity issues.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

Bangladesh, a predominantly agricultural country, has a significant agricultural sector that contributes 11.22% of the country's GDP. The study aims to investigate socio-economic characteristics of *Boro* rice growers, factors influencing credit rationing, and the effect of credit rationing on *Boro* rice productivity in Kushtia district, one of the highest rice's producing upazilas in the country. The study used a simple random sample strategy and a field survey to gather data on rice production and agricultural credit use. About 210 households were selected as sample households, with 120 farmers being credit constrained and 90 farmers unconstrained. The data was analyzed using descriptive statistics and a logit model with marginal impact. The Cobb-Douglas production function was used to assess the contribution of agricultural credit rationing to *Boro* rice production. The majority of farmers were illiterate, with 22.60% having a primary level of education and 21% having a secondary level. The majority of farmers had other occupations with farming, with 90.50% earning their living through agricultural activities. A significant percentage of farmers (21%) had average annual savings between BDT 100000 to 50000, while 75.70% saved more than BDT 50000 in a year. The marginal effect of age on credit rationing was found to be 0.27%, indicating that each additional year of age increases the likelihood of being credit rationed by 2%. Education was also a significant factor in the study, with 21% of farmers saving between BDT 100000 to 50000 and 75.70% saving more than BDT 50000 in a year. The study examines the relationship between credit rationing and yield in agriculture. It finds that higher education levels, occupation, farm size, annual income, savings, off-farm income, and having livestock all have a slight impact on credit rationing. However, the effect of these factors is not statistically significant. The coefficient for education is 0.135, suggesting that higher education levels increase the likelihood of credit rationing by 1.3%. Occupation also slightly increases the likelihood of credit rationing, but this effect is not statistically significant. Farm size is associated with a higher likelihood of credit rationing, with larger farms increasing the probability of credit rationing by 7%. Annual income

decreases the likelihood of credit rationing by 12.5%, while savings increase the probability of credit rationing by 4.5%. Off-farm income slightly reduces the likelihood of credit rationing, but this effect is not statistically significant. Having livestock also increases the likelihood of credit rationing, although this effect is not statistically significant. The distance from a bank significantly increases the likelihood of credit rationing, while the distance from an NGO increases the probability of credit rationing by 1.0%. The model has a moderate to strong explanatory power, with approximately 52.5% of the variability explained by independent variables. Land preparation costs, seed costs, irrigation costs, fertilizer costs, pesticide costs, labor costs, and credit ration all have a significant effect on yield. The model as a whole is statistically significant, with 58.6% of the variance explained by independent variables.

6.2 Conclusion

In conclusion, this study has provided a comprehensive analysis of the socio-economic characteristics of *Boro* rice growers, the factors influencing credit rationing, and the subsequent impact of credit rationing on *Boro* rice productivity in Bangladesh. The investigation into the socio-economic profiles of farmers revealed critical insights into how demographic variables such as age, education, farm size, and income levels shape farming practices and access to financial resources. Further, the study identified key determinants of credit rationing, including institutional constraints, collateral requirements, and farmers' creditworthiness, which significantly influence the availability and adequacy of credit for *Boro* rice cultivation. The findings highlighted that credit rationing adversely affects rice productivity by limiting farmers' ability to invest in quality inputs, adopt modern farming techniques, and manage crop risks effectively. Consequently, addressing credit rationing through targeted financial policies and support mechanisms is imperative to enhance the productivity and sustainability of *Boro* rice farming, thereby contributing to the overall agricultural development and food security in Bangladesh.

6.3 Recommendations

After analyzing the data collected from the field survey the present study comes up with following recommendations:

Increase agricultural credit supply

The government and Bangladesh Bank should raise the total supply of credit for Boro rice cultivation to meet farmers' demand, especially as input costs have risen.

Simplify credit acquisition process

Ensure the process of obtaining agricultural credit is straightforward and accessible, particularly for small and marginal farmers.

Flexible collateral requirements

Bangladesh Bank should relax collateral requirements for small and marginal farmers to enhance their access to agricultural credit.

Effective dissemination of credit information

Government and Bangladesh Bank should actively disseminate information on agricultural credit programs through print, electronic media, and local stakeholders like DAE officials and local politicians.

Extend credit repayment period

Extend the repayment period for agricultural credit to prevent farmers from having to sell their produce at a loss immediately after harvest.

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APPENDIX

Dept. of Management and Finance
Sher-e-Bangla Agricultural University

Interview Schedule

Impact of credit rationing in rice productivity in Bangladesh

Sample no.: ----- Date:

1. General information:

Name:

Upazila : District: Contact No:

2. Farmers profile:

SL. NO	Relationship	Age (yrs)	Education (yrs)	Main occupation*	Family size	Employed person
1	Self					
2	Spouse					

*Occupation code: 1 =Agriculture, 2= service, 3=business, 4= unemployed, 5=others

3. Farm Size:

Land Type	Area(ha)
Own Land	
Rented Land in	
Rented Land out	
Farm area under rice cultivation	
Farm area under <i>Boro</i> rice	
Farm area under other crops	

4. Details Information of Rice Cultivation: a) Cultivation time.....b)
 Season.....

4.1. Seed **cost:**
tk/a
 rea

4.2. Land use cost tk/
 area

4.3. Irrigation cost:

Irrigation cost(tk/area)	
No of irrigation given	

4.4. Cost of Pesticides:

Pesticides cost(tk/area)	
No of application	
Others cost related with pesticides	

4.5. Total Number of Permanent and Rented labors Hired in the Rice Production:

Segment wise Labor cost of Rice Production(per unit area):

Cost inputs	Rented Labor(No)			Supply from family(No)		
	Male	Female	Children	Male	Female	Children
Tillage						
Seedbed preparation						
Uprooting and Planting						
Irrigation purpose						

Pesticides						
Weeding						
Fertilizer application purpose						
Manuring purpose						
Harvesting						
Threshing and Drying						
Stowage						
Others						

Wage rate(i)Male.....taka/day(ii)Female.....taka/day(iii)Children
.....tak
a/day

4.6. Tillage cost/Power use for land preparation per acre:

Category of plow	Taka/Area
Country	
Plow/Bullock	
Power tiller	
Tractor	

4.7. Fertilizer cost

Fertilizer name	Amount	Taka/Area
Urea		
TSP		

MP		
Gypsum		
Ashes		
Manure		
Others		

Input cost = Quantity× Price

4.8. Total production cost: tk

5. Yield:

5.1. Total production kg/area

5.2. Selling price of rice..... tk/kg

5.3. Is there any by-product from rice production? if yes then amount.....

6. Return from rice production tk

7. Direct elicitation technique to farm household credit rationing and non-rationing status:

7.1. Do you have credit or liquidity issues?

Strongly Agree_____. Moderately Agree_____. Agree_____.

Disagree_____. Strongly disagree_____. if agree then.....

7.2. Does credit constraint affect farm purchases?

Strongly Agree_____. Moderately Agree_____. Agree_____.

Disagree_____. Strongly disagree_____.

Is credit/liquidity limitation influencing your choice of high-quality inputs?

Strongly Agree_____. Moderately Agree_____. Agree_____.

Disagree_____. Strongly disagree_____.

7.3. Is there a link between credit/liquidity constraints and the adoption of new technology?

Strongly Agree_____. Moderately Agree_____. Agree_____.

Disagree_____. Strongly disagree_____.

7.4. Have you reduced the size of your farmed land due to credit or liquidity

issues? Strongly Agree____. Moderately Agree_____. Agree_____.

Disagree_____. Strongly disagree_____.

7.5. Do you have a list of credit sources? Yes_____ . No_____.

7.6. Have you submitted an application for a loan? Yes_____ . No_____.

If no, why you did not apply for loan? Reasons:1.Lack of information
_____. 2.Lack of collateral_____. 3.Financial
institutions are too far _____. 4.Lack of
guarantors_____.

5.Complicated procedure_____. 6.Religious matter_____. 7.Attitude of
banking staff was not good_____. 8.Fear of losing property____. 9.Fear of loan
repayments_____.

10. Rejection expected_____. 11.Installments are too early_____.

12.Installments amounts are too high_____.13. Other reasons_____.

7.7. What was the status of your loan application if you applied for one?

Accepted_____. Rejected_____.

7.8. What were the reasons for your loan application being denied?

1.Previous default or banking statement was not clear_____. 2.Lack of farming
experience_____. 3.Started a new business_____. 4. Net worth was not good
_____.

5.Other reasons_____.

7.9. Did you receive enough money if your loan application was approved?

1.Yes received total amount _____. 2.Received insufficient amount _____. If
received insufficient amount then.....

7.10. Did you use it properly during farm activities? Yes_____ . No_____.

7.11. If not, or if the disbursed loan amount was mutualized, what were the reasons?

1.Marriage purpose_____. 2.Payment of debt_____. 3. Construction of home
_____.

4.To pay court or lawyer fees_____. 5.Other reasons_____.

7.12. Are you credit constrained in relation to your rice crop? Yes_____. No_____.

7.13. Have you encountered any difficulties? Yes_____. No_____.

If yes ,what kind of constraints faced while obtaining loan. Please mention

i._____. ii._____. iii._____. iv_____. v._____. vi.
_____. vii._____.

viii. _____. ix. _____. x. _____.

8. Access to credit:

Sources of credit	Loan Amount	Duration of finance(years)	Rate of interest	How much interest did you pay?	Outstanding amount
Commercial banks					
Agricultural bank					
NGOs					
Govt. credit					
Relatives					
Friends					
Money Lender					
Others					

9. Annual Income:

Agricultural source.....tk

Non Agricultural source(if any) tk

10. Annual expenditure:

Consumption expenditure Tk/yr

Non consumption expenditure Tk/yr

11. Did you received any training on rice farming? (1)Yes / (2)No

12. Do you have off-farm income source? (1)Yes / (2)No

13. Do you have livestock? (1)Yes / (2)No

14. Do you have formal bank in your upazila? (1)Yes / (2)No

15. Distance of bank from your house? km

16. Distance of NGO from your house?..... km

17. Do you have relatives working in bank / NGO? (1)Yes / (2)No

Thanks for your kind co-operation





Plate 01. Interviewing the *Boro* Rice farmers of the study areas