AN ECONOMIC ANALYSIS OF KATARIVOG RICE CULTIVATION IN PARBATIPUR AREAS OF DINAJPUR DISTRICT

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CERTIFICATE

This is to certify that the thesis entitled, **"AN ECONOMIC ANALYSIS OF KATARIVOG RICE CULTIVATION IN PARBATIPUR AREAS OF DINAJPUR DISTRICT"** *submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***MASTER OF SCIENCE (MS) in*** **AGRICULTURAL STATISTICS**, *embodies the result of a piece of bonafide research work carried out by Md. Shakil Akter, Registration No. 12-04887 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.

Dated: December, 2019
Place: Dhaka, Bangladesh

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TO

MY BELOVED FAMILY

AN ECONOMIC ANALYSIS OF KATARIVOG RICE CULTIVATION IN PARBATIPUR AREAS OF DINAJPUR DISTRICT

ABSTRACT

The present study was conducted to examine an economic analysis of Katarivog rice cultivation in Parbatipur areas of Dinajpur district. In total 71 farmers were selected randomly from three villages namely Dolapara, Shemuliapara and Gorerpara under Parbatipur Upazilla of Dinajpur district in Bangladesh. Primary data were collected from the farmers by survey method. The study revealed that most of the farmer's occupation was agriculture. The gross return, net return and total cost of Katarivog rice were 128374.11 Tk./ha, 60985.41 Tk./ha and 67388.7 Tk./ha, respectively. Also, the BCR was 1.905 and that's kind of BCR is always good for the farmers. The resource use efficiency showed that the Katarivog rice cultivator failed to use inputs efficiently, either the input was overused or underused. Among the constraints, attack by insect and pest was dominant and for suggestions, farmers wanted a stable market. The government should take necessary steps to overcome these constraints and expand the production of this valuable rice variety in Bangladesh.

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ACRONYMS AND ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
BER	Bangladesh Economic Review
BCR	Benefit-Cost Ratio
GOB	Government of Bangladesh
^{0}C	Degree Celsius
e.g.	exempil gratia (for example)
et.al.	et alia (and others)
etc.	et cetera (and others and so forth)
GDP	Gross Domestic Product
GM	Gross Margin
GR	Gross Return
HSC	Higher Secondary Certificate
SSC	Secondary School Certificate
Ha	Hectare
HYV	High Yielding Varieties
Kg	Kilogram
Km^2	Kilometer Square
Ln	Natural Logarithm
M.T	Metric Ton
MFC	Marginal Factor Cost
MVP	Marginal Variable Cost
M0P	Murate of Potas
MT	Metric Ton
TSP	Triple Super Phosphate
TVC	Total Variable Cost

CHAPTER I

INTRODUCTION

1.1 Background of the study

Bangladesh is one of the most densely populated countries in the world having a population of 162.7 million with a density of about 1103 per square kilometer (BBS, 2017). The people of Bangladesh mostly live on agriculture. A plurality of Bangladeshis earns their living from agriculture. Although rice and jute are the primary crops, wheat is assuming greater importance. Tea is grown in the northeast. Because of Bangladesh's fertile soil and normally ample water supply, rice can be grown and harvested three times a year in many areas. Due to a number of factors, Bangladesh's labor-intensive agriculture has achieved steady increases in food grain production despite the often unfavorable weather conditions.

As the country is not that rich to produce sufficient food to its population, poverty is every day's company of the people. The poor people of the country suffer from malnutrition as they are not able to balance food. The major part of the protein and calories of its peoples come from rice. Also, they have to meet their protein requirements by having foods like pulse crops, cereal, egg, etc. The economy of Bangladesh also depends on agriculture which is 10.98% (BBS, 2018). The last few years showed a declining GDP trend, however, the share of food grains (especially rice) had increased over time due to HYV seed, proper distribution of fertilizer and other relevant invention of technologies. In 2011-2012 the food grain was 338.89 Lac MT but in 2017-2018 it is 362.78 Lac MT (BBS, 2018). From the above, it is evident that rice has a great impact on the food grains production of Bangladesh.

1.2 Importance of agriculture in the economy of Bangladesh

Bangladesh is mainly an agricultural country. Agriculture is the single largest sector of the economy and contributes about 10.98% to the total gross development product of the country and also it accommodates around 40.6% (BBS, 2018) of the total labor force. GDP growth rates in Bangladesh mainly depend on the performance of the

agricultural sector. Due to several natural calamities like floods, cyclones, drought, loss of production in both food and cash crop are the almost regular phenomenon. Yet in recent years there has been a substantial increase in food grain production. Due to the use of modern machinery and equipment, agricultural production is increasing in spite of having a small number of holdings. Rice, jute, wheat, tea, potato, pulse crop, and tobacco are the principal crop of Bangladesh. The positive result is coming as the government pursues some policies like crop diversification program, credit supply, extension work, research and input work. The county is on the verge of attaining self-sufficiency on food grain production.

1.3 Importance of rice in the economy of Bangladesh

Rice is the main staple food of the people of Bangladesh. It provides nearly 48% of rural employment, about two-third of total calorie supply and about one-half of the total protein intakes of an average person in the country. The rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh. Almost all of the 13 million farm families of the country grow rice. Rice is grown on about 10.5 million hectares which have remained almost stable over the past three decades. About 75% of the total cropped area and over 80% of the total irrigated area is planted to rice. Thus, rice plays a vital role in the livelihood of the people of Bangladesh. Total rice production in Bangladesh was about 10.59 million tons in the year 1971 when the country's population was only about 70.88 million. About 75% of

the total cropped area and over 80% of the total irrigated area is planted to rice. Thus, rice plays a vital role in the livelihood of the people of Bangladesh. Total rice production in Bangladesh was about 10.59 million tons in the year 1971 when the country's population was only about 70.88 million. However, the country is now producing more than about 36.27 million tons to feed her 162.7 million people (BBS, 2017). This indicates that the growth of rice production was much faster than the growth of the population. This increased rice production has been possible largely due to the adoption of modern rice varieties on around 66% of the rice land which contributes to about 73% of the country's total rice production (Bangladesh Rice Research Institute, 2019).

Table 1.1 Rice producing counties in the world

Country	Millions of tones
China	214.4
India	168.5
Indonesia	81.4
Bangladesh	49.0
Vietnam	42.8
Thailand	33.4
Myanmar	25.6
Philippines	19.3
Brazil	12.5
Pakistan	11.2
World	769.7

Source: Adapted from FAOSTAT of the United Nations (2017)

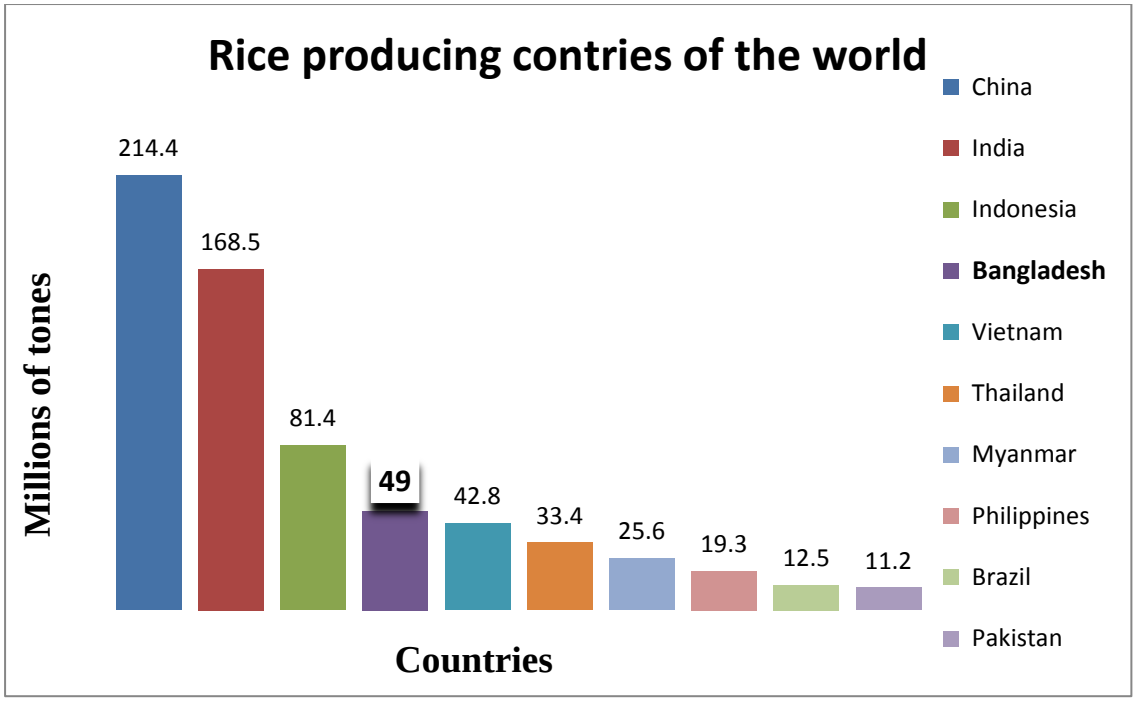

Figure 1.1 Rice producing counties in the world

Bangladesh is ranked 4th among rice-producing countries in the world after China, India, and Indonesia. In the past, the country largely depended on imported food grains with its deficit production, mainly due to the increasing number of population. However, the population growth rate, these days runs behind the growth rate of food grains.

The food grain production of Bangladesh has almost tripled since independence, due to the introduction of proper use of seed-fertilizer-irrigation technologies in her agricultural sector. As a result of some of the districts which were generally food grains deficit had been surplus in food grain production and this is possible only for HYV production throughout the country.

1.4 Contribution of Aman to the total production of Bangladesh

Aman is one of the main crops in Bangladesh. It is the second-largest rice crop in the country in respect of the volume of production while Boro remains the top. It is notable that the area coverage of Aman is the largest as a single crop and Boro remains the second. The production of Aman depends on the weather condition of the country and farmers usually cultivate Aman in their land.

Total area under Aman crop has been estimated (1,40,34,504) acres 56,79,456 hectares 2018 as compared to (1,37,96,773) acres (55,83,252) hectares in 2017. The harvested of 2018 has increased by 1.72%. Comparative area estimates are shown below:

Table 1.2 Total areas under Aman crop for the financial Year of 2017-18

Variety	2016-2017		2017-2018		Percentage changes over previous year
	Area (in acres)	Area (in hectares)	Area (in acres)	Area (in hectares)	
Broadcast Aman	8,10,494	3,27,989	9,03,078	3,65,456	(+)11.42%
Local Transplant (L.T.) Aman	26,75,628	10,82,768	23,13,473	9,36,212	(-)13.54%
High Yielding Variety (HYV)	1,03,10,651	41,72,494	1,08,17,952	43,77,788	(+) 4.92%
Total Aman	1,37,96,773	55,83,252	1,40,34,504	56,79,456	(+) 1.72%

Source: Adapted from Statistical Yearbook of Bangladesh 2018

The average yield rate of Aman for the financial Year 2017-18 has been estimated 2.464 Metric tons per hectare which are 0.74**%** higher than that of last year. Comparisons of estimated yield rates are shown below:

Table 1.3 Total yield rate of Aman crop for the financial Year of 2017-18

Variety	2016-2017		2017-2018		Percentage changes over previous year
	Yield per acre (Maunds)	Yield per hectare (M.Ton)	Yield per acre (Maunds)	Yield per hectare (M.Ton)	
Broadcast Aman	13.10	1.208	13.12	1.210	(+) 0.17
Local Transplant (L.T.) Aman	18.23	1.681	15.52	1.432	(-) 14.81
High Yielding Variety (HYV)	29.72	2.742	30.24	2.789	(+) 1.71
Total Aman	26.52	2.446	26.71	2.464	(+) 0.74

Source: Adapted from Statistical Yearbook of Bangladesh 2018

1.5 Performance of Aromatic and Katarivog rice varieties

Aromatic rice containing aroma (acetylene pyroline) is short and bold, short in height, its plant is N_2 responsive and it has also high tillering behavior. Dinajpur district is highly concentrated for aromatic rice production. Various rice processing companies like ACI, Pran Group and Square Company Limited have established aromatic rice processing plant in Dinajpur. In 2017-18 about 15,540 hectares of land was under Katarivog rice, which was about 5.6% of total Aman area and from where 36,460 tons of clean rice was produced with an average yield of 2.37 ton/ha in this district (DAE, 2017). Bangladeshi aromatic rice is expected to have a good market demand in the international market for its nice aroma and fine-grain quality. With low production cost and natural facilities, Bangladesh could enjoy a very good opportunity to export aromatic and fine grain rice abroad because of higher demand in the world market. So far, a few studies have been conducted on fine-grain paddy/rice in Bangladesh. However, there is not much exclusive study on Katarivog rice. For this reason, it was felt that a study on the Katarivog rice in the Dinajpur area would be of much importance. The present study is a modest attempt to describe the economic condition of Katarivog rice stating the problems of its production and profitability and giving some solutions.

1.6 Justification of the study

Thus it is very important to know the economic analysis of Katarivog rice for the enhancement of production and to suggest the policymaking entities for appropriate policy formation and to ensure profitable production as an end result. It has already shown that the majority of the people in Bangladesh live in agriculture. The majority of the people of Bangladesh depend on agriculture for their livelihood. Rice serves as an important staple food in the diet of an estimated 170 million people. It has been cultivating in almost all the arable land in Bangladesh. The total production of rice is around 36.2 million tons per year (BBS, 2017) and employs around 39.07% in 2017 from 69.51% in 1991 of the total labor forces (WB, 2017). Generally, rice can be divided into two types: regular rice and aromatic rice. The aromatic rice sector is a growing and profitable sector for Bangladesh. Dinajpur district is unconventional in producing aromatic rice. The area under cultivation is about 40765 hectares and the total rice production is around 85406 MT (Dinajpur, 2018). The area of cultivating Katarivog rice is about 3801 hectares and the total rice production is around 6424 MT (Dinajpur, 2018). So it is evident that Katarivog rice is a profitable farming venture. It may be mentioned here that Katarivog rice attracts premium prices because it is highly valued by consumers as it is closely related to the social and cultural heritage of Bangles and it consumes during different festivals, special events such as weddings, entertaining guests, Eid, Puja, etc. Also, Katarivog rice has more potentiality of profit in the domestic market as well as in the international market. It can be told that the production of Katarivog rice is profitable for farmers.

1.7 Objective of the study

The objectives of the study were:

i) To describe the socio-economic profile of the Katarivog rice growers.
ii) To assess the profitability level of Katarivog rice cultivation.
iii) To determine the resource use efficiency of Katarivog rice growers.
iv) To identify the constraints of Katarivog rice cultivation with probable suggestion to overcome those constraints.

1.8 Organization of the study

The study has been organized into six chapters.

- Chapter 1 describes the introduction of the study.
- Chapter 2 a review of literature is presented.
- In chapter 3 methodologies are described.
- Description of the study area is included in chapter 4.
- Chapter 5 represents result and discussion.
- Chapter 6 presents the summary, conclusion and policy recommendations of the study.

CHAPTER II
REVIEW OF LITERATURE

A number of journal articles, policy documents, technical reports, and other publications were reviewed during the course of this study. The available literature related to "An Economic analysis of Katarivog rice cultivation in Parbatipur areas of Dinajpur district of Bangladesh" was so limited. However relevant findings which are directly or indirectly related to this study are briefly described below:

Omar *et al. (2019)* conducted a study to investigate the Value Chain of Kataribhog (aromatic) rice at the Dinajpur district in Bangladesh. A structured interview schedule was used for primary data collected from the rice farmers. The findings of this study revealed that the yield of Kataribhog rice was 1250 kg/acre and gross return was 51,200 Tk./acre. The cost of cultivation of Kataribhog rice was 38045.75 Tk./acre. On full and current cost basis the Benefit Cost Ratio (BCR) was found 1.35 and 2.05, respectively. About 75% of the produced aromatic rice was supplied to the domestic market by the millers and different companies. The remaining 25% was exported to different countries. The study also found that on average, the marketing cost of aromatic rice for bepari, aratdar (paddy), miller, aratdar (rice), wholesaler and retailer were estimated as Tk. 81.90, Tk. 91.80, Tk.761.71 Tk. 73.49, Tk. 95.57, and Tk. 75.57, per quintal respectively. The share of net margin (other than the farmers) earned by the faria/bepari, paddy aratdar, miller, aratdar (rice), wholesaler and retailer was estimated as 7.56%, 9.42%, 42.75%, 11.02%, 11.33% and 17.92%, respectively. The producer share to the total rice value was 63.53% with a farm-retail price spread of Tk. 2612 per quintal. In the study area, major constraints found for aromatic rice production were labor unavailability, pest and disease problem, high cost of input, high cost of labor, lodging problems. Besides, the constraints associated with aromatic rice marketing were lack of storage facilities, lack of price regulation and execution. Proper planning and measure from the government side to solve the problems in the production and marketing would encourage farmers for better production and distribution of aromatic rice in the country.

An experiment was carried out by Tama *et al. (2015)* to assess the financial profitability of aromatic rice production. A total of 45 farmers of some selected

villages of Chirirbandar Upazila of Dinajpur district were considered as a sample for achieving these objectives. To collect data, a questionnaire was administrated through face-to-face interviews of the sample farmers. Collected data were analyzed with descriptive statistics. The result of the descriptive analysis revealed that the average family size of aromatic rice growers was 4.64 and 88.88 percent of total sample farmers were literate. Total costs for aromatic rice was estimated at Tk. 64446.51 per hectare and per hectare gross return of aromatic rice was Tk. 114243.71. The gross margin for aromatic rice was estimated at Tk. 59999.29 per hectare. Thus, the net return was estimated at Tk. 49797.20 for aromatic rice production. The undiscounted Benefit Cost Ratio on the basis of the total cost was 1.77 implying that the aromatic rice production was highly profitable. Finally, some policy recommendations based on the findings of the study were suggested in the study.

Kabir (2008) did an experiment to identify the present status of rice milling in Bangladesh, supply and value chain of automatic and semi-automatic rice mills, the constraints of rice mills especially in supply and value chains and recommend priority areas of supply and value chain for interventions. Based on the growth and concentration, Dinajpur was selected as a study site. Random Sampling and Cluster Sampling techniques were followed for the selection of samples. Four sets of questionnaires were developed for personal interviewing of supply chain actors and key informants. Four types of commercial rice mills are identified in the country, they are: Traditional rice hullers, Husking rice mills, Semi-automatic rice mills and Automatic rice mills, and the numbers are 100000, 14139, 457 and 142, respectively. There are three distinct channels of a supply chain in the rice mill sub-sector. The channels are imported machinery channel, rice mill equipment production channel and rice processing channel. The total market size of rice milling is Taka 64854 million employing 0.26 million labor forces. In automatic rice mills, the profit margins in rice milling are estimated as Taka 768 and Taka 1105 per ton of milling the whole paddy for parboiled and aromatic rice, respectively. In semi-automatic rice mills, the profit margin for per ton of aromatic rice milling is found as Taka 920. The major constraints identified by the study are lack of skill related to operation & maintenance of rice mills, fabrication of rice mill machines and equipment, marketing and financial management and accounting at rice mill level; Lack of easy market linkages for the small farmers, traders, and processors with large urban markets; lack

of access to export market for aromatic rice, easy access to financial market by the farmers, small traders and processors, adequate storage facilities for paddy at farmers' and traders' level during the harvesting season etc; Increased transport cost in peak season; Lack of modern technology at rice mills. The rice milling sub-sector has great potential to modernize and to add a valuable contribution to loss saving, quality milled rice production and employment generation.

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

Tasnoova (2000) conducted a study on the Katarivog rice marketing system in some selected areas of Dinajpur districts. It was reported that farmers faced some problems for katarivog rice marketing and the major problems were the market price is low at harvesting time, lack of capital, lack of adequate storage facilities and higher market tolls.

A study was undertaken by Bunthan *et al. (2018)* on Cambodian agriculture is now in the midst of a transition from the traditional subsistent to the modern commercial one. With respect to rice farming, more farmers are shifting from non-aromatic to aromatic rice production. Currently, aromatic rice accounts for about 10% of the total rice cultivated area, and 30% of total rice production. Furthermore, the competitiveness of non-aromatic rice has worsened recently. By observing this trend, this study aims to grasp the differences in characteristics and profitability between non-aromatic and aromatic rice production and to discuss the factors affecting the variety of selection from farmers' viewpoint. This study is based on the survey conducted in VoaTk.or commune, Battambang province in 2017, one of the biggest rice-producing areas in Cambodia. In the survey, a random sampling method was applied, and 82 rice farmers

were interviewed. Among the sample, 59 farmers adopted non-aromatic rice, and 61 farmers adopted aromatic rice, including farmers adopted both aromatic and non-aromatic. Study farmers generally cultivated only once a year, mainly in the wet season. The result of the study showed that aromatic rice was not commonly used for home consumption and that more than 80% of the production was for sale, considering greater demand from the international market. On the other hand, non-aromatic rice was mainly used for home consumption and the domestic market. The costs of aromatic rice production were higher on material and labor costs, but farmers were able to obtain higher yield in comparison with the non-aromatic rice. Despite higher production costs, aromatic rice was found to be more profitable in gross value added, gross margin and net profit, thanks to higher yield and favorable paddy price. In addition, this study also identified non-economic factors affecting the farmers' decision-making on varieties. Finally, some recommendations are offered.

The study was undertaken by Anik (2002) to evaluate the economic and financial profitability of aromatic and fine rice production, using both primary and secondary data. Forty farmers who cultivated both Kataribhog and Chinigura, and fifteen farmers each producing Pajam and Nizershail were selected from Dinajpur district. For the Kalijira variety, thirty farmers were selected from Sherpur district. Among the aromatic and fine rice varieties, Pajam had the maximum per hectare yield. But net returns per hectare for the aromatic varieties were higher due to the higher market prices and less production cost of the varieties. Domestic Resource Cost (DRC) ratios showed that Bangladesh had a comparative advantage in the production of aromatic and fine rice both from the point of view of export and import substitution, except the Nizershail variety which was marginally unprofitable under the export proposition. The study also identified some problems faced by the farmers in producing aromatic and fine rice. Finally, some policy guidelines were suggested.

The field experiment was carried out by Razzaque and Rafiquzzaman (2007) at Multilocation testing site Barguna in kharif -II seasons of 1999 and 2000 to find out the probable reason of yield gap of T. aman rice (BR-23) between demonstration plot (DP) with Research management and Non-demonstration plot (NDP) with Farmer management practices. Across the years there exists a big gap in yield (1220 kg ha^{-1}) between DP and NDP. DP gave about 25.15% higher yield than NDP due to the use

of the best quality seed, appropriate age of seedlings (30 days), closer spacing, and the optimum number of seedlings per hill, use of balanced fertilizer and pest control in proper time. Although the cultivation cost of DP was higher (Tk.2218 ha^{-1}) than that of NDP. Demonstration plots showed a higher benefit cost ratio (2.28) than the non-demonstration plot (1.98).

A study was conducted in the haor areas of Bangladesh by Alam *et al. (2011)* to assess the land utilization status, delineate the productivity and profitability of growing modern rice, evaluate the existing cropping patterns and assess the prospect of possible cropping patterns. Both primary and secondary data were used in the study. Applying the conventional descriptive statistics, the study revealed that, there are about 1.26 million hectares of cultivated lands in seven haor districts, of which 66% falls under the haor area. In Kishoregonj and Hobigonj, nearly 94 and 87% areas were devoted to MV Boro rice production. Both BRRI dhan 28 and 29 were being the widely adopted rice varieties. On average, about 33% of the haor areas were under mechanized irrigation, but in Kishoregonj, the coverage of mechanized irrigation was 87% that helped increasing cropping intensity. The cost of production for MV Boro was almost double than that of LV rice. The yield of MV Boro was 79% higher than that of LVs and the return from MVs was 82% higher. Rabi-Fallow-T. Aman, Vegetable-Aus-T. Aman and Rabi-B.Aman patterns were the potential cropping patterns in some selected areas and this could increase both cropping intensity and productivity in those areas. According to the farmers' assessment, lack of flood control dam and lack of short duration varieties etc are the major hindrance to the adoption of potential cropping patterns. Construction of community harvest and threshing facilities and flood control devices could be the important public interventions for enhanced agricultural productivity in the haor areas.

Islam (2004) conducted a study on the objective to estimate the technical efficiency of a farm producing rice with special emphasis on aromatic, fine and coarse rice varieties in Bangladesh. This was done for understanding the determinants of technical efficiency that may help designing rice production profitably and minimizing farmers' yield gap with a given technology and resource constraints and to provide future policy guidelines for researchers and public support services. Farm-level cross-section data were collected from one of the intensive rice-growing areas of

Dinajpur. A set of statistical and non-statistical stochastic approaches to frontiers have been used to estimate production efficiency. The application of the translog stochastic production frontier model gave the best fit for technical efficiency analysis. The estimated mean efficiency was 97% for aromatic, 98% for fine, and 85% for coarse rice farmers indicating that there is the little scope of increasing yield without breaking the yield frontier particularly for aromatic and fine rice through the introduction of high yield potential varieties. For coarse rice varieties, 15-16% yield could be increased even with the existing varieties, if the management practices of the parameters identified in this study are improved.

This study was conducted by Miah (2013) to analyze the value chain of rice in selected areas of Jamalpur district. The objectives of the study were to estimate the value addition of rice by different actors, to examine the activities related to value addition and to identify the constraints and opportunities of the rice value chain. Two Upazilas namely Dewangonj and Islampur were selected purposively for collecting data. To serve research objectives, 10 farmers, 15 paddy traders, 10 rice millers, and 10 rice traders were selected by purposive sampling. Data were collected from mid-January to mid-April 2012. The study found that the value chain actors were farmers, paddy traders (Farias, Beparies), rice millers and rice traders (Beparies and retailers). The value chain started from harvesting paddy and ended when rice was sold to the ultimate consumers. Farmers could earn on an average Tk. 10053/hectare by cultivating paddy. The farmers disposed of their production for family consumption, gift and kind payment to relatives, seed and sold to markets. They added the value of Tk. 1050, Tk. 1005 and Tk. 1000 per metric ton paddy by drying, storing and selling, respectively. Most of the farmers did not realize the value adding opportunities due to constraints such as high marketing cost due to poor transportation system, lack of market information etc. Paddy traders collected paddy from the farmers and supplied to the rice millers. Also, some of the large farmers stored paddy for higher prices in the future (speculation). The traders added the value of average Tk. 1176.7/metric ton paddy. Rice millers had to incur marketing costs, milling cost and selling costs. These costs were Tk. 769, Tk. 673.8 and Tk. 367.3 per metric ton paddy, respectively. Rice millers added about 23% value of which only 9% was added for total marketing and milling. Rice traders were the final value chain actors and added about 6.11% value with the rice purchase price. Since this study was done only in Jamalpur district, the

policymakers should be very careful with any policy decisions based on the findings of this study. However, this study helps to identify the scenario in the rice value chain in Jamalpur district.

Khalique (2019) conducted a study to examine the growth performance and profitability of rice production in Bangladesh using the time series data for the period 1981-82 to 2010-11. The study was based on secondary data. Growth rates of area, production, yield and nominal price of three seasons of rice were estimated by fitting the exponential trend function. Growth rates of the area which were significantly negative for Aus, Aman that were -4.6 percent and -0.3 percent and positive for Boro rice it was 4.5 percent over the whole period. The growth rates of yield for Aus, Aman and Boro were increased significantly at the rate of 2.2, 1.9 and 1.9 percent respectively during the entire time period. The growth rate of production was significantly negative for Aus rice was 2.4 percent and positive for Aman and Boro rice that were 1.6 and 6.3 percent respectively. There was an upward trend observed in the nominal price for Aus, Aman and Boro over the period. The short-run and long-run price elasticity of Aus was 0.010 and 0.210 and the short-run and long-run elasticity of Aman and Boro rice were 0.091, 0.112 and 0.051 and 0.395 respectively. The short-run responses in rice production are lower than long-run response as indicated by the higher long-run elasticities. The lagged area variable was highly significant in Aus and Boro rice area response equation. Rainfall in the sowing period had significant influences in Aus area response equation. Aman has a positive influence on the lagged yield and negative with the irrigated area. Policy related to technological advancement, improving varieties, extension services, fertilizer distribution, high yielding variety seeds and production management research may increase the productivity of food grains in Bangladesh.

CHAPTER III

METHODOLOGY OF THE STUDY

This chapter deals with the methodology used for the study which included the selection of study area, selection of samples, collection of data and analytical techniques. The farm management study usually involves the collection of information on individual farmers. The reliability of scientific research depends to a great extent on the appropriate methodology used in the research. The design of any survey is predominantly determined by the nature, aims, and objectives of the study. This study was based on field-level data where primary data were collected from Katarivog rice cultivar.

Since the farmers of Bangladesh do not usually maintain records and accounts of their farm operations, the survey method was followed to achieve the objectives of this study. The survey method has advantages over other methods. This method is less expensive and its coverage is much wider. However, the survey method is not free from drawbacks. The drawback of this method is to rely on the memory of the respondents. To overcome this problem, repeated visits were made to collect data in the study area and in the case of any omission or contradiction; the farmers were revisited to obtain the missing and or correct information. The selection of the study area, period of the study, sampling technique and sample size, preparation of the survey schedule, data entry and processing, and analytical techniques are given in the following section:

3.1 Selection of Study Area

The selection of the study area is an important step, which largely depends upon the objectives set for the study. The aim of the present study is to analyze Katarivog rice cultivation. For the selection of the study area, the researcher visited several villages namely Dolapara, Gorerpara and Shemuliapara under Parbatipur Upazila of Dinajpur district. These three villages have similar types of land and soil characteristics and grow mainly Katarivog rice in Aman season. These areas were selected for some other reasons also such as:

- Availability of a large number of small farmers.
- The study of this type was conducted previously in the study area.
- Easy accessibility and good communication facilities in these villages.
- Researcher himself was fairly well known to the local customs and practices and was able to speak the farmers' language. Good cooperation was expected from the respondents.

3.2 Preparation of Survey Schedule and Pre-testing

The survey schedule was designed in accordance with the objectives of the research. Data were collected from the operating farms by survey method through the personal interviews with the farmers for which necessary schedules were to prepare. The survey schedule was prepared for the study. Information about farmer's fixed resources, farm income and detailed information about the production of Katarivog rice such as acreage grew; use of inputs such as labor, seed, manures, fertilizers, water, and pesticides including their prices was collected. The schedules were tested prior to implementation and were improved for applicability in the actual field conditions.

3.3 Sample size

The survey will be designed quantitative information on the farm status of individual Katarivog rice cultivar. The researcher will conduct the study simple random sampling of farmers; it will collect 71 farmers information. Here, the 71 farmers are considered:

$$n = \frac{z^2 \times p \times (1 - p)}{d^2}$$

Where

n = desire sample size

z = standard normal deviate usually set at 1.645 which corresponds to the 90% confidence level.

p = assumed proportion in the target population estimated to have particular characteristics = 0.50

and (1-p) =0.50

d = degree of accuracy desired in the estimated proportion.

= 0.1

Now, $n = \frac{(1.645)^2 \times (.5) \times (.5)}{(0.1)^2}$

=67.65

The researcher assumed that 5% of those responded may provide wrong or invalid information as they mainly rely on their memory.

So the number of error is = 67.65 × 5%

=3.38

Hence the total number of sample is

n= 67.65+3.38

=71.03≈ 71

3.4 Time of Data Collection

Data were collected by the researcher himself through personal interviews with the respondents. Data were collected during the period from July to November, 2019. As the researcher had to depend on the memory of the farmer, so interviews were taken different time schedules.

3.5 Data Collection and Accuracy of Data

Normally most of the farmers did not keep their written records on annual, monthly or daily transactions and activities. It was very much difficult to collect actual data. Because the information of the farmers was supplied from their memory and the researcher had to rely solely on the memory of farmers. To overcome this problem, all

possible efforts were made by the researcher himself to ensure the collection of reasonably accurate information from the field on a recall basis. As it has not been possible to apply any other method of investigation such as cost or financial accounting which would require detailed and accurate information based on properly kept records and accounts. The survey method has the advantage that it facilitates quick investigation and involves less cost. In order to collect relevant information before taking the interview, the whole academic purpose of the study was clearly explained and made clear to the sample respondents where was necessary. The researcher himself collected the relevant data from the selected tenant farmers through face to face interviews. At the same time of the interview, the researcher asked questions systematically and explained whenever felt necessary. So the collected data were checked and verified in the field for accuracy and consistency.

3.6 Processing of Data

The collected data were manually edited and coded. Then all the collected data were summarized and scrutinized carefully. Data were processed to transfer to master sheets to facilitating tabulation in order to meet the objectives of the study. Also, the data entry was made in computer and analyses were done using the concerned software Statistical Package for Social Science (SPSS). It may be noted here that data were collected initially in locally used units. After necessary checking, it was converted into standard international units such as the hectare, metric ton, etc.

3.7 Statistical Analysis

Data collected were classified and analyzed in terms of the objectives set for the study. Statistical techniques were used to find important relationships among the relevant variables.

Analytical Technique

Profitability Analysis: Several variables such as cost of seedling, animal labor and power tiller, human labor, fertilizer, manure, irrigation and pesticide in producing Katarivog rice will be considered for Profitability analysis as well as Cobb-Douglas production function. Profit function of the following algebraic form will be used in this study,

Profit:

$(\pi) = \sum_{i=1}^{n}(Pyi.Yi) - \sum_{i=1}^{n}(Pxi.Xi) - TFC$

Where, Π= Net Return,

Py_i = Price per unit of the ith produce

Y_i= Quantity of the ith produce

Px_i= Price per unit of the ith inputs

X_i = Quantity of the ith inputs

TFC= Total Fixed Cost.

Regression Analysis: The general purpose of multiple regression analysis is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable. For example, the yield of Katarivog rice per hectare depends upon the quantity of seed, human labor, fertilizer, irrigation water used, etc. It enables us to study the individual influence of these variables on yield. The most common form of regression analysis is Cobb-Douglas revenue type production function that has been used in the present research.

Cobb-Douglas Production Function: For determining the effect of variable inputs to the production of Katarivog rice cultivation, Cobb-Douglas production function chose on the basis of best fit and significance result on the output. In this model, yield per hectare was considered as the dependent variable. The functional form of the multiple regression equation is as follows:

$$Y= a X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} + U_i$$

For the purpose of the present empirical exercise, the Cobb-Douglas production function was converted into the following logarithmic (Double log) form as:

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

Where,

Y = Per hectare yield of Katarivog rice (Tk. /ha)

a = Intercept

X_1 = Cost of seed in producing Katarivog rice (Tk. /ha)

X_2 = Cost of animal labor and power tiller/tractor (Tk. /ha)

X_3= Cost of human labor (Tk. /ha)

X_4= Cost of fertilizer in producing Katarivog rice (Tk. /ha))

X_5= Cost of manure in producing Katarivog rice (Tk. /ha)

X_6= Cost of pesticide in producing Katarivog rice (Tk. /ha)

b_1, b_2 ……b_6 = Coefficient of relevant variables.

Ui= Disturbance term

ln= Natural logarithm.

Cobb-Douglas form of production function has the following advantages.

- In Cobb-Douglas production function, returns to scale can be easily calculated by simply summing up the elasticity of Y with respect to Xj.
- This form of production function explains that agricultural production operates under either constant increasing or decreasing returns to scale.

Production function analysis was done to determine the resource use efficiency and productivity of Katarivog rice-producing small farmers. Cobb-Douglas function was fitted to determine the impact of selected inputs on the productivity of Katarivog rice. The marginal productivity of selected inputs was calculated to ascertain the level of efficiency of individual input use.

Efficiency of Resource Allocation

In order to test the efficiency, the ratio of Marginal value product to the Marginal Factor Cost for each input is computed and tested for its equality to 1.

i.e. $\frac{MVPxi}{MFCxi} = 1$

The marginal productivity of a particular resource represents the addition to gross returns in value terms caused by an additional one unit of that resource, while other inputs are held constant.

Marginal Value product (MVP)

The total value of output produced at each level of variable input use. When a marginal value product is measured monetary term then it is called marginal value product. In order to get a marginal value product, the co-efficient of production elasticity is multiplied by the output-input ratio of the geometric mean level, which can be shown in the following.

$$MVP = \frac{\bar{Y}}{\bar{X}} * b_i$$

Where,

b_i= Regression co-efficient of input X_i variables

$\bar{X}$ = Mean value of X_i variables

$\bar{Y}$ = Mean value of the gross return of Katarivog rice production

Marginal factor cost (MFC)

The implicit cost of fixed resources used to produce a good or service. In the model, marginal factor cost (MFC) of all inputs are expressed in term of additional taka invest for providing individual inputs.

Measurement of efficiency

In order to test the resource use efficiency, the ratio of marginal value product to marginal factor cost for each input was compared and tested for its equality to 1.

i.e. MVP/MFC=1

The resources are considered to be efficiently used as well as profit will be maximized in T. Aman rice production when the ratio of MVP to MFC approaches 1 or in other words MVP and MFC for each input are equal.

In this model the MFC will always be 1, so the ration will be equal to their respective MVP.

If the ratio (MVP/MFC) is greater than 1 (MVP>1), it would imply that the farmers are using their resources insufficiently.

If the ratio (MVP/MFC) is equal to 1 (MVP=1), it would imply that the farmers are using their resources efficiently.

If the ratio (MVP/MFC) is less than 1 (MVP<1), it would imply that the farmers are using their resources too much.

3.8 Specifications of Variables

The relative efficiency of alternative forms of tenure was to be ascertained on the basis of different measures of enterprise incomes of the farmers falling into different tenure categories. This required specification and measurement of variables in the form of input used and output received in the production of Katarivog rice. Inputs used included human labor, animal power, different materials used and output was yield per hectare of crop and by-product. Different input and output figures were multiplied by the average prices of the tenure groups to get cost and return figures for producing Katarivog rice but since no cash payment was made for the home-supplied inputs, the costs of these inputs were stir by using opportunity cost principle. For determining the opportunity cost of an individual input the relevant input price is the value forgone by replacing this input from another enterprise (Bishop and Toussaint, 1958) in calculating the gross expenses the following components of costs were considered.

3.8.1 Cost of Seed/Seedling

In the study area, farmers used both home supplied and also purchased seedling. The cost of purchased seed/seedling was calculated on the basis of the actual price paid by the farmers. The cost of home supplied seedling was estimated at the prevailing marketing price. The source of Katarivog rice seeds was BRAC, Upazila Krishi office and BADC and local bazaar in that study area.

3.8.2 Cost of Animal Power and Power Tiller/ Tractors

Animal power cost for producing Katarivog rice was calculated by taking account of the actual pair day of animals multiplied by the price per pair day. There was no use of animals in the study area. The farmers only used machines such as power tiller or tractors.

3.8.3 Human Labor

Human labor, both family and hired labor, for production of Katarivog rice included total man-day spent on various operating for producing the crop such as land preparation, sowing/planting of seed weeding, manuring, fertilizing, harvesting, threshing, carrying, etc. One man-day consists of 8 hours of work, by an adult man. Child and woman labor was converted into man equivalents by assigning appropriate ratios. This was performed as follows (Yang, 1965).

1 adult man = 1.5 adult woman 2 children

Total man-day used per unit of land was multiplied by the market wage rate to arrive at human labor cost for producing Katarivog rice. Thus the opportunity cost of unpaid family labor was considered equal to the market wage rate for calculating human labor costs.

3.8.4 Cost of Fertilizer

Chemical fertilizers which included urea, Triple super phosphate, Potash, Gypsum and Zinc, were charged according to the actual price by the farmers for the respective fertilizer.

3.8.5 Cost of Manure

Most of the farmers used home supplied manures which was mostly cow dung. The price of cow-dung was charged for each farm on the basis of information provided by the farmers locally.

3.8.6 Cost of Irrigation

In the study area, there was no irrigation required. Aman season is largely dependent on rain.

3.8.7 Cost of Pesticides

In the study area, Katarivog rice growers used pesticides, such as Kuit, Basudin, Dimecrone, Sumithion, Biter, Furadan, Marshal, Diazinon, etc. The costs of pesticides were computed on the basis of the actual price paid by the farmers themselves.

3.8.8 Interest on Operating Capital

Interest on operating capital was determined on the basis of opportunity cost principle. The operating capital actually represented the average operating cost over the period because all costs were not incurred at the beginning or at any single point of time. The cost was incurred throughout the whole production period; hence at the rate of 10 percent per annum interest on operating capital for six months was computed for Katarivog rice. Interest on operating capital was calculated by using the following formula (Miah and Hardekar, 1988).

IOC= AIit

Where,

IOC= Interest on operating capital

i= Rate of interest

AI= Total investment / 2

t = Total time period of a cycle

3.8.9 Land Use Costs

In the study area, the cost of the land was different from plots depending on location, topography and fertility of the plots. It also varies from one season to another, i.e., from kharif-2 to Rabi season. Land use cost was calculated on the basis of the

opportunity cost of the use of land per hectare for the cropping period of six months. In this study, the cost of land use was considered as the cash rental value of the land.

3.9 Calculation of Returns

3.9.1 Gross Return

Per hectare gross return was calculated by multiplying the total amount of product and by-product by their respective per-unit prices.

3.9.2 Gross Margin

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

Gross margin = Gross return – Variable cost

3.9.3 Net Return

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

Net return = Gross return – Total production cost

The profit equation discussed earlier in this chapter was used to assess the profitability of Katarivog rice production farmers.

3.9.4 BCR (Benefit Cost Ratio)

BCR is the ratio of the present worth of benefit and presents worth of cost. It indicates the benefit of per-unit cost at present worth. BCR was calculated by using the following formula-

$$\text{BCR} = \frac{\text{Gross return}}{\text{Total cost}}$$

3.10 Problems Encountered in Collecting Data

The researcher encountered these following problems in collecting data from the field:

1. Generally, most of the farmers did not keep their written records on annual, monthly or daily transactions and activities. It was very difficult to collect actual data. Because the information of the farmers was supplied from their memory and the researcher had to depend solely on the memory;
2. Most of the respondent were not well educated which caused another problem to data collection to the researcher;
3. Sometimes respondent could not answer questions accurately and to the point;
4. The farmers were afraid of the imposition of taxes and they always tried to avoid providing true information relating to the actual size of holding, expenses and income;
5. Generally, the farmers were not present at home, so, the researcher had to visit some of them even at the field and researcher sometimes had to pay more than two visits to meet the farmer which was very time consuming;
6. Most of the farmers do not want to give proper or accurate information about input used in their rented inland also.

CHAPTER IV

DESCRIPTION OF THE STUDY AREA

For any research study, it is necessary to know the physical feature of the study area because it provides an overall scenario of agriculture. It provides topography, soil condition climate, temperature and rainfall, occupation of the villagers, communication and marketing facilities and cropping patterns of the study area. The aim of this chapter is to present a brief description of the study area and to provide an outline of its current agricultural status.

4.1 Physical Feature of the Study Area

4.1.1 Location

Dinajpur district is a district in the Rangpur division of northern Bangladesh. Dinajpur is the largest district among all sixteen northern districts of Bangladesh.

At the time of the Partition of India in 1947, part of the greater Dinajpur district was included in West Bengal and it was named West Dinajpur district.

Dinajpur District area 3437.98 sq km, located in between 25°10' and 26°04' north latitudes and in between 88°23' and 89°18' east longitudes. It is bounded by Thakurgaon and Panchagarh districts on the north, Gaibandha and Joypurhat districts on the south, Nilphamari and Rangpur districts on the east and the west Bengal state of India on the west.

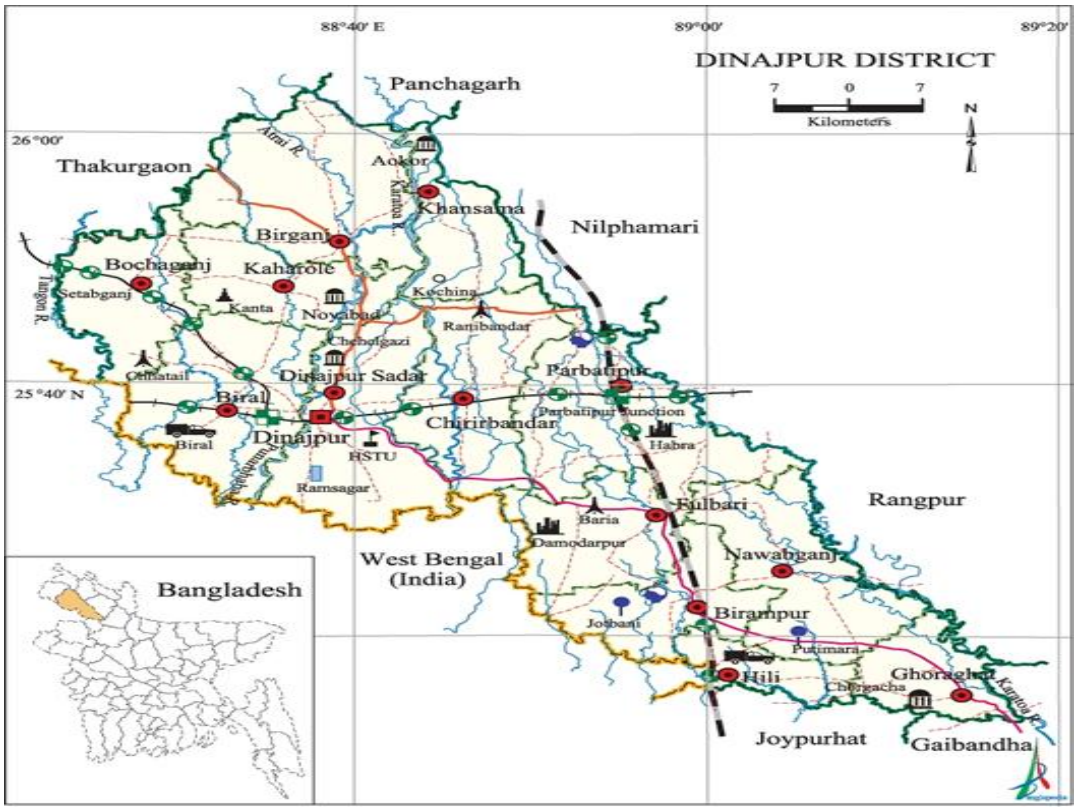

Figure 4.1 Geo-Code of Dinajpur District

Source: Adapted from banglapedia.com

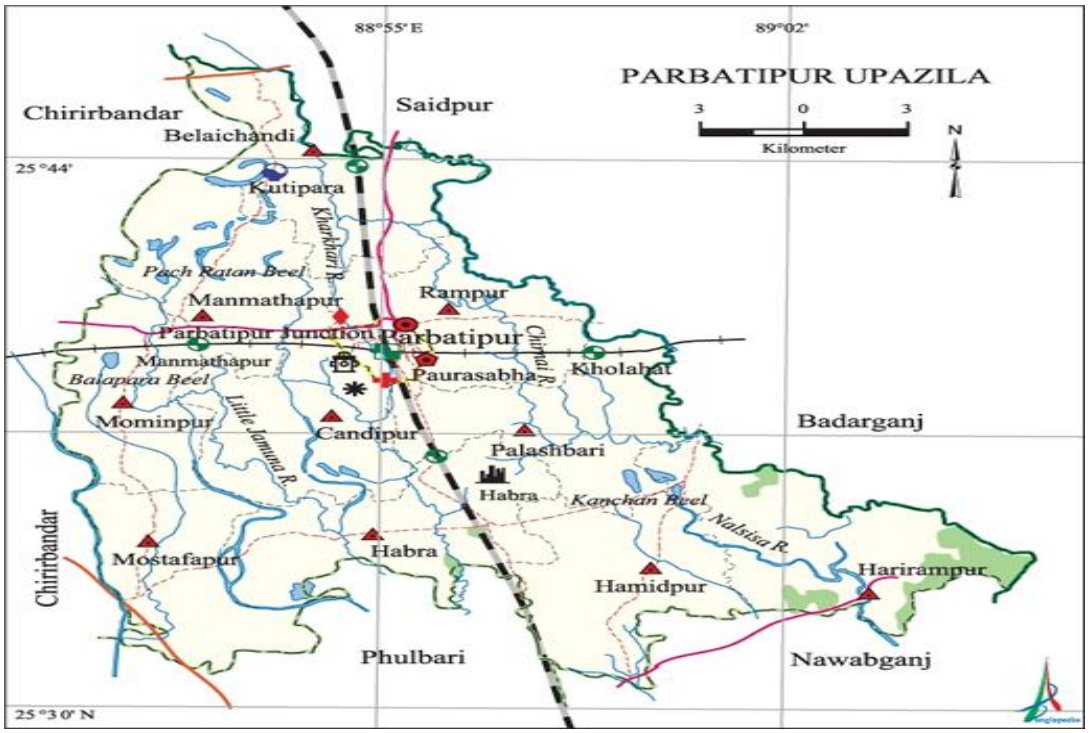

Figure 4.2 Geo-Code of Parbatipur Upazilla

Source: Adapted from banglapedia.com

4.1.2 Climate, Temperature and Rainfall

The annual average temperature varies from the highest 33.5 °C to the lowest at 10.5 °C. The annual rainfall is 2,536mm. Climate change is becoming a big headache in this area (BBS, 2011)

Table.4.1 Annual average temperature Dinajpur district

Years	Temperature (centigrade)		Rainfall (millimeter)	Humidity (%)
	Maximum	Minimum		
2008	34.1	9.9	1787	77.0
2009	33.0	12.1	1994	74.0
2010	33.5	10.1	1453	60.3
2011	20.8	9.2	1632	75.8

Source: Adapted from BBS 2011

4.1.3 Area, Population and Household

The district's total number of households is 715773. The total population of Dinajpur district is 29, 90,128(Male- 15, 08,670 and Female- 14, 81,458), sex ratio 102:100, population density 868.Sq. Km and the annual growth rate is 1.22%. (BBS, 2011)

Table.4.2 Area, population and household of Dinajpur district

Upazila	Household	Population			Sex ratio (M/F)	Average size of household	Density per sq. km.
		Male	Female	Both sex			
Dinajpur Sadar	111779	247792	236805	484597	105	4.19	1366
Fulbari	43137	88984	87039	176023	102	4.05	770
Parbatipur	88725	183772	181331	365103	101	4.08	924

Source: Adapted from BBS 2011

4.2 Economic Situation

The economy of Dinajpur is predominately agricultural. Out of total 662677 holdings of the districts, 59.15% holdings are farms that produce varieties of crops namely local and HYV paddy, sugarcane, wheat, vegetables, spices, jute, pulses, and other minor cereals. Various fruits like mango, banana, jackfruit, guava, coconut etc. are grown in the district. Almost all kinds of vegetables are cultivated particularly bitter guard (Karala), pumpkin (Misti Kumra), potato and Brinjal are abundantly grown. Pisciculture and rearing of livestock and poultry add an additional income to rural households. Fish of different varieties abound in this district. Moreover, varieties of fish are caught from rivers, tributary channels, even from paddy fields during rainy seasons. Some valuable timber and forest trees are grown in this district. Out of total 3437.98 sq. km of the total area to the district, organized forestry is almost absent but riverine areas occupy about 19.45 sq. km only. (BBS, 2011)

CHAPTER V

RESULT AND DISCUSSION

5.1 To describe the socio-economic profile of the Katarivog rice growers.

Social scientists use socio-economic characteristics as an umbrella term with a view to cover a wide variety of interesting social and economic factors. Socio factors refer to any number of demographic and social conditions such as age structure, racial composition ratio, marital status, family type, etc. Economic refers to economic conditions such as income, employment rate, etc. They often use socio-economic characteristics as a means of predicting behavior. So socio-economic characteristics depends on a combination of variables, including occupation, education, income, marital status, age of the family member, place of residence and so on. These characteristics affect the production pattern of farmers. This chapter provides information on the socio-economic characteristics of the Katarivog growers. As for getting the socioeconomic characteristics of the sample farmer some of the characteristics have been taken into consideration for discussion.

5.1.1 Age of the farmers

Table 5.1 shows that the selected Katarivog growers were categorized into five groups. The highest proportion was belonged to the age group of 20-30 and was 26.8%.

One an average 21.1%, 19.7%, 22.5% and 9.9% belonged to the groups of 31-40, 41-50, 51-60, and 60+ years respectively, which also support of (Tasnoova, 2000) That was performed at the same study area.

Table 5.1: Age Distribution of Respondents

Age group(year)	Katarivog growers	
	No. of respondent	Percentage
20-30	19	26.8
31-40	15	21.1
41-50	14	19.7
51-60	16	22.5
60+	7	9.9
Total	71	100.0

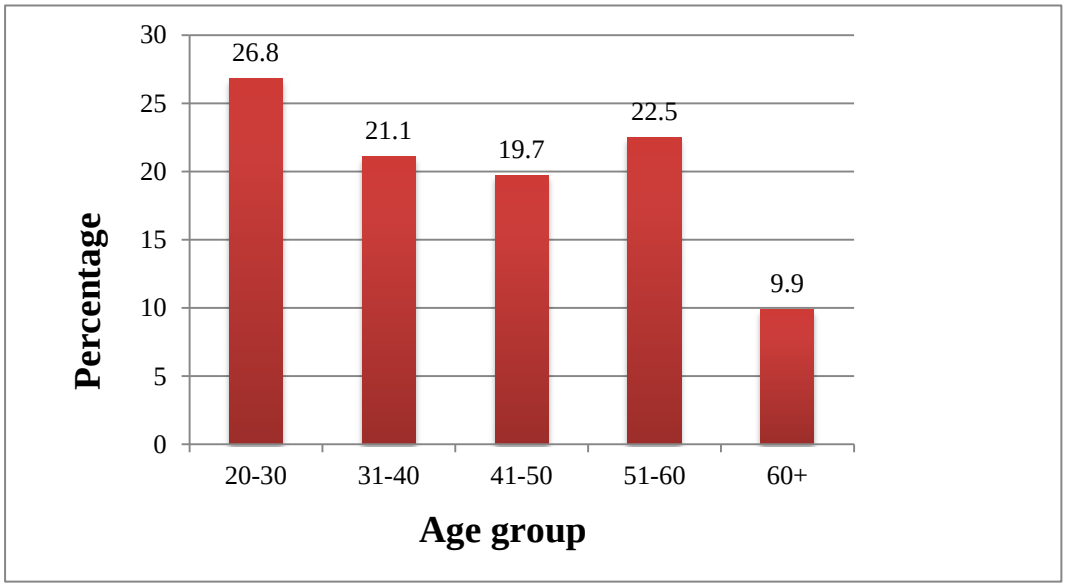

Figure 5.1 Age Distribution of Respondents

5.1.2 Education of the farmers

Most of the farmers had secondary education and their corresponding was 33.8 percent. In the study area, about 31% of farmers had no education, 8.5% primary education, 16.9% HSC and only 9.9% above education.

Table 5.2: Education Levels of Respondent

Education level	No. of respondent	Percentage
No education	22	31.0
Primary	6	8.5
Secondary	24	33.8
HSC	12	16.9
Above	7	9.9
Total	71	100.0

5.1.3 Average family size and composition

In the present study, family size (members) has been defined as the total number of persons living together and taking meals from the same kitchen under the administration of the same head of the family. The family members are including wife, sons and unmarried daughter, parents, etc. Also, persons who have been employed in a family for household works like servants, caretakers etc., are excluded from the family members in the present study. Table 5.3 reveals the family size, age and sex distribution of the sampled households. All the family members of households were classified into the following age groups:

i. Infant(below 5 years);
ii. Child(between 5.00-15.00 years);
iii. Working member(between 15.00-55.00 years);and
iv. Old (above 55 years).

Table 5.3 Average Family Size and Age Composition of Family Members

Age group	Male	Female	Both
Below 5	2	6	8
5-15	15	15	30
16-55	114	97	211
Above 55	17	6	23
Total	148	124	272
Average	2.09	1.75	3.84

5.1.4 Occupational Status of Sample Farmers

Most of the farmers have agriculture as the main occupation in that study area. In spite of having agriculture as the main occupation, they also involved in an occupation like a business, services, etc.

Table 5.4 Occupational Status of Sample Farmers

Occupation	No. of respondent	Percentage
Agriculture	28	39.4
Business	22	31.0
Service	12	16.9
Other income	9	12.7
Total	71	100.0

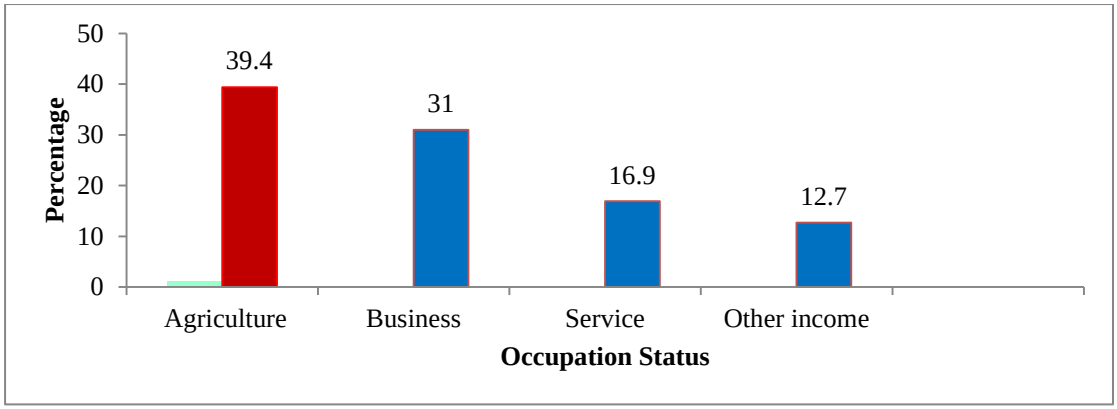

Figure 5.2 Occupational Statuses of Sample Farmers

5.1.5 Land Ownership Pattern and Farm Size

According to Yang (1965), farm size refers to the entire land area operated by the operator. The landholding of the respondents is categorized into several categories such as homestead land, own land in cultivation, leased in, mortgage in, leased out and mortgage out. Table 5.5 reveals that the average farm size of owners was .59 ha. The average farm size was calculated using the following formula:

Average Farm Size= Own Land + Rented/Leased in + Mortgaged in + Current Fallow Land +Pond– Rented/Leased Out – Mortgaged Out

Table 5.5 Average Land Holding of Farm Families (Ha)

Types of Land	Area
Homestead	0.06
Own Land in Cultivation	0.88
Leased in	0.29
Leased Out	0.67
Mortgage in	0.48
Mortgage Out	0.39
Average Farm Size	0.59

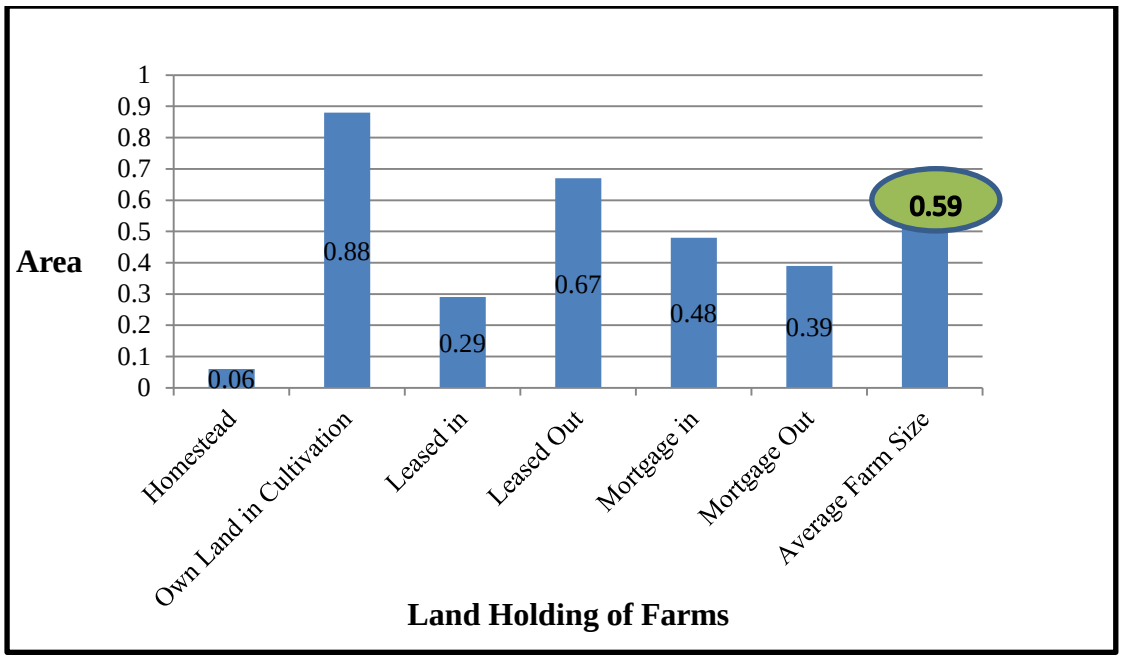

Figure 5.3 Average Land Holding of Farm Families (Ha)

5.1.6 Sharing Arrangement

In the study area, the local name of contractual arrangements is called "Borga". The traditional sharing arrangements 50:50 crop sharing was the common practice where the landowner did not share any input cost but received half of the total produce. Sometimes the landowner shares a few or half of the input costs (fertilizer and irrigation costs) and receives half of the produce (main product and by-product). In the study area, some contractual arrangements are practiced also. In this regulation, the tenant must give the landowner a fixed amount of taka, or fixed amount of paddy per "Shotok" land within a year, whether the tenant can produce or not and the landowner bear no production cost. The amount of rent paid in cash tenant was largely fixed in advance of production. In the case of low production or lower output prices, the agreement was not revised at all. But the landowner has the right to get back land ownership right any time he wishes.

5.2 To assess the profitability level of Katarivog rice cultivation.

Profitability mainly depends on the cost involved in rice cultivation and return from rice and its by-product. Also, the amount of input use directly affects the cost. So, the extent of inputs use, cost and returns of Katarivog rice are explained in the following section.

5.2.1 Inputs use and costs for rice production

5.2.1.1 Human labor cost

Human labor was the most important used input for the production of rice. Production of Katarivog rice required different operations such as land preparation, seedling, uprooting and transplanting, fertilizer application, weeding, threshing and drying etc. Table 5.6 reveals that the cost of human labor was 33908.07 Tk. /ha which is 47.993 % of all cost.

5.2.1.2 Cost of animal labor and machine

None of the farmers in the study area was found to be used any kind of animal labor. All used machine power instead of animals. Table 5.6 reveals that the cost of power tiller was 3063.969 Tk. /ha which is 4.337% of all cost. These machine power making their life and cost very easy in this cultivated area.

5.2.1.3 Seed cost

The farmers largely bought seeds from the market. They didn't believe in the home supplied seed that will be got for germination as their previous experience. The amount of per hector seed is only 12.076 kg. The main reason is the secondary transplant which they call it "Chorai" at their local language. Furthermore, they call the seedbed "Bichon Kasla". Table 5.6 reveals that the cost of seed was 3557.33 Tk./ha which is 5.035% of all cost.

5.2.1.4 Cost of Fertilizer

In that study area, farmers used several types of chemical fertilizer namely, Urea, Triple Supper Phosphate (TSP), Muriate of Potash (MP), Gypsum and Zinc Sulphate

($Znso_4$). These chemical fertilizers were charged at the rate of the price paid by the farmers. Table 5.6 shows the per hectare costs of chemical fertilizers.

Per hectare costs of Urea was Tk. 1122.86 and its percentage of the total cost of production was 1.589 percent.

Per hectare costs of TSP was Tk. 1742.936 and its percentage of the total cost of production was 2.466 percent,

Per hectare costs of MOP was Tk. 837.218 and its percentage of the total cost of production was 1.185 percent.

Per hectare costs of Gypsum was Tk. 209.192 and its percentage of the total cost of production was 0.296 percent.

Per hectare costs of Zinc was Tk. 1006.289 and its percentage of the total cost of production was 1.424 percent.

Per hectare costs of Manure was Tk. 3782.038 and its percentage of the total cost of production was 5.353 percent.

5.2.1.5 Cost of Irrigation

In the study area, none of the farmers was found to be used any kind of supplementary irrigation in the rice field, as T. Aman rice mainly depends on rainfall conditions.

5.2.1.6 Cost of Pesticides

In the study area, there was the different kind of pesticide used by the farmers. The pesticides used by the farmers were Basudin, Dimocrone, Sumithion, Theovit, Furadon, Malathianon, etc. Table 5.6 shows that per hector cost of pesticides was Tk. 4403.05 and its percentage of the total cost of production was 6.232 percent.

5.2.1.7 Interest on Operating Capital

Interest on operating capital per hectare was Tk. 2518.5 which is 3.565 percent of all cost.

5.2.1.8 Land Use Cost

In the study area, the cost of land use was estimated on the basis of cost rental value per hectare land for a period of 12 months. The land-use cost per hectare was Tk. 14500.

5.2.2 Estimation Average Yields and Gross Return

The average yields of Katarivog rice were 2881.805 kg/ha. In this case, the gross return was estimated by summing up all the returns earned from selling paddy and its by-product. The average gross return per hectare was Tk. 128374.11. Figure -5.3 presents the total cost, gross return and net return of all farms.

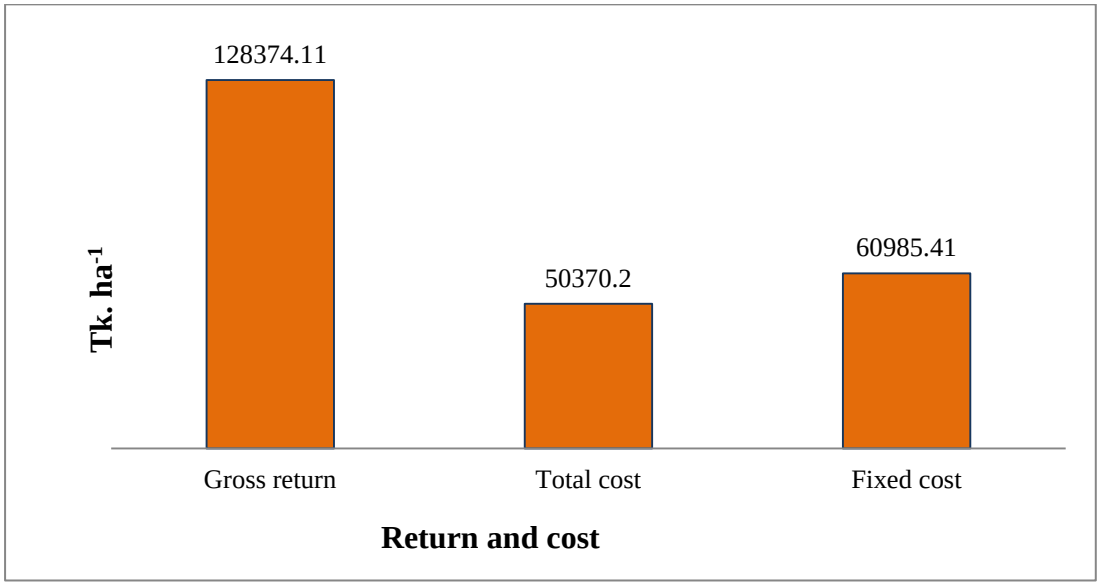

Figure-5.4: Total Cost, Gross Return and Net Return of Katarivog cultivar

5.2.3 Benefit Cost Ratio (BCR)

The undiscounted benefit cost ratio (BCR) is a relative measure that is used to compare benefits per unit of cost. Table 5.6 reveals that the BCR was 1.905.

(Miah, 2000) observed that his gross return, total cost and net return of Katarivog rice were 37466.88 Tk./ha, 16467.62 Tk./ha and 20999.26 Tk./ha. His benefit cost ratio was 2.22. He also got 2507.74 kg/ha yields.

Table 5.6 Per Hectare Costs, Returns, and Other Parameters for Katarivog Producing Farmers

Particulars	**Quantity**	**Rate (Tk./unit)**	**Cost (Tk./ha)**	**% of Total Cost**
Seed (Kg/ha)	12.076	294.578	3557.33	5.035
Animal Labor /Power Tiller cost (Tk./ha)			3063.97	4.337
Human labor cost (No. of Man-days/ha)			33908.07	47.993
Urea(Kg/ha)	16	70.189	1122.86	1.589
TSP (Kg/ha)	24	72.632	1742.94	2.466
MoP (Kg/ha)	15.2	54.982	837.22	1.185
Gypsum (Kg/ha)	15.57	15.372	209.19	0.296
Zinc Sulphate (Kg/ha)	200	5.094	1006.29	1.424
Manure (Kg/ha)			3782.04	5.353
Cost of irrigation (Tk./ha)			0	0
Cost of Pesticides (Tk./ha)			4403.05	6.232
A. Total Variable Cost (TVC)			**50370.2**	**75.912**
Interest on operating capital @ of 10% for 6 months			2518.5	3.565
Rental value of land			14500	20.523
B. Fixed Cost (FC)			**17018.5**	**24.088**
C. Total Cost (A+B)			**67388.7**	**100**
Main product value	2881.805	41.142	118563.9	
By-product value			9810.21	
D. Gross Return (Tk./ha) i. e. (GR)			**128374.1**	
Total variable cost (Tk./ha) i. e. (TVC)			50370.2	
Total cost (Tk./ha) i.e. (FC+TVC)			67388.7	
E. Gross Margin (Tk./ha) i.e. (D-A)			**78003.9**	
F.Net Return (Tk./ha) i.e. (D-C)			**60985.4**	
G.BCR i.e. (GR/GC)			**1.905**	

5.3 To determine the resource use efficiency of Katarivog rice growers

This proceeding section focuses on the economic viability of Katarivog rice in the form of cost, return and profitability. The following discussion will be made on the production function analysis of Katarivog rice under the framework of Cobb-Douglas production function.

5.3.1 Factors affecting production function of Katarivog rice

In the study area the different inputs used for Katarivog rice cultivation, were mainly Human labor, power tiller, seed, fertilizer, manure and pesticide etc. These were the inputs was considered as explanatory variables, affecting the gross return of Katarivog rice. A Cobb-Douglas production function was specified to determine the effects of the input on the productivity of rice, which was already described in chapter III

5.3.1.1 Interpretation of the production function

Estimated values of the co-efficient and related statistics of the cob-Douglas production function for Katarivog rice are presented in Table 5.7. In each case, the model fitted the data well as indicated by co-efficient of determination. The co-efficient of determination (R^2) is 0.659, which means the explanatory variables included in each of the models explained 65.9% of the variation in Katarivog rice cultivation.

5.3.1.2 Relationship between dependent and explanatory variables

Seed cost (X_1)

The co-efficient for human labor was 0.067 and was significant. So it can be said that keeping other factors constant, 1 percent increase in seed cost keeping other factors constant, would increase the gross returns by 0.067 percent.

Power tiller (X_2)

The regression coefficient of power tiller was found insignificant. The insignificant relationship of power tiller may due to inefficient use of power tiller.

Human labor (X_3)

The regression coefficient of human labor was found positive but insignificant. The insignificant relationship between labors may be due to the inefficient use of labor.

Fertilizer (X_4)

The regression coefficient of fertilizer was found insignificant. The insignificant relationship of fertilizer may be partly due to estimation errors and partly due to the inefficient use of fertilizer.

Manure cost (X_5)

The co-efficient for human labor was found positive but insignificant. This insignificant relationship of manure may be partly due to estimation errors and partly due to inefficient use of manure.

Pesticide cost (X_6)

The coefficient for human labor was 2.539 and was significant. So it can be said that 1 percent increase in seed cost keeping other factors constant, would increase the gross returns by 2.539 percent.

F-Value: The F-value of the equation was highly significant and it implies that the included variables are important for explaining the variation in returns under Katarivog cultivation.

Returns to Scale [Σ co-efficient**]:** The summation of all the production coefficients indicates returns to scale. For Katarivog production the summation of the coefficients was 5.879. So this indicated that the production function showed increasing returns to scale.

Table 5.7 Estimated Values of Co-efficient for Katarivog Rice and Its Related Statistics of Cobb-Douglas Production Function Model

Explanatory variable	co-efficient	t-value	p-value
Intercept	-10.524	-0.529	0.599
Seed cost (X_1)	0.067*	2.157	0.035
Power tiller (X_2)	2.908	1.162	0.250
Human labor (X_3)	0.398	0.219	0.827
Fertilizer (X_4)	-0.044	-1.497	0.140
Manure cost (X_5)	0.011	0.416	0.679
Pesticide cost (X_6)	2.539**	2.894	0.005
R-square	0.695		
F-values	17.681		
Return to scale (Σ co-efficient)	5.879		

***P<0.001, **P<0.01 and *P<0.05,

5.3.2 Resource Use Efficiency

In order to test the resource use efficiency, the ratio of marginal value product to marginal factor cost for each input was compared and tested for its equality to 1.

i.e. MVP/MFC=1

Marginal value product was computed at the geometric mean level for each variable. To get MVP co-efficient of each variable was multiplied by the average value product.

Table 5.8 Resource Use Efficiency of Katarivog rice Production

Variables	Co-efficient	Geometric mean	MVP	MVP/MFC	Comment
Seed	0.067	1782.397	2.58	2.58	Under Utilized
Power tiller	2.908	1605.165	124.35	124.35	Under Utilized
Human labor	0.398	18764.45	1.46	1.46	Under Utilized
Fertilizer	-0.044	1959.244	-1.54	-1.54	Over Utilized
Manure	0.011	1937.519	0.39	0.39	Over Utilized
pesticide	2.539	2154.621	80.88	80.88	Under Utilized

MVP= Marginal Value Product

MFC= Marginal Factor product

MFC=1 for each input

The marginal value products of Katarivog rice are shown in table 5.8 and the calculation of MVP was given in the appendix. In Cobb-Douglas production function model, the marginal factor cost of all input is expressed in terms of an additional Taka spent for providing individual inputs. So in calculating the ratio of MVP to MFC, the denominator would always be one and the ratio would be equal to their MVP.

From the table it reveals that incase of seed, power tiller, human labor, pesticide MVP/MFC>1, It indicates that farmers of Katarivog cultivar had not availed themselves of the opportunity of fuller use and there were ample opportunities for

Katarivog rice farmers to increase their production. Furthermore, in the case of fertilizer and pesticide MVP/MFC<1 which indicates excessive use of these inputs.
So from the above discussion, it can be summarized that Katarivog rice farmers did not properly use their inputs efficiently; either input was overused or underused.
(Miah, 2000) was found that for aromatic rice cultivation, labor cost and seed cost was overused. But fertilizer cost, manure cost and pesticide cost was under used which means that also not efficient in the case of fertilizer use.

5.4 To identify the constraints of Katarivog rice cultivation with probable suggestions to overcome those constraints.

5.4.1 Problems and constraints

The Katarivog rice growers were to face different problems and constraints in producing rice. The main constraints in producing were an attack by insect and disease, low yield and unstable price, the high price of fertilizer pesticide, lack of capital and shortage of hired labor at the critical stage. The nature and extent of these problems are discussed below.

a) **Attack by insect and disease:** It was a severe problem of rice production. About 92 percent of farmers faced this problem. This problem was ranked 1st for this study area.

b) Low yield and unstable price: It was one of the constraints for Katarivog rice production. About 55 percent of farmers faced this problem. This problem was ranked 5th for this study area.

c) High price of fertilizer pesticide: It was a constraint of Katarivog rice production. About 86 percent of farmers faced this problem. This problem was ranked 2nd for this study area.

d) Lack of capital: It was the 4th constrain of Katarivog rice production. About 72 percent of farmers faced this problem

e) **Shortage of hired labor at the critical stage:** It was an also severe problem of rice production. About 82 percent of farmers faced this problem. This problem was ranked 3rd for this study area.

Table 5.9 Problems faced by farmers in producing Katarivog rice cultivation

Problems and constraints	Percentage of farmers responded	Rank obtained
Attack by insect and disease	92	1st
Low yield and unstable price	55	5th
High price of fertilizer and pesticide	86	2nd
Lack of capital	72	4th
Shortage of hired labor at the critical stage	82	3rd

5.4.2 Suggested solutions

The Katarivog growers were asked to suggest solutions to the above-mentioned problems. Their suggested problems are discussed below:

a) **Input should be available as and when necessary:** In the study area, about 83 percent responded that input should be available as and when necessary.

b) **Stability of market price at peak period:** The big concern is the price fluctuation of the rice market. Almost every respondent told the researcher about that. 97 percent of respondents agreed to have a price unstable situation.

c) **Reasonable price of fertilizer and pesticide:** This was the second most given solution among them. About 86 percent of respondent's feces this problem.

d) **Available credit facility:** About 77 percent of respondent suggested managing available institutional and non-institutional credit facilities on easy terms of condition.

e) Regular extension contact: About 56 percent of farmers suggested ensuring regular extension agent's contact.

Table 5.10 Farmers suggestion to overcome production problems

Problems and constraints	Percentage of farmers responded	Rank obtained
Input should be available as and when necessary	83	3rd
Stability of market price at peak period	97	1st
Reasonable price of fertilizer and pesticide	86	2nd
Available credit facility	77	4th
Regular extension contact	56	5th

CHAPTER VI

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter discusses the summary, conclusion and recommendations of the study. These chapter summaries on Introduction (Chapter 1), Review of literature (Chapter 2), Methodology (Chapter 3), Description of the study area (Chapter 4), Result and Discussion (chapter 5), Finally Chapter 6 presents summary, conclusion and recommendations of the study**.**

6.1 Summary

Bangladesh is predominantly an agricultural country. Agricultural development is still synonyms with economic development. Bangladesh is ranked 4th among rice-producing countries in the world after China, India, and Indonesia. The majority of the people of Bangladesh depend on agriculture for their livelihood. Rice serves as an important staple food in the diet of an estimated 170 million people. It has been cultivating in almost all the arable land in Bangladesh. The total production of rice is around 36.2 million tons per year and employs around 39.07% in 2017 from 69.51% in 1991 of the total labor forces. Generally, rice can be divided into two types: regular rice and aromatic rice. The aromatic rice sector is a growing and profitable sector for Bangladesh. Dinajpur district is unconventional in producing aromatic rice. The area under cultivation is about 40765 hectares and the total rice production is around 85406 MT. Katarivog is one of the major renounce aromatic rice of the Dinajpur district. The area of cultivating Katarivog rice is about 3801 hectares and the total rice production is around 6424 MT. So it is evident that Katarivog rice is a profitable farming venture. It may be mentioned here that Katarivog rice attracts premium prices because it is highly valued by consumers.

An attempt has been made in this study to examine the profitability and resource use efficiency of Katarivog rice. The overall objective of the study will be to measure profitability and resource use efficiency of Katarivog rice and also identify the

socioeconomic characteristics of the farmers in the study area. The following are the specific objectives:

i) To describe the socio-economic profile of the Katarivog rice growers.
ii) To assess the profitability level of Katarivog rice cultivation.
iii) To determine the resource use efficiency of Katarivog rice growers; and
iv) To identify the constraints of Katarivog rice cultivation with probable suggestion to overcome those constraints.

The villages of Parbatipur Upazilla of Dinajpur district were purposively selected to collect for fulfilling the objectives of the study. Three villages Dolapara, Gorerpara and Shemuliapara were selected for collecting information. These villages were selected because it possesses similar socio-economic attributes and homogeneous physiographic conditions. A list of these farmers was collected from the Office of the Upazila Agriculture Office, Parbatipur. These lists served as the population of the study. About 71 sample farmers were selected for the present study. A random sampling technique was used in the study. A complete list of the farmers in the selected village was done by the researcher himself. The field survey was conducted over the period from July-November, 2019. There are different statistical analysis was done to examine the objectives.

It was observed from the socioeconomic characteristics that in case of age, the highest proportion was belonged to the age group of 20-30 and was 19%. In education, most of the farmers had secondary education and their corresponding was 24 percent. The average family size was 3.84 in the study area. Also, most of the farmers had agriculture as the main occupation in that study area. The average farm size of owners was .59 ha. There was also some sharing practice like Borga, 50:50, etc present among the farms.

The results of the profitability analysis of Katarivog rice, it was found that per hectare costs of seedlings of Katarivog rice were Tk. 3557.33. Again per hectare animal labor and power tiller cost costs for producing Katarivog rice Tk. 3063.969. The per hectare human labor costs was Tk. 33908.07 which comprised 47.993 percent of its total costs of production.

Per hectare costs of Urea, TSP, MOP, Gypsum, Zinc and Manure were in Tk. 1122.86, Tk. 1742.936, Tk. 837.218, Tk. 209.192, Tk. 1006.289 and Tk. 3782.038, respectively which comprised 1.589, 2.466, 1.185, 0.296, 1.424 and 5.353 percent of their respective total costs of production.

In the study area, none of the farmers was found to be used any kind of supplementary irrigation in the rice field. Per hector cost of pesticides was Tk. 4403.05 and its percentages of the total cost of production were 6.232 percent. Interest on operating capital per hectare was Tk. 2518.5 which is 3.565 percent of all the cost. The land-use cost per hectare was Tk. 14500 for all tenure categories.

The average yields of Katarivog rice were 2881.805kg/ha. Thus the average gross return per hectare was Tk. 128374.11 and was observed that per hectare net return was Tk. 60985.41.

Cobb-Douglas production function analysis was carried out for examining the effect of input use and resource use efficiency. The coefficients of seedling and pesticide appeared to be significant. The summation of the co-efficient of different inputs was greater than one implying that the production functions exhibited increasing returns to scale.

Finally, it was observed that most of the MVPs of inputs were positive or more than one which indicates that the more profit can be obtained by increasing each input included in the production function.

6.2 Conclusion

From the above discussions, it can be said that Katarivog rice cultivation is a profitable cultivation system for farmers if we consider their net return. But most of the case's uses of variables are insignificant. So it shows that there is some management practice lacking among the farmers in that study area.

6.3 Recommendations

1. Farmer's training should be arranged so that the rice-growing farmers can get better yield following proper crop management practices and using the optimum level of inputs.
2. Most of the farmers of the study area cultivate Katarivog rice for only family requirements. As the present study shows that it is a profitable production, therefore, the rice-growing farmers should be made conscious or create awareness regarding the profitability level of Katarivog rice.
3. At the harvesting period price market should be made stable, as the farmers can get the price they expect as always.
4. Incentives like credit, rice insurance etc, to the cultivators so they can bear production cost and minimize risk and uncertainty during an adverse situations.
5. Government should take action against special syndicate who precisely monitor rice market which is bad for the farmers.
6. Also, the government should take necessary steps to explore the possibility of export, the Katarivog rice in different countries of the world.

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Appendix A

CALCULATION OF MARGINAL VALUE PRODUCT

Variables	Co-efficient	$\overline{Y}i / X_i$	MVP= Co-efficient*$\overline{Y}i / X_i$	MVP/MFC	Comment
Seed	0.067	68637.82/1782.39	2.580084	2.580084	Under Utilized
Power tiller	2.908	68637.82/1605.16	124.3478	124.3478	Under Utilized
Human labor	0.398	68637.82/18764.4	1.45583	1.45583	Under Utilized
Fertilizer	-0.044	68637.82/1959.24	-1.54144	-1.54144	Over Utilized
Manure	0.011	68637.82/1937.51	0.389682	0.389682	Over Utilized
pesticide	2.539	68637.82/2154.62	80.88264	80.88264	Under Utilized

Where,

$\overline{Xi}$ = Geometric mean of variables

$\overline{Y}i$ = Geometric mean of production

MFC=1, as all was converted in money

Appendix B

Interview Schedule

Sher-e-Bangla Agricultural University

Department of Agricultural Statistics

An Economic Analysis of Katarivog Rice Cultivation in Parbatipur Areas of Dinajpur District

1. Farmer's Identification

a). Name……

b). Age…….

c).Village…….....….

d). Upazila……

e). Zilla…….....

2. Farmers Socio-Economic Characteristics

2.1. General Information

Sl. No	Relation with H .H	Sex	Age	Education (Years of schooling)	Marital status	Occupation	
						Primary	Secondary

N.B. Sex Code: (Male=1, Female=2). Marital status Code: (Married=1, Unmarried=2). Occupation Code: No work=0, Katarivog rice cultivar=1, Other then katarivog cultivar=2, Fish culture=3, Poultry rearing=4, Livestock's=5, Labor=6, Student=7, Business=8, House wife=9,

3. Farm Size

(Please indicate the area of your land)

Category	Own cultivated land	Leased-in	Leased-out	Rented in	Rented out	Mortgage in	Mortgage out	Other
Cultivable land								
Homestead								

4. Farm Expenditure

(Please mention you monthly expenditure in following source)

SL. No.	**Items**	**Monthly Expenditure(Taka)**
1.	Food	
2.	Energy(Petrol, Gas, Electricity)	
3.	Health Care	
4.	Education	
5.	Clothing	
6.	Transportation	
7.	Festivals & social Economics	
8.	House Rent	
9.	Cell phone expense	
10.	Entertainments	
11.	Others (.....)	

5. Farmer's Income source

(Please mention the amount of annual income from the following sources)

a). Agricultural sources

SL. No.	Crop Name	Amount of income (in TK.)/yearly
1.	Katarivog Rice	
2.	Livestock's rearing	
3.	Poultry rearing	
4.	Fisheries/ Fish culture	
5.	Others crops	
(a)	Jute	
(b).	Maize	
(c).	Potato	
(d).	Mustard	
(e).	Pulse crops	
(f).	Vegetables	
(g).	Fruits	
(h).	Others (…….)	
Total		

b). Non-Agricultural sources

SL No.	Income sources	Amount of income (in TK.)/yearly
1.	Business	
2.	Services	
3.	Foreign Remittance	
4.	Labor	
5.	Rickshaw puller	
6.	Auto driver	
7.	Other income source	
Total		

6. Katarivog Rice Cultivation Information

(Please mention the following regarding Katarivog Cultivation)

Management Practices	Katarivog Cultivation
Amount of Land (Bigha)	
Variety	
Seed rate (kg/ Bigha)	
Number of Irrigation (No)	
Weeding	

7. Cost and Return

a. Human Labor Requirement (man/day)

(Please mention of your Human Labor requirement)

Name of items	**Katarivog Rice**			
	No. of labor		**Taka/ Labor**	**Total (Tk.)**
	Own	**Hired**		
Seedbed preparation& Sowing				
Main land Preparation (tillage & laddering)				
Uprooting & transplanting				
Manure & fertilizer				
Weeding				
Irrigation				
Pest management				
Harvesting				
Carrying ,threshing & storing				
Winnowing, sunning & drying				
Total				

b).Cost of animal/ Mechanical powers used

(Please mention your cost of animal or mechanical powers used)

Name of Practices	**Katarivog Rice**				
	Name of machine/animal	**No of machine/animal**	**Rent (taka/Unit)**	**Cultivated Area(Bigha)**	**total (taka)**
Tillage					
Weeding					
Spraying					
Thrashing					
Total					

c. Materials inputs used

(Please mention about material input used)

Inputs	**Unit Price (Tk./unit)**	**Katarivog rice**	
		Amount(kg/Unit)	**Total Taka**
Seedling (kg)			
Manure (kg)			
Fertilizer			
a. Urea (kg)			
b. TSP (kg)			
c. MP (kg)			
d. Gypsum (kg)			
e. Zinc (kg)			
Pesticides (lit)			
Insecticides (lit)			
Irrigation (No)			
Others (.....)			
Total			

8. Amount of Katarivog rice production and disposal/Return

(Please mention about Katarivog rice production and disposal)

Rice Variety	Total production (kg)	Unit price(TK./kg)	Total taka	Straw production (kg)	Unit price (TK./kg)	Total Taka	Grand Total taka
1	2	3	4(2*3)	5	6	7(5*6)	4+7

9. Please mention the problems faced by you in rice cultivation

a)…….

b)…….

c)…….

d)…….

e)…….

10. What are your suggestions to overcome the above problems?

a)……

b)…….

c)…….

d)…….

e)…….

Thank you for your kind co-operation

Date……. **Signature of the interviewer**