PROFITABILITY AND RESOURCE USE EFFICIENCY OF AUS RICE CULTIVATION IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH

TAMANNA AKTER PREETY

DEPARTMENT OF AGRICULTURAL ECONOMICS

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

SHER-E-BANGLA NAGAR, DHAKA -1207

DECEMBER, 2018

PROFITABILITY AND RESOURCE USE EFFICIENCY OF AUS RICE CULTIVATION IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH

BY

TAMANNA AKTER PREETY

REGISTRATION NO: 12-05144

A Thesis
Submitted to the Faculty of Agribusiness Management
Sher-e-Bangla Agricultural University, Dhaka-1207
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE
IN
AGRICULTURAL ECONOMICS

SEMESTER: DECEMBER, 2018

Approved by:

(Dr. Rokeya Begum) **Professor** **Dept. of Agricultural Economics** **Supervisor**	**(Dr. A.S.M. Anwarul Huq)** **Member Director** **Agricultural Economics & Rural Sociology Division** **Bangladesh Agricultural Research Council** **Dhaka-1215** **Co-supervisor**

Professor Gazi M. A. Jalil
Chairman
Examination Committee
Department of Agricultural Economics

DEPARTMENT OF AGRICULTURAL ECONOMICS
Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207

CERTIFICATE

This is to certify that the thesis entitled " ***PROFITABILITY AND RESOURCE USE EFFICIENCY OF AUS RICE CULTIVATION IN SOME SELECTED AREAS OF CUMILLA DISTRICT IN BANGLADESH****" submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***MASTER OF SCIENCE IN AGICULTURAL ECONOMICS,*** *embodies the result of a piece of bona fide research work carried out by* **TAMANNA AKTER PREETY**, *Registration No.* **12-05144** *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: 14November, 2019
Place: Dhaka, Bangladesh

_____
Prof Dr. Rokeya Begum
Supervisor

DEDICATED TO

MY BELOVED

PARENTS

ABSTRACT

The present study was designed to measure the profitability and resource use efficiency of Aus rice growing districts Cumilla of Bangladesh. The study was confined to randomly selected 60Aus rice farmers. It revealed that Aus rice production is profitable to the farmers. The productivity of Aus rice at farm level was 1520 kg/ha. Aus rice farmers received Tk.24087 as gross return per hectare. And total cost was tk. 20143 per hectare. So the Benefit cost ratio (BCR) on full cost basis is 1.2. Here variable cost is tk.16243 per hectare. So the benefit cost ratio on variable cost basis is 1.5.Functional analysis showed that cost of human labor, seed, and fertilizer had positive significant contribution to gross return of Aus rice cultivation. On the other hand power tiller cost and insecticides cost had insignificant effect on gross return of Aus cultivation. Resource use efficiency indicated that in case of seed, fertilizer and insecticides; the resources were under used for Aus rice production. In case of human labor the resources are over utilized and power tiller use bring the inefficiency of Aus rice cultivation. So there is a positive effect of key factors in the production process of year round Aus rice cultivation. This study also identified some of the problems and constraints associated with Aus rice farming. Farmer faces several types of problem from production period to harvesting period. Heavy rainfall, extreme temperature, lack of capital, high input price, shortage of quality seed, shortage of labor in pick period, high wage rate and lack of capital are some acute problem that the farmer faces most.

ACKNOWLEDGEMENT

First of all I would like to thank Almighty Allah, the most merciful and compassionate, the most gracious and beneficent to Whom every praise is due and to His prophet Mohammad (SM) Who is forever a torch of knowledge and guidance for humanity as a whole with whose delighting the present and endeavor beautiful. All praises are due to the omnipotent, omnipresent and omniscient Allah, Who enabled me to pursue my higher studies in Agricultural Economics and to complete the research work and this thesis successfully for the degree of Master of Science in Agricultural Economics.

Now, I would like to pay ineffable gratitude to my supervisor Dr. Rokeya Begum, Professor, Department of Agricultural Economics , Sher-e-Bangla Agricultural University, Dhaka- 1207, for her ever inspiring guidance, keen interest, scholarly comments and scholastic and constructive suggestions throughout the research work and preparation of thesis. I am deeply indebted to and grateful for her prompt comprehensive feedback, encouragement and patience throughout the duration of the research undertaken for this thesis. Despite an enormous workload because of her teaching and research and many others responsibilities, Dr. Rokeya Begum has always been extremely generous without limits in giving her time and assistance. Dr. Rokeya repeatedly read earlier draft of this thesis and provides me useful guidance and helped to clear my perceptions about the complex issues related to my thesis. Without her valuable intellectual advice, precise constructive comments and help this work would never have come to life.

I am especially grateful to my respected Co-supervisor, Dr. A.S.M. Anwarul Huq, Member Director, Agricultural Economics & Rural Sociology Division, Bangladesh Agricultural Research Council Dhaka-1215, for his proper guidance, inspiring co-operation and encouragement during the research work and preparation of thesis.

I would also like to extend my appreciation to Professor Gazi M. A. Jalil, Chairman, Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Dhaka, for his sincere cooperation, valuable suggestions and encouragement at every stage of this thesis.

I am highly grateful my friend, Rebeka Sultana Supti, Post graduate student from Sher-e-Bangla Agricultural University, dept. of Agricultural Economics for her indescribable help, direct and indirect advice, encouragement and co-operation during the whole study period. I also want to express special thanks to her for helping me to put the data in excel, he cooperated me during data collection process and also analysis.

I would like to express my gratitude to 60 farmers who actively participate in this survey and most importantly help me to understand their initiatives and activities related to Aus rice farming in general and in particular. They provided important data upon which different models were employed to evaluate the efficiency of farming activities. Their invaluable cooperation during my data collection process is highly acknowledged.

I found no words to thank my parents for their never ending affection and continuous support, their sacrifice and untiring efforts to fulfill my dream of higher education. They were constant source of inspiration in the critical moments of my studies.

November, 2019

Tamanna Akter Preety

CONTENTS

CONTENTS (continued)

CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

BARI	: Bangladesh Agricultural Research Institute
BBS	: Bangladesh Bureau of Statistic
BCR	: Benefit Cost Ratio
BDT	: Bangladeshi Taka
BER	: Bangladesh Economic Review
DAE	: Department of Agricultural Extension
et al.	: and others (at elli)
GR	: Gross Return
GM	: Gross Margin
GDP	: Gross Domestic Product
Gm	: Gram
Ha	: Hectare
HIES	: Household Income and Expenditure Survey
HYV	: High Yielding Variety
IOC	: Interest on Operating Capital
Kg	: Kilogram
MoP	: Muriate of Potash
MMT	: Million Metric Tons
Mt	: Metric Ton
NGO	: Non Government Organization
NI	: Net Income
t	: Ton
TC	: Total Cost
TR	: Total Revenue
TFC	: Total Fixed Cost
Tk.	: Taka
TSP	: Triple Super Phosphate
TVC	: Total Variable Cost
US	: United States
USDA	: United States Department of Agriculture
$	: Dollar

CHAPTER 1

INTRODUCTION

Background

Aus rice began to lose its importance as farmers slowly started shifting to cultivation of irrigated Boro rice encouraged by its higher yields. But it has a great potential to enhance profit and establish food security. High population pressure and the rapid pace of human activity including urbanization, industrialization and other economic activities have led to a dwindling supply of arable land per capita and a process of agricultural intensification in South Asia. While this process has significantly increased food production to feed the growing population. Bangladesh economy has been growing over the last three decades. Among the three subsectors of economy, agriculture plays an important role to generate employment for its population by increasing productivity and growth. Bangladesh is a country with a population of almost 165.2 million (BER, 2019) increasing at a rate of 1.042 percent adding about 41.91 percent labor force every year. Agriculture sector has performed remarkably well over the years. Between 1973/74 and 2016/17, agricultural GDP has increased by 5.8 times. Value of agriculture GDP has increased from 5.21 billion dollars to 28.92 billion dollars. All sub-sectors of agriculture (crop, livestock, fisheries and forestry) have increased substantially. Crop GDP has increased by 4.4 times, livestock GDP has increased by 5.8 times and forestry GDP has increased by eight times. On the other hand, fisheries GDP has increased by more than six times. During this period, Total GDP has grown by 20.8 times, increased from 8.92 billion dollars to 185.43 billion dollars. (Deb, 2016). If we only consider the rural economy, agriculture alone provides employment for more than 70 percent of the rural labor force. The growth rate of area, production and yield were found increasing steadily from the year 1980-81. A substantial change has been started from the year 1998-99. The trend of inputs used was found increasing. Almost all the partial as well as the input, output and total factor productivity indices were also found increasing. (Baset, 2009). The varying performance of crop sector has emphasized the need for evolving regionally differentiated strategies for ensuring sustainable and inclusive agricultural growth in a state and consequently in the country. The instability in productivity continues to persist and there are wide variations in instability across different districts. To mitigate the consequences of persisting instability, large-scale promotion of

stabilization measures like insurance should be pursued vigorously. The analysis of district level data has revealed the important role of modern inputs in enhancing the productivity of crop sector. The use of fertilizers has turned out to be the most important input. Along with fertilizer-use, rainfall, irrigation, source of irrigation, better human resources and road connectivity have emerged as the other critical determinants of agricultural productivity. These results signify the importance of use of modern inputs and prudent management of rainfall water, particularly in the low productivity districts. (Kumar and Jain, 2013)

Agriculture in Bangladesh

International development agencies have projected that the country will stand out by growing at record 8% in 2019 and 2020, making it the fastest growing economy in Asia-Pacific. At a time when the global economic outlook is challenging, and growth is expected to moderate across most of developing Asia at 5.7% in 2019 and 5.6% in 2020, Bangladesh will continue to be the fastest growing economy in the Asia-Pacific region. International development agencies have projected that the country will stand out by growing at record 8% in 2019 and 2020, making it the fastest growing economy in Asia-Pacific. Today, Bangladesh is seen as a model for growth even in this difficult global economic outlook. And in this growth story, agriculture is an important sector for Bangladesh. The country has gained significant success in agriculture, achieving third fastest growth in vegetable production, fourth position in rice production, third in fish production from inland water bodies, fifth in aquaculture production and seventh position in mango production in the world. The country is now self sufficient in rice and fish production. Bangladesh is mainly an agricultural country. Agriculture is the single largest producing sector of the economy and contributes about 12.68% to the total Gross Domestic Product (GDP) of the country. This sector also accommodates around 41.91% of labor force. GDP growth rate of Bangladesh mainly depends on the performance of the agriculture sector. (BBS, 2019). The economic development is inextricably linked with the performance of this sector. The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development and food security. Agriculture sector plays an important role in overall economic development of the country. The broad agricultural sector (crops, animal farming, forests and fishing) contributes

14.23 percent to GDP, provides employment about 40.62 percent of the labor force according to Quarterly Labor Force Survey 2016-17. Moreover, agriculture is the source of wide range of agricultural commodity markets, especially in rural areas. In Bangladesh, food security of the vast population is associated with the development of agriculture. Besides this, agriculture has a direct link to the issues like poverty alleviation, improved standard of living and employment generation. In order to ensure long-term food security for the people, a profitable, sustainable and environment-friendly agricultural system is critical. Broad agriculture sector and rural development sector have been given the highest priority in order to make Bangladesh self-sufficient in food. Over the last few years, there has been an increasing trend in food production. According to preliminary estimate of BBS, in FY2017-18, food grains production stood at around 413.25 lakh metric tons (MT). In the same fiscal year, the total internal procurement of food grains was 16.7 lakh MT against the target of 17.3 lakh MT. In addition, an amount of Tk.20,400 crore was targeted to be disbursed as agricultural credit against that Tk.21,393 crore was disbursed till June 2018, which was 104.87 percent of the target. In order to scale up productivity, subsidy in agricultural inputs was increased, as well as enhanced coverage and increased availability of agricultural credit was ensured. Programmes have been launched to popularize the use of organic and balanced fertilizer to maintain soil fertility and productivity. Considering the importance of increased productivity of agricultural products, an amount of Tk.6,000 crore was allocated in the revised budget of FY2017-18 to provide subsidy on fertilizer and other agricultural inputs. In recent years, there has been a tremendous increase in food grain production. Agricultural holding in Bangladesh is generally small but use of modern varieties, inputs and equipment is gradually increasing. Rice, jute, sugarcane, potato, pulses, wheat, tea and tobacco are the principal crops of Bangladesh. Crop diversification program, credit supply, extension work, research and input distribution policies pursued by the government are yielding positive results. The country is now on the threshold of attaining self-sufficiency in food grain production.

Contribution of Agriculture to GDP

Until the 1980s, share of the crop and horticulture sector to the total Agricultural GDP was slightly less than eighty percent. Forestry contributed about 5.5 percent to the agriculture sector in the early seventies which has gradually increased to about 11 percent in 2016/17 Animal farming particularly poultry, dairy, egg production and animal fattening for meat production has contributed towards many-fold increase in livestock production. Small scale commercial poultry farming has expanded in the periphery of towns and cities. Share of animal farming to the Agricultural GDP has increased from about 7 percent in the seventies to about 11 percent in 2016/17. In the early seventies, fisheries sector contributed about 10 percent which was declining in the seventies and eighties. Fisheries sector contributed about 23 percent of the total agricultural GDP in the recent years.

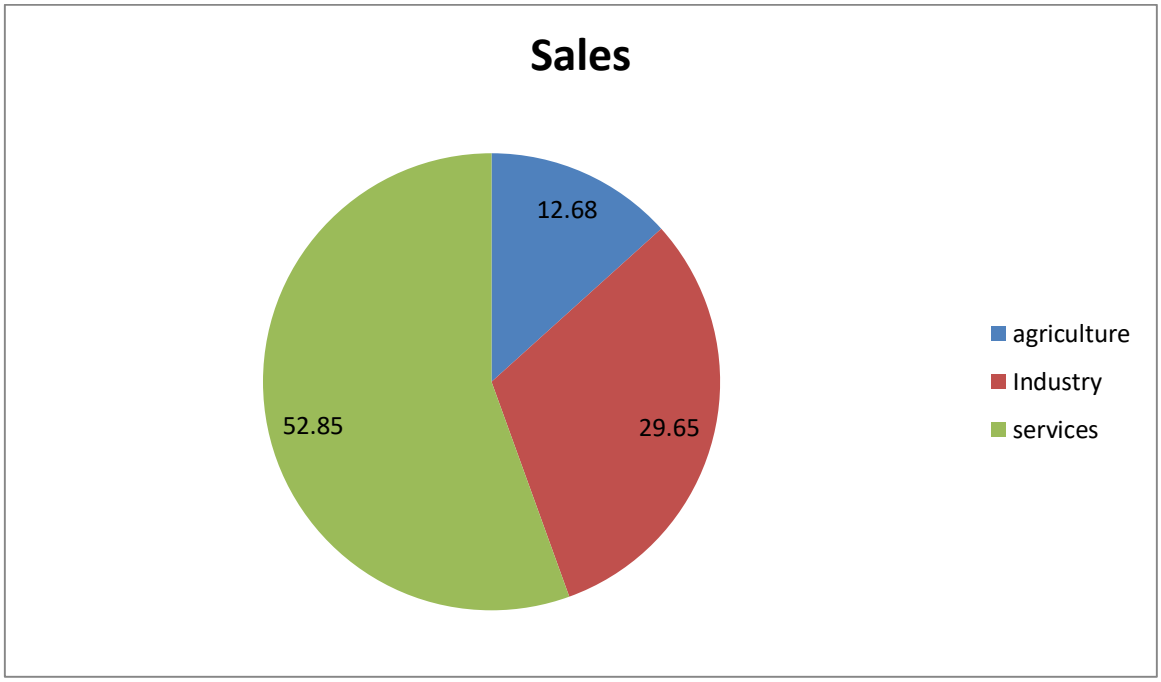


Figure 1.1 Sectorial Share of GDP at Constant Price, 2019

Source: BER, 2019

Figure 1 shows that during 2009-10 to 2016-17 the share of agricultural GDP has decreased. In 2009-10 the share of agriculture in GDP was 18.38%, but in 20016-17 this share has fallen to

14.74%. Figure 1.2 shows that the largest share of GDP is by the service sector. The growth rate also shows the same evident (figure 1.2).

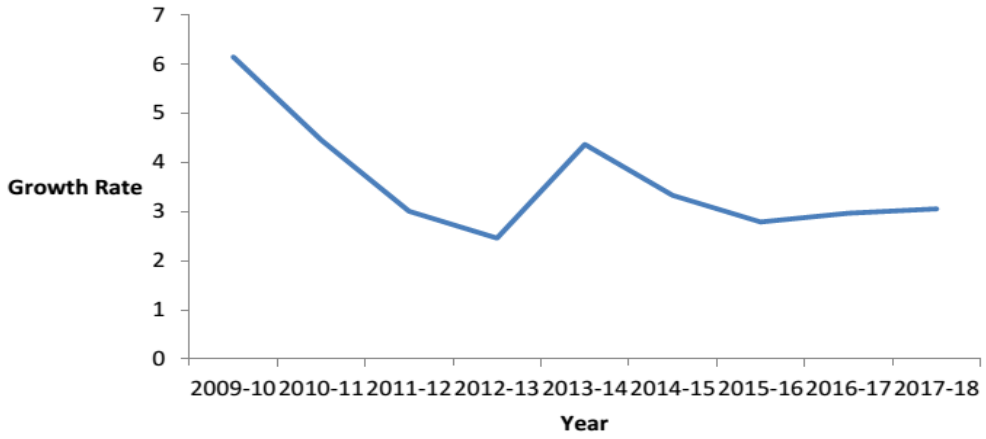


Figure 1.2: Growth rate of agricultural GDP at Constant Price, 2009-2018

Source: BER, 2018

Though share and growth rate of agricultural GDP compared to other sector has decreased in last few decades but in terms of volume agricultural GDP shows an increasing trend. In 2009-10 agricultural GDP was 1065108 million BDT, but in 2016-17 it becomes 1340511 million BDT.

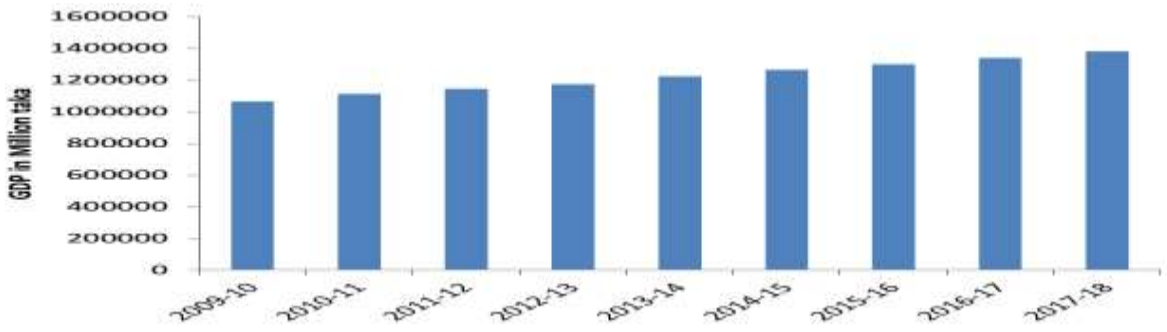


Figure1.3: Trends in Agricultural GDP at Constant Prices

Source: BBS, 2018

In terms of growth, Bangladesh agriculture performed remarkably well both in the long-term FY1973/74 to FY2007/08 and in the short term or recent years FY2008/09 to 2014/15. Annual growth rate in the overall agriculture sector ranged between 1.6 percent in FY2013 and 4.4 percent in FY2014. For crop & horticulture subsector it varied between 0.6 percent in FY2013 and 3.9 percent in FY2011. Animal farming experienced annual growth between 2.6 percent in FY2011 and 3.1 percent in FY2015. On the other hand, forest and related services had annual growth in the range of 5.0 percent in FY2014 and 6.0 percent in FY2012. Fishing had annual growth between 5.3 percent in FY2012 and 6.5 percent in FY2015. (Deb, 2016).

Present Status of Crop in Bangladesh

Priority of agriculture today has been shifted towards nutritional security of its growing population. Demand for diversified food items is a newer challenge to agriculture. On the other hand development of climate smart agriculture added to the development agenda that the science is focusing today. Rice is the staple food of about 135 million 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. Rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh. Almost all of the 13 million farm families of the country grow rice. Rice is grown on about 10.5 million hectares which has remained almost stable over the past three decades. About 75% of the total cropped area and over 80% of the total irrigated area is planted to rice. 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 about70.88 millions. However, the country is now producing about 25.0 million tons to feed her 135 million people. This indicates that the growth of rice production was much faster than the growth of population. This increased rice production has been possible largely due to the adoption of modern rice varieties on around 66% of the rice land which contributes to about 73% of the country's total rice production. However, there is no reason to be complacent. The population of Bangladesh is still growing by two million every year and may increase by another 30 million over the next 20 years. Thus, Bangladesh will require about 27.26 million tons of rice for the year 2020. During this time total rice area will also shrink to10.28 million h hectares. Rice yield therefore, needs to be increased from the present 2.74 to3.74 t/ha.

Table 1.1: Food grains production status during the period from FY2010-11 to FY2017- 18

(In lakh MT.)								
Food Grains	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Aus	21.33	23.33	21.58	23.26	23.28	22.89	21.34	27.09
Aman	127.91	127.98	128.97	130.23	131.9	134.83	136.56	139.94
Boro	186.17	187.59	187.78	190.07	191.92	189.38	180.16	195.76
Total Rice	**335.41**	**338.9**	**338.33**	**343.56**	**347.1**	**347.1**	**338.06**	362.79

Source: BBS, 2018

Rice in Bangladesh:

Rice is the most important and fundamental food crop in Bangladesh. It dominates the crop sector of Bangladesh agriculture approximately more than 73 % of total cropped area and is treated as principal food to the people of Bangladesh. (Moniruzzaman, 2010). Aus is one of the major crops in Bangladesh. It has been contributing to food production in addition to other two rice (Aman and Boro) crops. The weather condition for Aus cultivation was favorable in the growing stage of recent years. The paddy which are sown during the month March-April and harvested in July-August every year is considered to be Aus paddy. There are two types of Aus paddy namely local Aus and high yielding variety (HYV) Aus. From time immemorial Aus paddy which is grown in our country is called local Aus. Generally this type of paddy does not need irrigation and is purely dependent on natural rainfall. Very recently, the Ministry of Agriculture allocated Taka 302.1 million to 2.10 lakh farmers for promoting cultivation of rain-fed Aus in 48 districts which will help farmers to re-introduce Aus rice cultivation in a sustainable way as risk-free technologies from natural calamities and requires minimum cost to produce. Through this incentive, farmers may able to grow 70 thousand tones additional rice, as

worth of Tk. 224 crore. The expected cost-benefit ratio will be around 1.8 is the Consultant of International Rice Research Institute (IRRI).

The dominant food crop of Bangladesh is rice, accounting for about 75 percent of agricultural land use Rice production increased every year in the 1980s (through 1987) except FY 1981, but the annual increases have generally been modest, barely keeping pace with the population. Rice production exceeded 15 million tons for the first time in FY 1986. In the mid-1980s, Bangladesh was the fourth largest rice producer in the world, but its productivity was low compared with other Asian countries. It is currently the world's sixth-largest producer. The cultivation of rice in Bangladesh varies according to seasonal changes in the water supply. The largest harvest is Aman, occurring in November and December and accounting for more than half of annual production. Some rice for the Aman harvest is sown in the spring through the broadcast method, matures during the summer rains, and is harvested in the fall. The higher yielding method involves starting the seeds in special beds and transplanting during the summer monsoon. The second harvest is Aus, involving traditional strains but more often including high-yielding, dwarf varieties. Rice for the Aus harvest is sown in March or April, benefits from April and May rains, matures during the summer rain, and is harvested during the summer. With the increasing use of irrigation, there has been a growing focus on another rice-growing season extending during the dry season from October to March. The production of this Boro rice, including high-yield varieties, expanded rapidly until the mid-1980s, when production leveled off at just below 4 million tons. Where irrigation is feasible, it is normal for fields throughout Bangladesh to produce rice for two harvests annually.

Table 1.2 shows the rice production from 2000 to 2017 and its growth rate in MMT (million metric tons)

Table 1.2: Rice Production in Bangladesh, from 2000-2001 to 2016-2017

Year	Aus Rice (MMT)	Aman Rice (MMT)	Boro Rice (MMT)	Total Production (MMT)
2000-2001	1.916	11.249	11.92	25.085
2001-2002	1.808	10.726	11.766	23.834
2002-2003	1.85	11.115	12.222	25.187
2003-2004	1.832	11.521	12.837	26.19
2004-2005	1.5	9.82	13.837	25.157
2005-2006	1.745	10.81	13.975	27.52
2006-2007	1.512	10.841	14.965	27.326
2007-2008	1.507	9.662	17.762	28.931
2008-2009	1.895	11.613	17.809	31.317
2009-2010	1.709	12.207	18.811	32.727
2010-2011	2.133	12.792	18.617	33.542
2011-2012	2.332	12.798	18.759	33.988
2012-2013	2.158	12.897	18.778	33.826
2013-2014	2.326	13.023	19.007	34.356
2014-2015	2.328	13.19	19.192	34.71
2015-2016	2.281	13.483	18.937	34.701
2016-2017	2.134	13.656	18.014	33.804
Growth rate (%)	**0.63**	**1.14**	**2.43**	**1.75**

Source: BER, 2017

Aus Rice

Aus is one of the major crops in Bangladesh. It has been contributing to food production in addition to other two rice (Aman and Boro) crops. The weather condition for Aus cultivation was favorable in this year but due to lower productivity as compared to two other rice crop Aman and Boro, farmers are reluctant to produce Aus. The contemporary crops are becoming profitable day by day. In a subjective manner, farmers were interviewed on some management issues of seed and fertilizer. They opined that due to government support as well as favorable weather conditions, the production of rice remains almost same in relation to the previous year.

Area:

Total area under Aus crop has been estimated at 10.75 million hectares this year as compared to 9.41 million hectares in last year which is 14.164% higher than that of last year. The total area of this year and the last year of Aus by variety are as follows

Table 1.3: Total area of Aus production

Variety	2016-2017		2017-2018		Percentage (%) Changes over previous year
	Area(in acres)	Area(in hectares)	Area(in acres)	Area(in hectares)	
Local Aus	4,65,703	1,88,460	3,96,308	1,60,377	(-)14.90
HYV Aus	18,61,285	7,53,221	22,60,276	9,14,682	(+)21.436
Total Aus	23,26,988	9,41,681	26,56,583	10,75,061	(+) 14.164

Source: BBS, 2019

Yield Rate:

Average yield rate of 2017-2018 has been estimated at 2.52 metric tons per hectare which is 11.209% higher than that of last year. Estimates of yield rates by varieties and combined average yield rate of all varieties are as follows

Table 1.4: Total yield rate of Aus production

Variety	2016-2017		2017-2018		Percentage (%) Changes over previous year
	Area(in acres	Area(in hectares)	Area(in acres	Area(in hectares)	
Local Aus	14.58	1.345	15.07	1.390	(+)3.346
HYV Aus	27.06	2.496	29.47	2.719	(+)8.934
Total Aus	24.56	2.266	27.33	2.520	(+)11.209

Source: BBS, 2019

Production:

Total Aus production (husked) of 2017-2018 has been estimated at 2.7 million metric tons as compared to 2.13 million metric tons in last year which is 26.998% higher. Estimates of production by varieties and combined total of Aus are as follows

Table 1.5: Total production (M.Ton) of Aus rice

Variety	2016-2017	2017-2018	Percentage (%) Changes over previous year
	Production (M.Ton)	Production (M.Ton)	
Local Aus	2,53,527	2,22,892	(-)12.082
HYV Aus	18,80,090	24,86,751	(+)32.268
Total Aus	21,33,617	27,09,643	(+)26.998

Source: BBS, 2019

Table 1.6 : Yield, Area and Production Statistics of AUS Rice:

Financial Year	Area (In Lac Hectare)	Total Production Lakh M.Ton	Yield Rate (M.ton per Hectare)
2006-2007	9.06	15.12	1.669
2007-2008	9.19	15.07	1.640
2008-2009	10.66	18.95	1.778
2009-2010	9.84	17.09	1.737
2010-2011	11.13	21.33	1.916
2011-2012	11.38	23.32	2.049
2012-2013	10.53	21.58	2.049
2013-2014	10.51	23.26	2.213
2014-2015	10.45	23.28	2.227
2015-2016	10.40	23.40	2.20
2016-2017	10.51	23.32	2.12
2017-2018	10.45	23.56	2.26

Source: BBS, 2018.

Justification of the Study

As Aus is less produced crop in Bangladesh, it seems profitable in our country. Total area under Aus crop has been estimated at 1.45 million hectares this year as compared to 1.51 million hectare in last year. Profitability is an important aspect of production decision for the semi-subsistence farming system in Bangladesh. But a few studies are found to analyze Aus rice profitability and resource use efficiency measure. No one actually did the profitability and resource use efficiency of Aus rice, maximum researcher did their research on Boro and Aman rice. But in my study area I found rice as a profitable crop. I think my research gap is my crop selection; my crop selection is a unique work that was not happen before. This is the challenge of my study to show Aus rice cultivation potentiality in Bangladesh.

Objectives of the Study

- To study the socio-demographic profile of Aus rice producer in cumilla district.
- To assess cost and returns of Aus rice production.
- To analyze the resource use efficiency of the inputs used by the farmers.
- To identify the problems associated with the production unit of Aus rice production and provides some policy recommendations to overcome the problems.

Organization of the Study

The study consists of 9 chapters. Chapter 1 describes introduction of the study. Relevant review of literature, methodology, description of the study area, socioeconomic characteristics of the sample farmers, results and discussion, problems of Aus rice growers and summary, conclusion and recommendations are presented in Chapter 2, Chapter 3, Chapter 4, Chapter 5, Chapter 6, Chapter 7, Chapter 8 and Chapter 9 respectively.

CHAPTER 2

REVIEW OF LITERATURE

Akter *et al.*, (2019) studied on Factors determining the profitability of rice farming in Bangladesh. The finding of cost-benefit analysis reveals that rice farming is a profitable activity in Bangladesh as the estimated cost of production was lower than the return in the selected study areas. However, the profitability differs among different farmers' group and large farmers are more profitable in rice cultivation than small and medium farmers. In addition, the functional analysis identifies three inputs such as the cost of power tiller, fertilizer and hired labor as the significant determinants of profitability for all farmers in the study regions. Moreover, these factors also differ across the farmer's groups except the cost of fertilizer. Therefore, it is recommended in this study that the concerned authority of the government should ensure adequate and timely fertilizer use at a subsidized price which would be affordable by the farmers.

Kandel *et al.*, (2019) experimented on Evaluation the growth, productivity and profitability of rice (Sukhadhan-3 variety) under different methods of weed management. The study showed that Although the single application of butachlor as pre emergence spray showed highest grain yield which seems economically viable and profitable practice to the farmers but it is not environmentally safe to the whole universe.

Nayak *et al.*, (2019) studied on Productivity and profitability of summer paddy under different establishment method and irrigation management. They found that among different combinations, PTR with AWD recorded the highest grain yield (5.78 t/ha), straw yield (5.77 t/ha) and harvest index (0.51). However, NPTR with AWD recorded minimum water use (13500 m3/ha) with water productivity of 0.38 kg/m3. DSR with AWD recorded the lowest cost of production (35567 Rs/ha) but PTR with AWD recorded the highest gross return (97668 Rs/ha), net return (55005 Rs/ha) and B-C ratio (1.49).

Bari and Ahmed (2018) experimented a study on Performance of Aus rice in different tillage systems and crop establishment method in Southwest Bangladesh. They found that High labor wage and irrigation water scarcity are the major constraints to becoming rice production less profitable and unsustainable in Bangladesh. To address these problems, rice production needed

less water and less labor consuming production technologies. In traditional rice production systems which is puddled-transplanted rice (PTR), a significant amount of water and labor are used for tillage (wet) and transplanting operations. A farmers' participatory on-farm trial was conducted to evaluate the performance of Aus rice at different tillage systems and crop establishment methods in the southern part of Bangladesh

Hosssain *et al.*, (2018) conducted a study on Productivity and Profitability of Four Crops Based Cropping Pattern in Cumilla Region of Bangladesh. Field experiment was conducted at the farmers' field of Amratoli, Barura multi location testing site of Cumilla during 2014-15 and 2015-16 to increase cropping intensity and productivity by inclusion of T. Aus in existing cropping pattern. Thus experiment variables were F: Existing cropping pattern (Potato-Boro-Fallow-T. Aman) and FA: Alternate cropping pattern (Potato- Boro- T. Aus- T. Aman). Research result indicated that rice equivalent yield (REY) in alternate cropping pattern was 43.46 t/ha, which is25.90% higher over existing pattern (34.52 t/ha). Higher gross return (Tk. 651900 per ha), gross margin (Tk. 416520 per ha) and higher marginal benefit cost ratio (2.77) obtained from alternate cropping pattern messaged that this pattern may be recommended to other extrapolation areas of Cumilla region.

Lucky *et al.*, (2018) studied an Agronomic and Profitability Study on Rice Production: A Case of Jalgaon Village of Comilla District, Bangladesh. They found that Farmers' fertilizers management is highly inconsistent with recommendation practice. Both manual and chemical methods are used for controlling weeds. Chemical method is mainly practiced for controlling insects and diseases of crops. Paddle and power thresher is used for threshing rice. Boro rice gave Boro rice gave higher yield (4.94 t/ha) followed by T. Aman (3.29 t/ha) and Aus (3.09 t/ha) due to better cropping environment, good management practices, higher inputs and usages of better genotypes. The performance of rice in the three seasons showed large yield gap. T. Aman gave higher gross margin (BDT 22,015/ha) followed by Boro (BDT16,468/ha) and Aus (BDT 9,414/ha) because of higher price and lower production cost. Participation of women in the intercultural operations of crops and their roles in decision making about farming was a few. Nevertheless, they intensively participate in post-harvest processing of crops and other household activates and decisions. In short, despite a large yield gap, rice production is profitable in the three seasons at survey year's price.

Uddin and Dhar (2018) studied on Government input support on Aus rice production in Bangladesh: impact on farmers' food security and poverty situation. The results show that rice cultivation occupied the major portion of farmers' total cropped area. The government of Bangladesh had provided with input (both cash and kind) support in order to boost Aus rice (UFSHI and NERICA variety) production. Cropping intensity of supported farmers' was increased by 39.7%, whereas it was increased by only 1.4% for non-supported farmers. Productivity of Aus rice was 138.0 and 100.0% in stare of supported and non-supported farmers, respectively. Average per capita daily calorie intake of the households was still below the national average level of 2122 kcal. Poverty in terms of deprivation of health education, employment, housing, mobility and income was decreased, and overall livelihood circumstances were improved through government input support on Aus rice production.

Islam *et al.*, (2017) studied on Evaluation of Aus Rice (Oryza sativa L.) Production in Less Irrigated Situation in Northern Region of Bangladesh. They found that About 20 to 60% higher grain yield was observed in different farmers 'field with BRRI dhan48 over BRRI dhan28, which indicated that BRRI dhan48 is a potential rice variety during Aus or Braus season. BRRI dhan48 can be cultivated after Boro harvest or as Boro, Aus after potato harvest. The variety could also decrease the pressure on ground water utilization for rice cultivation during dry season.

Rahman *et al.*, (2016) experimented on Forecasting Aus Rice Area and Production in Bangladesh using Box-Jenkins Approach. They found that The forecasted Aus rice area and production both were showed a decreasing trend. Government should create an enabling environment to develop HYV rice varieties for Aus rice crop to ensure ongoing food security by increasing cultivated area and production.

Goldman (2013) studied on India's rice production and it's technical efficiency. He found that the determinants of technical efficiency that may help designing rice production profitably and minimizing farmers' yield gap with 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 little scope of increasing yield without breaking the yield frontier particularly for aromatic and fine rice through 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.

Afroz and Islam (2012) measured Economics of Aus Rice (Oryza sativa) and Jute (Corchorus olitorius) Cultivation in Some Selected Areas of Narsingdi District of Bangladesh. The present study was conducted to estimate the relative profitability of growing Aus rice and jute and to determine the resource use efficiency in the production of these crops in three selected village of Raipura upazila in Narsingdi. A total of 60 farmers were interviewed to collect primary data of which 30 farmers were produced Aus rice and another 30 farmers were produced jute. Total costs for producing jute and Aus rice were Tk50254 and 44970 per hectare, respectively. The equivalent gross returns were Tk83717 and Tk55762, respectively. Accordingly, net return for jute was Tk33463, which was about 3 times higher than that for Aus rice (Tk. 10792/ha). Moreover, BCR of producing jute was about 30% higher (1.7) than that of Aus rice (1.3). Cobb-Douglas production function was used to estimate specific effects of individual inputs on production of jute and Aus rice. Resource use efficiency analysis showed that neither jute nor Aus rice farmers was efficient enough to use various inputs. Therefore, it seems that efficient and judicious use of various resources would enable both jute and Aus rice farmers to earn more profit.

Rahman and Forman (2012) conducted a study on a comparative financial analysis of Aus and jute production in some selected areas of Mymensingh district. It was revealed that the cultivation of Aus rice and jute was a profitable business from the viewpoint of farmers. It was observed that most of the included variables had significant impact on Aus rice and jute production. Among the included variables, four variables namely human labor, seed, fertilizer and manure had positive and significant impact on returns from both Aus rice and jute production. The major problems of the study were seed purity level, insufficient water and irrigation facility and higher input costs.

Rahman (2003) examined the Profit efficiency among Bangladeshi rice farmers. Production inefficiency is usually analyzed by its three components—technical, allocative, and scale efficiency. In this study, we provide a direct measure of production efficiency of the Bangladeshi rice farmers using a stochastic profit frontier and inefficiency effects model. The data, which are for 1996, include seven conventional inputs and several other background factors affecting production of modern or high yielding varieties (HYVs) of rice spread across 21 villages in three agro-ecological regions of Bangladesh. The results show that there are high levels of inefficiency in modern rice cultivation. The mean level of profit efficiency is 77% suggesting that an estimated 23% of the profit is lost due to a combination of technical, allocative and scale inefficiency in modern rice production. The efficiency differences are explained largely by infrastructure, soil fertility, experience, extension services, tenancy and share of non-agricultural income.

Concluding Remarks :

The above mentioned discussion and review indicate that most of the studies dealt with productivity and profitability of rice cultivation .Some studies also determine the factors affecting the profitability. Some other studies implies to comparative financial analysis of Aus rice and Jute production in Bangladesh. Maximum studies examined performance of Aus rice producing area, growth factor, Agronomic study of rice production, Government input support on Aus rice, Forecasting Aus rice area and production and profit efficiency among rice farmers.

CHAPTER 3

METHODOLOGY

Introduction

Methodology is an indispensable and integral part of any study. The reliability of a specific study finding depends to a great extent on the appropriate methodology used in the study. Improper methodology very often leads to misleading result. So, careful considerations are needed by an author to follow a scientific and logical methodology for carrying out the study. The author has great responsibility in describing clearly what sorts of method and procedure is to be followed in selecting the study areas, the sources of data and the analyses as well as interpretations to arrive at a meaningful conclusion. This study was carried out by using a primary data collection from selected Aus rice producers in selected areas of Bangladesh for estimation of resource use efficiency and profitability of Aus rice production. The methodological framework is presented in this chapter. The first part describes sampling procedure, sample frame, sample size and survey design. Second part describes data collection procedure, formal and informal survey, and primary and secondary data. Data analysis techniques are described in detail in the last part.

Selection of the Study Area

Most of the upazila under Cumilla district where Aus rice is cultivated. Among them Nangalkot & Laksham upazila the most important area for Aus rice cultivation. From these two upazila of Cumilla District, six villages named at Patwar, Hesakhal, Sukuntala, Horipur. Krisnopur, Naoti were selected randomly as study area. Cluster sampling techniques were taken into consideration.

Sample Size and Sampling procedure

The total sample sizes from two upazilas were 60 Aus rice cultivators. The number of sample from each village was 10 Aus rice cultivators. Multi-stage cluster sampling procedure was used to select the farmer who cultivates Aus rice in these areas for collecting the data.

Data Collection

Primary data were collected through structured interview schedule which were filled up by the researcher. Data was collected July to August 2019. Additionally, secondary data were also collected from various sources like Bangladesh Bureau of Statistics (BBS), Ministry of Agriculture, Bangladesh Economic Review (BER), Bangladesh Agricultural Research Institute (BARI), Department of Agricultural Extension (DAE).

Data Processing and Analysis

In this study, a statistical tool and technique both descriptive and inferential is used to analyze the data. Besides, a descriptive tool and technique tabulation is also used in the study. Primary data were recorded into Microsoft excel and economic analysis was carried out to STATA for determining factor affecting Aus rice growers. In this study, cost and return analysis were done on both variable and total cost basis. To achieve the objective of the study a simple tabular analysis was completed.

Analytical Technique

Data were analyzed with the purpose of fulfilling the objectives of the study. Both tabular and functional methods of analysis were employed in this study. At first, the collected data were edited and summarized for analysis. The tabular method of analysis involved different descriptive statistics like mean, percentage, ratio, etc. Land use cost was calculated on the basis of per year lease value of land. The profitability of Aus rice cultivation was estimated by using gross margin, net return, and benefit cost analysis. Cob-Douglas production function analysis was used to estimate the productivity and resource use efficiency of Aus rice cultivation.

To determine the contribution of the most important variables in the production process, the following specification of the model was applied:

The empirical cost function was the following:

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

Where,

Y = Gross Return (tk/ha); X_1 = Human Labor (tk/ha); X_2 = Seed (tk/ha)

X_3 =Fertilizer (tk/ha); X_4 = Power Tiller (tk/ha); X_5= Insecticide cost (tk/ha)

a = Intercept; b_1, b_2 -------- b_5 coefficients of the respective variables to be estimated.

Ui = Error term.

Profitability Analysis

Net value of the produce and cost involved were estimated. Cost of variables inputs such as land preparation, labor, seed, fertilizer, and insecticides were calculated. The tabular method of analysis involved different descriptive statistics like mean, percentage, ratio, etc. Land use cost was calculated on the basis of per year lease value of land.

Variable cost

i. Cost of seed
ii. Cost of hired labor
iii. Cost of chemical fertilizer
iv. Cost of power tiller
v. Cost of insecticide

Fixed cost

i. Interest on operating capital
ii. Land use cost
iii. Family Labor

Gross Margin

GM = TR - VC

Where as,

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

Net Income

NI = TR - TC

Where as,

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

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

Benefit Cost Ratio: The BCR was computed by this method.

Where $B_t$is the benefit in time t and $C_t$is the cost in time t. If the BCR exceeds one, then the project might be a good candidate for acceptance.

BCR = TR/TC

Whereas

BCR = Benefit Cost Ratio TR = Total Revenue

TC = Total Cost

Π = Gross return − (Variable cost + Fixed cost) Here, Π = Profit per hectare

Gross return = Total production × per unit price

$$\textbf{BCR} = \frac{\textbf{Total return}(\textbf{Gross } \boldsymbol{Return})}{\textbf{Total } \boldsymbol{cost}}$$

The separate activity analyses of farm producing different combination of flowers were also performed by tabular analysis. Per hectare profitability of Aus rice cultivation from the view point of individual farmers were measured in terms of gross return, gross margin, net return and benefit cost ratio.

Resource use efficiency Measure:

The efficiency of inputs used in production was measured by

the following equation:

MVPx/MFCx

Where, MVPx is the marginal value product of 'X input and MFCx is the marginal factor cost of 'X' input. When the ratio of MVP and MFC is equal to unity, it indicates that the resource is efficiently used. When the ratio is more than unity, it implies that the resource is underutilized. In that case, there is an ample opportunity to increase total production by increasing the use of specific input in the production process keeping other resources it is possible to reduce production cost remains total production unchanged by decreasing the use of specific input. According to Dhawan and Banal (1977), the useful estimate of MVP is obtained by taking the geometric mean of the resources (X_i) as well as the gross return. MVP is computed by multiplying the coefficient of a given resource with the ratio of the geometric mean of the resource i.e Thus

MVP (X_i) = bi Y_i/X_i

Where Y = Mean value of gross return in Tk.

X_i = Mean value of different resources in Tk.

i = (1, 2 ...4) and

bi =dy/dx_i= Slope of the production function

Since all the inputs and outputs were expressed in monetary terms, the acquisition cost of the inputs was taken as one taka. The criteria used here to assess the resource allocation efficiency are to test the MVPs against unit.

CHAPTER 4

DESCRIPTION OF THE STUDY AREA

Introduction

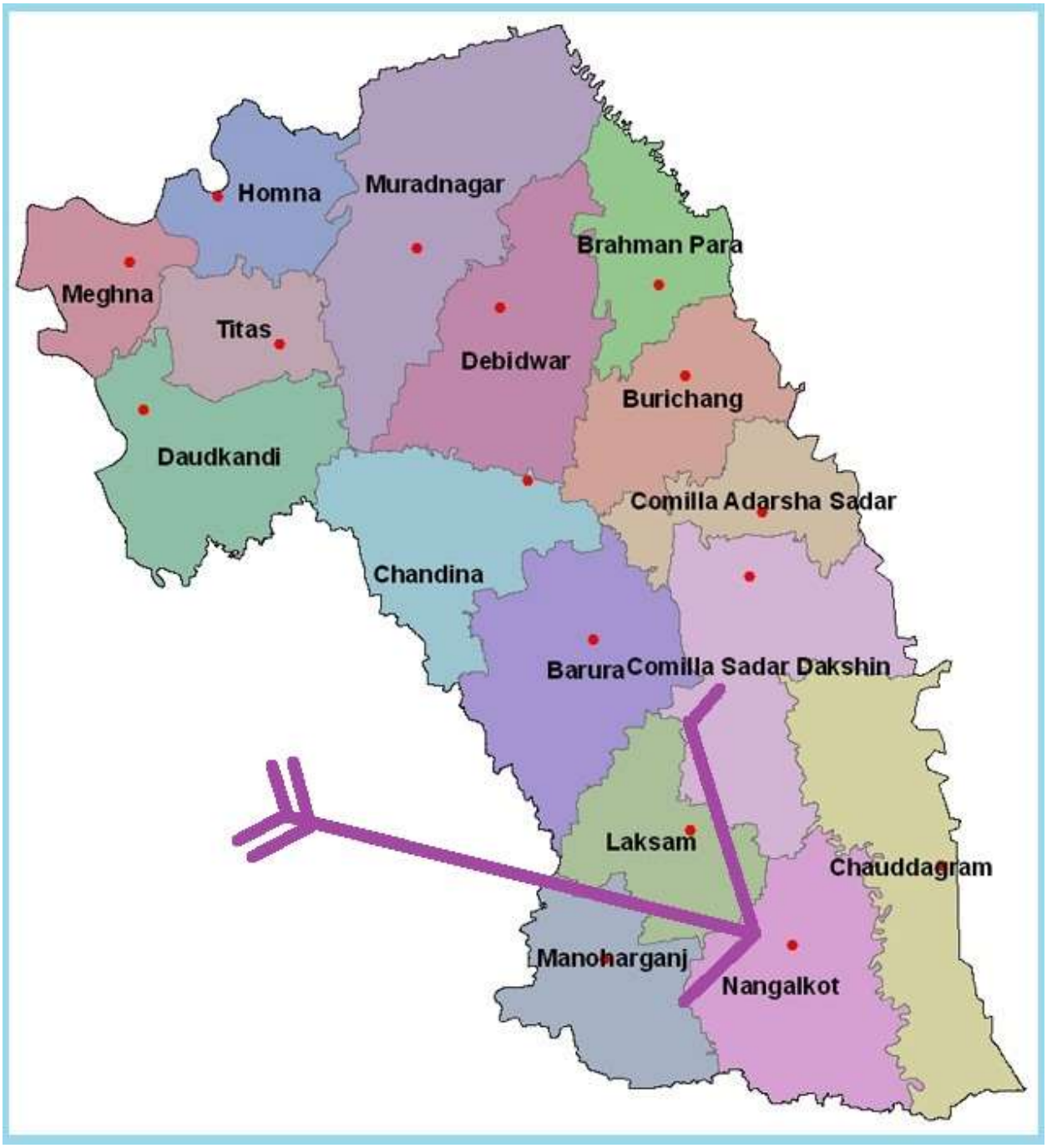
A short description has been presented in this chapter to know the overall features of the study area. It is essential to know the agricultural activities, possible development opportunities and potentials of the study area. Location, area, population, monthly average temperature and rainfall, agriculture, occupation, cropping patterns, communication and marketing facilities of the study area are discussed in this chapter. However, for the production of Aus rice, it is very essential to know the climate and topography of the study areas.

Location

Nangalkot Upazila (comilla district) area 236.44 sq km, located in between 23°02' and 23°14' north latitudes and in between 91°'07' and 91°18' east longitudes. It is bounded by laksham and chauddagram upazilas on the north, senbagh and daganbhuiyan upazilas on the south, Chauddagram upazila on the east, Laksham upazila on the west.

Laksham Upazila (comilla district) area 135.61 sq km, located in between 23°10' and 23°19' north latitudes and in between 91°01' and 91°11' east longitudes. It is bounded by comillasadardakshin and barura upazilas on the north, nangalkot and manoharganj upazilas on the south, Nangalkot and ComillaSadarDakshinupazilas on the east, Barura and shahrasti upazilas on the west.

The locations of the upazilla are presented in the Map 4.1, 4.2 respectively.



Source: homnacomilla

Figure 4.1: Map of Study Area

Source: banglapedia

Figure 4.2: Location of Study Area

Area and Population

The total area, population and density of population of the selected upazilas are presented in Table 4.2 .The highest population density (1880 per sq.km) is Laksham Sadar and the population density of Nangalkot is (1655 sq. km) in Cumilla district.

Table 4.1: The total area, population and density of population of study area

Upazila	Household	Population (000)			Sex ratio (M/F)	Average size of household	Density per sq. km.
		Male	Female	Total			
Laksham	57119	141	154	295	91	5.13	1880
Nangalkot	72891	172	202	374	85	5.11	1655

Source: BBS, 2011

Education:

Literacy rate and educational institutions Average literacy 46.67%, male 46.33%, female 41.40%. Educational institutions: college 4, palli college 1, technical college 1, secondary school 70, primary school 504, community school 1, madrasa 60. Noted educational institutions: Nawab Faizunnesa Government College, Laksham Pilot High School, Laksham Girl's High School, Harishchar Union High School, BN High School, Daulatganj Government Primary School, Gazimura Alia Madrasa.

Farm holding

A farm holding is defined as being an agricultural production unit having cultivated land equal to or more than 0.05 acres. Farm holdings are classified into following three broad groups:

(a) Small: Farm holdings having minimum cultivated land 0.05 acre but operated land more than this minimum but up to 2.49 acres.

(b) Medium: Farm holdings having operated land in between 2.50 to 7.49 acres.

(c) Large: Farm holdings having operated land 7.50 acres and above.

Small cultivated land 0.04 acre or less is generally used for kitchen garden growing mainly vegetables. Often seeds of white gourd, water gourd, pumpkin and other strains are sown on households; but these creepers spread out around house roofs and other structures. As such, the minimum cultivated land considered for qualifying to be a farm holding is 0.05 acres.

Temperature, Rainfall and Humidity:

Last data from BBS showed that the maximum temperature of 2011 was 29 .6 centigrade and minimum was 11.3. The rainfall in 2011 was 187milimeter. And the humidity percentage was 77.6.

Table 4.1Temperature, Rainfall, Humidity of Cumilla District from 2008-2011

Years	Temperature (centigrade)		Rainfall (millimeter)	Humidity (%)
	Maximum	Minimum		
2008	33.2	11.1	2064	79
2009	33.9	13.4	1924	80
2010	33.5	11	1055	64.2
2011	29.6	11.3	1879	77.6

Source: BBS, 2011

Land description:

This is land area actually cropped during the census year regardless of number of crops grown plus current fallow. It includes areas under temporary and permanent crops and also current fallow**.** Laksham had high land, medium land and low land of total 27196 acre. And Nangalkot had total land of 32501 acre.

Table 4.2: Land type of study area (in acre)

Upazila	High land	Medium land	Low land	Total land
Laksham	1791	22638	2767	27196
Nangalkot	3884	26675	1942	32501

Source: BBS, 2011

Soil Classification:

Laksham and Nangalkot has doash, bele, etel, kankar type of soil. The area covered by this soil type is given below.

Table 4.3: Soil type of study area.

Upazila	Total	Soil classification				
		Doash	Bele	Etel	Kankar	Others
Laksham	27196	25105	0	2010	0	81
Nangalkot	53889	38	0	1358	0	1235

Source: BBS, 2011

Agriculture holding

Main crops Paddy, potato, wheat, mustard, vegetables. Extinct or nearly extinct crops Jute. An agriculture holding is a techno-economic unit of agricultural production under single management comprising all livestock kept and all land used wholly or partly for agricultural production purposes without regard to title, legal form or size. Single management may be exercised by either an individual holder or jointly by two or more individuals or holders or by a judicial person such as a corporation, co-operative or government agency. A holding may consist of one or more parcels (fragments of land) located in one or more areas or mauzas or in more than one administrative unit or division provided that all separate parcels of fragments form parts of same technical unit under operational control of same management.

The definition covers practically all holdings/households engaged in agricultural production of both crops and livestock. Some agriculture holdings may have no significant agricultural land, e.g. holdings keeping livestock, poultry and hatcheries for which land is not an indispensable input for production.

Rice production of Laksham and Nangalkot upazilla:

Here the area under Aus rice production for both Laksham and Nangalkot are 1494.2 acre and 26616 acre of land.

Table 4.4: Area and production of rice 2010-2011

Upazila	Aus		Aman		Boro	
	Area	Production	Area	Production	Area	Production
Laksham	13454	14301	1494.2	404.5	9904	43878
Nangalkot	25070	26616	32110	28052	31924	56545

Source: BBS, 2011

Tenancy

Owner holdings are those having and operating their owned land and who may or may not be leasing out land. Tenant holdings are those having no owned land but operating land taken from others on share cropping basis or on other terms. Owner-cum-tenant holdings are those having owned land and who may or may not be leasing out their own land to others and who may be taking land from others on share cropping basis or on other terms.

Table 4.6: Number of agriculture holding by tenure (in acre)

Upazila	Total farm holding	Owner holding	Owner cum tenant	Tenant holding
Laksham	28193	32620	14166	1829
Nangalkot	40463	42353	18917	2571

Source :BBS 2011

Occupations

The major occupations of the peoples under study areas are agriculture, non-agricultural labourer, wage labourer, industrial labourer, service holder and others. Average wage rate of agricultural labour varies in different areas. Day labours were charged with high wage rate and they became scarce during harvesting period.

Transportation, Communication and Marketing Facilities

Transportation and communication is the pre-condition for the development of a particular region or a country. The selected areas for the study are well communicated with the different places of Bangladesh. The road network of this area facilitates the local people to market their agricultural as well as other products to the nearby and distance market places. Most of the roads in the study areas are concreted and some of the roads are muddy. Due to well communication with the different markets, usually farmers do not deceive from having good price of their produced commodities. The modes of transportation of this area are rickshaw, van, bullock carts, truck, by-cycle, motorcars and boats. There are many hats, which are sit on more than one day in a week and the local bazars are held on every morning and afternoon.

CHAPTER 5

SOCIO-DEMOGRAPHIC PROFILE OF AUS RICE PRODUCING FARMERS

Introduction

This chapter deals with the socioeconomic characteristics of the sample farmers. Socioeconomic characteristics of the farmers are important in influencing production planning. People differ from one another in many respects. Behavior of an individual is largely determined by his/her characteristics. There are numerous interrelated and constituent attributes that characterize an individual and profoundly influence development of his/her behavior and personality. It was, therefore, assumed that enterprise combination, consumption pattern, purchase pattern, and employment patterns of different farm household would be influenced by their various characteristics. Finally socioeconomic aspects of the sample households were examined. These were family size and composition, age distribution. Occupation, level of education, land ownership pattern etc. A brief discussion of these aspects is given below.

Age & Sex Distribution of the Sample Farmers

Age of farmers have an influence on the production and in the better management of the farming system. Some researchers think that older farmers are more experienced and more efficient in resource use. Other researchers comment that younger farmers are eager to adopt improved technology than older.

Table 5.1 Age Distribution of the Respondent

Age Category	NO.	Percent (%)
30-40 Years	8	13.33
41-50 Years	19	31.67
51-60 Years	16	26.67
Above 61 Years	17	28.33
Total	60	100.00

Source: Field survey, 2019

In the present study, all categories of farmers of the study area were classified into different age groups as presented in Table 5.1. It is evident from the table that most of the farmers were middle aged in the study area. The Aus producing farmers were classified into four age groups: up to 30-40 years, 41-50 years, 51-60 years and above 61. Out of the total sample farmers 13.33 percent belonged to the age group of 30-40 years, 31.67 percent belonged to the age group of 41-50 years, 26.67 percent belonged to 51-60 years and 28.33 percent fell into the age group of above 61. This finding imply that majority of the sample farmers were in the most active age group of 41-50 years indicating that they provided more physical efforts for farming. This age group is supposed to have enormous vigor and risk bearing ability. Table 5.2 indicated that about 33.56 percent of total family member were adult male, 33.56 percent were adult female and 32.88 percent of household member were children.

Table 5.2: Sex Ratio of the Household Members by Study Area

Sex	NO.	Percent (%)
Adult Male	49	33.56
Adult Female	49	33.56
Children	48	32.88
Total	146	100.00

Source: Field survey, 2019

Family Type:

In the study area 81.67 percent of family was nuclear family .On the other hand 18.33 percent of family was joint in nature.

Table 5.3: Family type of respondents of the study area

Family Type	NO.	Percent (%)
Nuclear	49	81.67
Joint	11	18.33
Total	60	100.00

Source: Field survey, 2019

Educational Status of the Respondents

Education is generally regarded as an index of social improvement of a community. It plays a critically important role in reducing poverty and inequality, improving health and enabling the use of knowledge. Education means efficiency. Education of farmers helps to increase skill and productivity. Education plays an important role in accelerating the pace of agricultural development and it greatly influences the new technology and scientific knowledge regarding farming. It is evident from table 5.2 that out of 60 sample farmers, 31.67 percent farmers had primary education, 55 percent farmers had completed their secondary level education,11.67 percent farmers had completed their higher secondary education and last of all only 1.67 percent farmers had completed their higher study.

Table 5.4 Educational Status of the Aus Producing Farmers

Level of Education	NO.	Percent (%)
Primary	19	31.67
Secondary	33	55.00
Higher Secondary	7	11.67
Above	1	1.67
Total	60	100.00

Source: Field survey, 2019

Occupational Status of the Aus Producing Farmers

The work in which a man was engaged more or less throughout the year was considered as the occupation of the person. The distribution of principle occupation is fascinating because it varies greatly depending on how much they are involved and what level of income is earned from the present occupation. In the present study, the selected farmers were engaged with various types of occupation along with Aus rice production. It was observed that, as a main source of income, crop production was the principle occupation for Aus farmers. Some of them had opportunity to be engaged in other activities. Occupational status of the sample farmers are shown in the following figure 5.5. It is evident from the figure that 40 percent farmers were involved in crop farming. After that Business was their second most important occupation at

21.67 percent. About 15, 11.67, 8.33 percent of farmers have their occupation as respectively livestock, fisheries and service sector.

Table 5.5: Occupational Status of the Aus Producing Farmers

Occupation	NO.	Percent (%)
Crop farming	24	40.00
Livestock	9	15.00
Fisheries	7	11.67
Business	13	21.67
Services	5	8.33
Others	2	3.33
Total	60	100.00

Source: Field survey, 2019

Size of Land Holdings of the Sample Farmers

In the present study the size of land holdings of the Aus producing farmers are classified into different categories. Size of land holdings includes own land, rented in, rented out, mortgage in, mortgage out as reported by the sample farmers. It is evident from the table 5.6 that 36.73 percent, 20.19 percent, 12.46 percent, and 16.36 percent areas were own land, rented in, rented out and mortgage in area respectively hold by the sample farmers on an average.

Table 5.6: Size of Land Holdings of the Sample Farmers

Types of Land	Average Area (Decimal)	Percent (%) of Area
Own Land	78.61	36.73
Rented In	43.215	20.19
Rented Out	26.67	12.46
Mortgaged In	35	16.36
Mortgaged Out	30.5	14.25
Total	213.995	100.00

Source: Field survey, 2019

Income Distribution of the Respondent

The yearly income of Aus farmers differs from one another. In the present study, the incomes of Aus farmers were categorized as follows: tk.60,000 from 80,000 tk.81,000 to tk.100000 and above tk.100,000. It is evident from the table 5.7 that most of the farmer's yearly income belonged to the category of 60,000 to 80,000. About 56.67 percent of the Aus producing farmers were earned Tk. 60,000 to 80,000 per year, 36.67 percent of the farmers were earned Tk. 81,000 tk.1,00000 per year and 6.67percent farmers were earned Tk. Above 100,000 per year**.**

Table 5.7 : Income distribution of the Respondents

Income Distribution	NO.	Percent (%)
Tk 60,000- Tk 80,000	34	56.67
Tk 81,000- Tk 1,00,000	22	36.67
Above Tk 1,00,000	4	6.67
Total	60	100.00

Source: Field survey, 2019

Concluding Remarks :

This chapter analyzed the socioeconomic attributes of the sample farmers. The findings of analysis clearly indicate the socio economic characteristics from each other in respect of age distribution, family type, education, occupation, size of land holding, occupation, income distribution etc.

CHAPTER 6

PROFITABILITY OF AUS RICE CULTIVATION

Introduction

The main purpose of this chapter is to assess the costs, returns and profitability of growing Aus rice. Profitability is a major criterion to make decision for producing any crop at farm level. It can be measured based on net return, gross margin and ratio of return to total cost. The costs of all items were calculated to identify the total cost of production. The returns from the crops have been estimated based on the value of main products and by-products.

In this chapter, in terms of Aus rice farming per hectare yield, gross return, gross margin, net return and undiscounted benefit-cost ratio are discussed. Therefore, a financial return of producing Aus rice was calculated from the standpoint of farmers. All the returns were accounted for the study period. A brief account showing how the individual costs and returns were estimated in the present study is presented below. For analytical advantages, the cost items were classified under the following heads:

Cost and Return from Aus rice Cultivation

All variable cost incurred for human labor, seed cost, fertilizers, insecticides, and irrigation were considered for calculating the cost of Aus cultivation. The cost of land use calculated on the basis of prevailing local lease value of land.

i. Human labor cost
ii. Seed cost
iii. Fertilizer cost
iv. Power tiller/ mechanical cost
v. Insecticides cost
vi. Land use cost
vii. Interest on operating capital

Interest on Operating Capital

Interest on operating capital was determined on the basis of opportunity cost principle. The operating capital actually represented the investment on different farm operation over the period because all the cost was 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 9 percent per annum interest on operating capital for six months was computed for Aus production (Interest rate was taken according to the bank rate prevailing in the market during the study period). Interest on operating capital was calculated by using the following standard formula.

Interest on Operating Capital (IOC) = Alit

Where,

Al= Total investment /2,

t = Total time period of a cycle

i= interest rate which was 6percent per year during the study period. The interest on operating capital was estimated at Tk. 488.2 constituted 2.42 percent share of total cost.

Variable Costs

Human Labor Cost

Human labor is one of the most important variable inputs in the production process. Human labor is required for various activities and management of the selected farms such as- farm preparation, raising dyke, weeding, sorting, grading, harvesting etc. Human labor was classified into: (a) hired labor and (b) family labor. It is easy to calculate hired labor costs. To determine the cost of family labor, the opportunity cost concept was used. In this study, the opportunity cost of family labor was assumed to be as wage rate per man i.e., the wage rate, which the farmers actually paid to the hired labor for working a man-day. The items include in variable cost are human labor is tk.9706 per hectare which contribute 48.19 percent of total cost.

Cost of seed:

Among the respondents two types of seed are observed. a. Own seed b. Hired seed. So price of seed is different for seeds. Seed cost is tk.1310 which contributes 6.50 percent of total cost.

Cost of Fertilizer:

Fertilizer is an important input for Aus rice cultivation. Farmers applied fertilizer such as Urea, TSP MP, Gypsum and Zinc. Uses of these fertilizers influence in increasing the growth of rice. The cost of fertilizer is estimated by using the prevailing market rate which was actually paid by the farmers. Total cost contribution of fertilizer is tk.2151 which contributes 10.6 percent of total cost.

Cost of Insecticide:

The cost of insecticides is tk.1009 which contributes 5.01 percent of total cost.

Cost of Power tiller:

Power tiller cost is tk. 2068 which contribute 10.27 percent of total cost.

Fixed cost

Fixed cost is also an important part for economic analysis. Here land use cost is tk. 2670 per hectare which contributes 13.25 percent of total cost. Interest on capital is tk.1230 per hectare which contributes 6.10 percent of total cost (Table 6.1).Total fixed cost is tk. 3990 per hectare which contributes 19.36 percent of total cost.

Total cost

Total cost is calculated on the basis of variable cost and fixed cost. Total variable cost is tk. 16243 per hectare and total fixed cost is tk. 3990 per hectare. So the total cost is tk.20143 per hectare (Table 6.1).

Table 6.1 : Cost and Return of Aus Cultivation in Study Area

Items	**Amount (Acre/ha)**	**Percentage (%)**
a. Variable cost		
Human labor	9706	48.19
Seed	1310	6.50
Fertilizers	2151	10.6
Insecticides	1009	5.01
Power tiller	2068	10.27
Total variable cost	**16243**	**80.63**
b. Fixed cost		
Land use cost	3411.8	16.93
Interest on operating capital	488.19	2.42
Total fixed cost	**3900**	**19.36**
c. Total cost	**20143**	**100**

Source: Field survey, 2019.

Gross return

Gross return is calculated on the multiplication of yield per hectare and price of Aus rice. The yield of rice per hectare is 1505 kg and price of kg per hectare is tk.15 so the gross return is tk.24087 by adding the straw price per hectare (Table 6.2)

Gross Margin

Gross margin is calculated by the subtraction from gross return to variable cost. Gross return is tk.24087 and the variable cost is 16243 tk. in per hectare. So the gross margin is tk. 7844 (Table 6.2)

Net return

Net return is calculated by the subtraction from gross return to total cost. Gross return is tk. 24087 and total cost is tk. 20143.So the net return is tk. 3040.

Table 6.2: Profitability of Aus cultivation in the study areas

Items	**Amount (Taka)/Ha**
A. Total cost	20143
Variable cost	16243
Fixed Cost	3900
B. Gross return	24087
C. Net Return (GR-TC)	3040
D. Gross Margin(GR-TVC)	7844
E. Rate of return(BCR)	
BCR on full cost	1.2
BCR on variable cost	1.5

Source: Field survey, 2019.

Benefit cost ratio (undiscounted)

Benefit cost ratio is calculated from the table 6.3 by the division of gross return and total cost on the full cost basis. Gross return is tk.24087 and total cost is tk.20143 per hectare. So the Benefit cost ratio (BCR) on full cost basis is 1.2. Here variable cost is tk.16243 per hectare. So the benefit cost ratio on variable cost basis is 1.5 (Table 6.2)

Concluding Remarks

From the results we can say that per hectare total variable cost for Aus rice farming is more than per hectare total fixed costs. Farmers finally find that gross return of Aus rice farming is moderate. So, farmers can increase their income by cultivating Aus rice in their area.

CHAPTER 7

RESOURCE USE EFFICIENCY OF AUS RICE GROWERS

Introduction

An attempt has been made this chapter to identify and measure the effects of the major variables on Aus rice and the resource use efficiency of Aus rice growers. Cobb-Douglas production function was chosen to estimate the contribution of key variables on the production process of rice farming. The estimated values of the model are presented in Table 7.1.

Functional Analysis for Measuring Production Efficiency

Production function is a relation or a mathematical function specifying the maximum output that can be produced with given inputs for a given level of technology. Keeping in mind the objectives of the study and considering the effect of explanatory variables on output of Aus farming, six explanatory variables were chosen to estimate the quantitative effect of inputs on output.

Management factor was not included in the model because specification and measurement of management factor is almost impossible particularly in the present study, where a farm operator is both a labor and manager. Other independent variables like water quality, soil condition, time etc., which might have affected production of farm enterprises, were excluded from the model on the basis of some preliminary estimation. A brief description is presented here about the explanatory variables included in the model.

Estimated Values of the Production Function Analysis

i. F-value was used to measure the goodness of fit for different types of inputs. The coefficient of multiple determinations (R^2) indicates the total variations of output explained by the independent variables included in the model.

ii. Coefficients having sufficient degrees of freedom were tested for significance level at 1percent, 5 percent and 10 percent levels of significant.

iii. Stage of production was estimated by returns to scale which was the summation of all the

production elasticity of various inputs. The estimated coefficients and related statistics of the Cobb-Douglas production function for Aus production are shown in Table 7.1.

Table 7.1: Estimated coefficients and their Related Statistics of Production Function of Aus rice cultivation.

Explanatory Variable	**Coefficient**	**Standard Error**	**P-value**
Intercept	2.33***	0.37	0.000
Human labor(x_1)	0.15*	0.08	0.058
Seed(x_2)	0.327***	0.02	0.000
Fertilizer(x_3)	0.460***	0.011	0.000
Power tiller(x_4)	-0.017	0.03	0.589
Insecticides(x_5)	.074	0.09	0.454
R-squared			0.97
F-value			373.82

Source: Field survey, 2019

Note: *** Significant at 1 percent level;

** Significant at 5 percent level;

* Significant at 10 percent level; and

NS: Not Significant

Factors Affecting the Yield of Aus rice

Here an attempt has been made to identify and measure the effects of different factors on yield of Aus rice in the framework of production function analysis. Five explanatory variables were taken into consideration for production function analysis. The effects of each of the variables on the yield of Aus are interpreted below.

Effect of Human labor (X_1):

From the table it can be seen that the value of the coefficient was positive and significant at 10 percent level of significance. One percent level of significant indicates that the 1 percent increase in the cost of human labor keeping others factor remaining constant would increase the return of Aus rice by 0.15 percent.

Effect of seed(X_2):

From the table the value of coefficient of seed was positive and significant at 1 percent level of significance. One percent level of significant indicates that the 1 percent increase in the cost of seed keeping others factor remaining constant would increase the return of Aus rice by 0.37 percent.

Effect of fertilizer (X_3):

It was observed from the regression that the coefficient of the use of urea was positive and significant at 1 percent level of significance. One percent level of significant indicates that the 1 percent increase in the cost of urea keeping others factor remaining constant would increase the return of Aus rice by 0.46 percent.

Effect of power tiller (X_4):

It was observed from the regression that the coefficient of the power tiller was negative and insignificant. One percent level of significant indicates that the one percent increase in the cost of power tiller keeping others factor remaining constant would decrease the return of Aus by 0.017 percent.

Effect of insecticides (X_5):

From the table it can be seen that the value of the coefficient was positive and insignificant. The higher cost of insecticides keeping others factor remaining constant would decrease the return of Aus by 0.074 percent.

Value of R square

The multiple co-efficient of determination (R^2) is a summary measure which tells how the sample regression line fits with the data (Gujarati, 1995). In this table the value of R^2 was 0.97 that means the variables considered in the models can explain 97 percent of the variation in yield explained by independent variables include in the model.

Value of F

In the table the F value was found 373 which is significant at one percent level implying that the explanatory variables included in the model were important for explaining the variation in gross return of Aus rice production the variation of yield mainly depends on the explanatory variables include in the model.

Resource Use Efficiency in Aus rice Production

In order to identify the status of resource use efficiency, it was considered that a ratio equal to unity indicated the optimum use of that factor, a ratio more than unity indicated that the yield could be increased by using more of the resources. A value of less than unity indicated the unprofitable level of resource use, which should be decreased to minimize the losses because farmers over used this variable. The negative value of MVP indicates the indiscriminate and inefficient use of resource.

The ratio of MVP and MFC of human labor (.37) for Aus production was positive and less than one, which indicated that in the study area human labor was over used (Table 7.2). So, farmers should decrease the use of human labor to attain efficiency considerably.

Table 7.2 showed that the ratio of MVP and MFC of seed (5.88) for Aus production was positive and more than one, which indicated that in the study area seed for Aus production was under used. So, farmers should increase the use of seed to attain efficiency level.

The ratio of MVP and MFC of fertilizer was found to be 5.15 for Aus production was positive and more than one, which indicated that in the study area use of fertilizer for Aus production was, underused (Table 7.2). So, farmers should increase the use of fertilize for Aus production to attain efficiency considerably.

Table 7.2 revealed that the ratios of MVP and MFC of power tiller used for Aus production were negative and less than one (-0.12), which indicated that power tiller involves the indiscriminate and inefficient use of resource. So, farmers should decrease the use of power tiller to attain efficiency in Aus production.

It was evident from the table 7.3 that the ratio of MVP and MFC of insecticides (1.67) for Aus production was positive and more than one, which indicated that in the study area use of insecticides for Aus production was under used. So, farmers should increase the use of insecticides to attain efficiency in Aus production.

Table 7.2: Estimated Resource Use Efficiency in Aus Production

Variable	GM	MVP	MFC	MVP/MFC	Comment
Human labor	9706	0.37	1	0.37	Overused
Seed	1310	5.88	1	5.88	Underused
Fertilizer	2151	5.15	1	5.15	Underused
Power tiller	2068	-0.12	1	-0.12	Inefficient
Insecticides	1009	1.67	1	1.67	Underutilized

Source: Field survey, 2019

Concluding Remarks

It is evident from the Cobb-Douglas production function model, that the included key variables had significant and positive effect on Aus production except the negative and insignificant effect of power tiller and insecticides. Resource use efficiency indicated that in case of seed, fertilizer and insecticides; the resources were under used for Aus rice production. In case of human labor the resources are over utilized and power tiller use bring the inefficiency of Aus rice cultivation. So there is a positive effect of key factors in the production process of year round Aus rice cultivation.

CHAPTER 8

CONSTRAINTS OF AUS RICE GROWERS

Introduction:

Bangladeshi farmers basically grow three rice categories including Aus, Aman and Boro. Almost most of the region of Bangladesh grows Boro and Aman. But limited people choose Aus cultivation for its moderate returns. Farmers face some problem in cultivating Aus rice in their area. Problems are given follow:

Heavy rainfall

The climate and weather pattern of the study area of our country is changing day by day. Heavy rainfall is one of an effect of climate change, it vastly and negatively affect the Aus production and yield. Farmer loss their yield than their desired level. Table 8.1 shows that almost 60 percent Aus growers in Laksham and Nangolkot reported this as severe problem.

Extreme temperature

Nowadays climate change is a matter of discussion. Weather pattern is changing day by day. So the growing of crop yield is disturbed by the unusual nature of environment. Sometimes it seems acute head, acute cold, sometimes it seems overflow of river water. This changing temperature hampers the Aus cultivation. Extreme temperature in the study area of Laksham and Nangolkot seems the highest prior problem for the Aus growers in that region. About 58 percent farmer faces this problem nowadays.

High Price of Inputs

Inputs like seeds, fertilizers, insecticides, etc. at fair price was a problem in the way of producing enterprises. During the production period price of some inputs tend to rise due to their scarcity. It appears from Table 8.1 that 53.3 percent Aus growers reported that they had to purchase some inputs at a high price during the production period.

Lack of Quality Seed

Lack of quality seed was one of the most important limitations Aus rice in the study area. From Table 8.1 it is evident that about 53.3 percent Aus growers reported this problem. Farmers told that they were cheated by buying so called hybrid seeds from the local markets and from the seed dealers.

Shortage of labor in pick period

Shortage of labor is a big issue in case of agriculture production. Large number of people migrates from rural area to urban area because of better livelihood opportunity. They are attracted by different garment factory and much other industry for higher wage benefit. So during the time of production and harvesting, the labor becomes short for Aus production. In the study area about 50 percent of farmer faces this problem repeatedly.

High wage rate

In recent time the problem of high labor cost is a big issue for rice growers in Bangladesh. From production to harvest, farmer bears the burden of high labor cost. Almost each and every household claim about this problem. It can be seen in table 8.1 that 43.3 % Aus grower reported this problem

Table 8.1: Problems and Constraints of Aus rice Production by no. of Farmers

Name of the problem	Number	Percent	Rank
Heavy rainfall	36	60	1
Extreme temperature	35	58.3	2
High input price	32	53.3	3
Shortage of quality seed	32	53.3	4
Shortage of labor in pick period	30	50	5
High wage rate	26	43.3	6
Lack of capital	23	38.3	7

Lack of capital

The farmers of the study area had capital constraints. For cultivation of Aus, a huge amount of cash money was needed to purchase various inputs like, human labour, seed, fertilizers, insecticides, etc. In the study area 38.3 percent farmers reported that they did not have sufficient amount of money for purchasing the required quantity of inputs for the relevant enterprises (Table 8.1).

CHAPTER 9

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

Summary

Rice is the most important and fundamental food crop in Bangladesh. It dominates the crop sector of Bangladesh agriculture approximately more than 73 % of total cropped area and is treated as principal food to the people of Bangladesh. Aus is one of the major crops in Bangladesh. It has been contributing to food production in addition to other two rice (Aman and Boro) crops. The weather condition for Aus cultivation was favorable in this year but due to lower productivity as compared to two other rice crop Aman and Boro , farmers are reluctant to produce Aus.

Objectives of the Study

- To study the socio-demographic profile of Aus rice producer in cumilla district.
- To assess cost and returns of Aus rice production.
- To analyze the resource use efficiency of the inputs used by the farmers.
- To identify the problems associated with the production unit of Aus rice production and provides some policy recommendations to overcome the problems.

The study was mainly based on primary data, which were collected by the researcher himself through interviewing the sample farmers. A total of 60 year round Aus farmers were selected from Nangalkot & Laksham the most important area for Aus rice cultivation. Two upazila Cumilla District were selected purposively as study area. From these two upazila of Cumilla District, six villages named at Patwar, Hesakhal, Sakuntala, Horipur. Krisnopur, Naoti were selected purposively as study area.. Purposive and multi-stage sampling techniques were taken into consideration. Survey method was followed to collect production related data while, simple random sampling technique was used to select the shrimp farmers. Tabular as well as statistical technique was followed to fulfill the objectives of the study**.** Data was collected July to August

2019. Besides, a descriptive tool and technique tabulation was also used in the study. Primary data were recorded into Microsoft excel and economic analysis was carried out to STATA for determining factor affecting Aus rice growers. In this study, cost and return analysis were done on both variable and total cost basis. To achieve the objective of the study a simple tabular analysis was completed. In this study, a statistical tool and technique both descriptive and inferential was used to analyze the data specially analysis the Cob-Douglas production function.

With respect to socioeconomic features of the sample farmers, the findings revealed that none of the farmers had the age below 30 years. The shrimp producing farmers were classified into three age groups: up to 30-40 years, 41-45 years, 51-60 years and above 61. Out of the total sample farmers 13.33 percent belonged to the age group of 30-40 years, 31.67 percent belonged to the age group of 41-50 years, 26.67 percent belonged to 51-60 years and 28.33 percent fell into the age group of above 61.About 33.56 percent of total family member were adult male ,33.56 percent were adult female and 32.88 percent of household member were children .In the study area 81.67 percent of family was nuclear family .On the other hand 18.33 percent of family was joint in nature which is almost similar to national data.

Out of 60 sample farmers, 31.67 percent farmers had primary education, 55 percent farmers had completed their secondary level education,11.67 percent farmers had completed their higher secondary education and last of all only 1.67 percent farmers had completed their higher study.

The main occupation of the majority of the sample farmers was crop farming, about40 percent farmers were involved in crop farming as a main and subsidiary occupation. After that Business was their second most important occupation at 21.67 percent. About 15, 11.67, 8.33 percent of farmers have their occupation as respectively livestock, fisheries and service sector. In the study area it is found that 36.73 percent, 20.19 percent, 12.46 percent, and 16.36 percent areas were own land, rented in, rented out and mortgage in area respectively hold by the sample farmers on an average. The incomes of Aus farmers were categorized as follows: tk.60,000, from tk.80,000, tk.81000 to tk.100000and above tk.100,000. It is evident from the table 5.7 that most of the farmer's yearly income belonged to the category of tk.60,000 to tk. 80,000. About 56.67 percent of the Aus producing farmers were earned. Tk.60,000 to tk.80,000 per year, 36.67 percent of the

farmers were earned tk.81,000 to tk.1,00000 per year and 6.67percent farmers were earned Tk. Above tk.100,000 per year**.**

To determine the profitability of Aus cultivation both the inputs and outputs were valued at market price during the study period. For analytical advantages, the cost item were identified as human labor, seed ,fertilizer, power tiller insecticides, land use cost, and interest on operating capital. Cost and returns were worked out to estimate profitability of Aus production. The yield of rice per hectare is 1505 kg and price of kg per hectare is tk.15 so the gross return is tk.24087 by adding the straw price per hectare. Gross margin is calculated by the subtraction from gross return to variable cost. Gross return is tk.24087 and the variable cost is 16243 tk. in per hectare. So the gross margin is tk. 7844. Net return is calculated by the subtraction from gross return to total cost. Gross return is tk. 24087 and total cost is tk. 20143.So the net return is tk. 3040.Benefit cost ratio (BCR) on full cost basis is 1.2. Here variable cost is tk.16243 per hectare. So the benefit cost ratio on variable cost basis is 1.5.

In this study, Cobb-Douglas production function model was used to determine the effects of key variable cost. It was observed that cost of seed, fertilizer and human labor significant at 1%, 1% and 5 % level and the other cost like power tiller and insecticides were insignificant. The value of R^2 was 0.97 that means the variables considered in the models can explain 97 percent of the variation in yield explained by independent variables include in the model. The F value was found 373 which is significant at one percent level implying that the explanatory variables included in the model were important for explaining the variation in gross return of Aus rice production the variation of yield mainly depends on the explanatory variables include in the model.

In case of resource use efficiency the ratio of MVP and MFC of human labor (.37) for Aus production was positive and less than one, which indicated that in the study area human labor was over used So, farmers should decrease the use of human labor to attain efficiency considerably. The ratio of MVP and MFC of seed (5.88) for Aus production was positive and more than one, which indicated that in the study area seed for Aus production was under used. So, farmers should increase the use of seed to attain efficiency level. The ratio of MVP and MFC of fertilizer was found to be 5.15 for Aus production was positive and more than one, which indicated that in the study area use of fertilizer for Aus production was underused. So, farmers should increase the use of fertilize for Aus production to attain efficiency considerably.

The ratios of MVP and MFC of power tiller used for Aus production were negative and less than one (-0.12), which indicated that power tiller involves the indiscriminate and inefficient use of resource. So, farmers should decrease the use of power tiller to attain efficiency in Aus production. It was evident that the ratio of MVP and MFC of insecticides (1.67) for Aus production was positive and more than one, which indicated that in the study area use of insecticides for Aus production was under used. So, farmers should increase the use of insecticides to attain efficiency in Aus production.

This study also identified some of the problems and constraints associated with Aus rice farming. Farmer faces several types of problem from production period to harvesting period Heavy rainfall, extreme temperature, lack of capital, high input price, shortage of quality seed, shortage of labor in pick period ,high wage rate and lack of capital are some acute problem that the farmer faces most.

Conclusion and Policy Recommendations

It is evident from the Cobb-Douglas production function model, that the included key variables had significant and positive effect on Aus production except the negative and insignificant effect of power tiller and insecticides. Resource use efficiency indicated that in case of seed, fertilizer and insecticides; the resources were under used for Aus rice production. In case of human labor the resources are over utilized and power tiller use bring the inefficiency of Aus rice cultivation. So there is a positive effect of key factors in the production process of year round Aus cultivation. And by profitability analysis we find the Aus cultivation as a profitable business for farmer. So it has a great potential in future profit margin of the farmer. There is an ample opportunity to improve per hectare yield of year round Aus production. To enhance the productivity, efficiency and effectiveness of Aus rice farming, the following recommendations are made as a part of present study which acts as a formulating strategy for enhancing Aus production in Cumilla district.

Recommendations

On the basis of the finding of the study it was evident that Aus was profitable enterprises and they can generate income earnings and employment opportunity to the rural people of Bangladesh. But some problems and constraints bared to attain the above mentioned objectives.

The policy makers should, therefore, take necessary measures. According to the findings of the study; some policy recommendations may be advanced which are likely to be useful for policy formulation. On the basis of the findings of the study, the following specific recommendation may be made for the development of Aus sector.

I. Fertilizer price should be low. In some cases subsidy is necessary, so should focus on fertilizer subsidy to the Aus cultivars.
II. If seeds of improved Aus variety and production technology can be made available to the farmers, yield of improved Aus can be increased which may help to increase farmers' income as well as nutritional status.
III. Adequate training on recommended fertilizer dose, insecticides, use of good seed, intercultural operations, etc., should be provided to the Aus farmers which will enhance production as well as technical efficiency by improving the technical knowledge of the farmers.
IV. Education and scientific knowledge about farming can increase Aus rice production.

Scope for Further Study

Although the present study is intended to provide some valuable information for the guidance of farmers, extension workers, policy makers as well as researchers, it is not free from criticisms. Due to limitation of time and resources this study could not cover some important areas. The weaknesses of the present study, of course, open avenues for further research which are given below:

a) A broad based study in this line may be undertaken for better understanding not only to study relative profitability of Aus but also with other crops.

b) A further study can be undertaken by taking into account different farm sizes to assess the impact of profitability of Aus on income and employment opportunity.

c) Acreage response, growth and instability of Aus can be studied with respect to Bangladesh.

REFERENCE

Afroz, S., and Islam, M.S. (2012). Economics of Aus Rice (Oryza sativa)and Jute (Corchorus olitorius) Cultivation in Some Selected Areas of Narsingdi District of Bangladesh.A Scientific Journal of Krishi Foundation.*The Agriculturists* **10**(2): 90-97.

Akter, T., Parvin, M.T., and Mila, F.A. (2019). Factors determining the profitability of rice farming in Bangladesh.*Journal of Bangladesh Agricultural University*. **17**(1): 86–91.

Bari, L., and Ahmed, S., (2018). Performance of Aus rice in different tillage systems and crop establishment method in Southwest Bangladesh *Journal of Experimental Sciences*, **l9**(1): 05-08.

Baset, M.A., Karim, M.R., Akter, M. (2009). Measurement and Analysis of Total Factor Productivity Growth in Modern Variety Potato. *J Agric Rural Dev* **7**(1&2): 65-71.

BBS (2018).*Statistical Yearbook of Bangladesh*, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic Bangladesh, Dhaka.

BBS (2017).*Statistical Yearbook of Bangladesh*, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic Bangladesh, Dhaka.

BBS (2011).*Statistical Yearbook of Bangladesh*, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic Bangladesh, Dhaka.

BBS (2014a).*Statistical Pocketbook of Bangladesh*, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic Bangladesh, Dhaka.

BER (2016).*Bangladesh Economic Review,* Department of Finance, Ministry of Finance, Government of the People's Republic of Bangladesh, Dhaka.

BER (2017).*Bangladesh Economic Review,* Department of Finance, Ministry of Finance, Government of the People's Republic of Bangladesh, Dhaka.

BER (2018).*Bangladesh Economic Review*, Department of Finance, Ministry of Finance, Government of the People's Republic of Bangladesh, Dhaka.

Deb, U. (2016). Agricultural Transformation in Bangladesh: Extent, Drivers and Implications.

Gujarati, D.N. (1995). Basic Econometrics (3rd Ed.) Journal of Finance and Finace and Economics..**2**(6): 210-214.

Hosssain, M. H., Bhowal S. K. and Bashir M. M. (2018)**.** On Productivity and Profitability of Four Crops Based Cropping Pattern in Cumilla Region of Bangladesh. *The Agriculturists.* **16**(2): 88-92.

Islam, M.S., Hossain, A.B.M., and Miah, M.S. (2017) .Evaluation of Aus Rice (Oryza sativa L.)Production in Less Irrigated Situation in Northern Region of Bangladesh. *The Agriculturists* **15**(1):110-115.

Kandel, G., Adhikari B.B and Adhikari, R. (2019).Evaluation the growth, productivity and profitability of rice (Sukhadhan-3 variety) under different methods of weed management.*Journal of Research in Weed Science*. **2**(4): 282-392.

Kumar, A., and Jain, R. (2013). Growth and Instability in Agricultural Productivity: A District Level Analysis. *Agricultural Economics Research Review.* **26**(3&4): 31-42.

Lucky, R.Y., Kabir, J. and Rabbani, G. (2018). An Agronomic and Profitability Study on Rice Production: A Case of Jalgaon Village of Comilla District, Bangladesh. *International Journal of Agricultural Economics.* **3**(1): 14-22.

Nayak, A., Biswal, S. and Pradhan P.P. (2019). Productivity and profitability of summer paddy under different establishment method and irrigation management.*International Journal of Chemical Studies.* **7**(3).

Rahman, N.M.F., Hasan, M.M. and Hossain, M.I. (2016)**.**Forecasting Aus Rice Area and Production in Bangladesh using Box-Jenkins Approach. *Bangladesh Rice J.* **20**(1): 1-10.

Rahman, M.S. and Forman, M.S.H. (2012). A comparative financial analysis of Aus and jute production in some selected areas of Mymensinghdistrict.Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh 2202, *Bangladesh. Journal of Science and Technology*. PP:12-16

Rahman; (2003). Economics of Aus Rice (Oryza sativa) and Jute (Corchorus olitorius) Cultivation in Some Selected Areas of Narsingdi District of Bangladesh. A Scientific Journal of Krishi Foundation.*The Agriculturists* **10**(2): 90-97.

Uddin, M.T., and Dhar, A.R. (2018). Government input support on Aus rice production in Bangladesh: impact on farmers' food security and poverty situation. Agriculture & Food Security.7:14

https://doi.org/10.1186/s40066-018-0167-3.

Department of Agricultural Economics

Sher-e-Bangla Agricultural University

An Interview Schedule on

Profitability and Resource use efficiency of Aus Rice Cultivation in some selected areas Of Cumilla District in Bangladesh

Sample No……..

1 .Identification of the farmer:

Name: ……Gender:……

Father's Name: ……..

Age ……Years

Education: Primary / secondary / Higher secondary and above

Village …….. Thana ……

2. Farming Experiences:

How long you have involved in farming…….Years

3. Family type: nuclear family/ joint family

4. Family size:
What is the number of your family members included yourself?

Total members……. **Adult Male**……..

Adult Female…… **Children (<12yrs)**……

Effective labor …… **Permanent Labor** ……..

5. Educational status of the family:

Members	Number	Educational qualification		
		Primary	Secondary	Higher secondary & above
Infant(0-6)				
Male				
Female				

6. Farm size:

Please indicate the area of your land in your possession

Types of land	Area (acres)
a. Own Cultivated Land	
b. Rented In	
c. Rented Out	
d. Mortgaged In	
e. Mortgaged Out	
Total=(a+b+d-c-e)	

7. Farmers Occupational sources:

Please mention your annual income according to occupational source

Occupation		Amount(Taka)
Agriculture	Crops	
	Livestock	
	Fisheries	
	Forestry	
Non agriculture	Business	
	Service	
	Others	

8. Crop Management Information:

Please answer the following questions regarding Agricultural Practice

Management practices	Aus rice varieties
Amount of land	
Land type	
Soil type	
Seed rate	
Date of seed bed preparation	
Date of seedling transplantation	
Date of fertilizer application	
Date of weeding	
Date of irrigation	
Drainage facilities of land	
Source of seeds	
Row to row distance	
Plant to plant distance	
Date of Harvesting	
Source of Agricultural Information	

9. Human Labor Requirement (man/day):

Please mention of your Human Labor requirement

Name of items	Aus 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				

10. Cost of animal or mechanical powers used:

Please mention your cost of animal or mechanical powers used

Name of practices	Aus rice			
	Name of Machine/ Animal	No. of machine/ animal	Rent per machine/animal (Taka)	Total (Tk)
Tillage				
Weeding				
Spraying				
Threshing				
Total				

11. Materials inputs used:

Please mention about material input used

Inputs	Unit Price	Aus rice	
		Amount (kg)	Taka
Seed			
Manure			
Fertilizer			
a. Urea			
b. TSP			
c. MP			
d. Gypsum			
e. Zinc			
Pesticide			
Irrigation			
Others			
Total			

12. Amount of rice production and disposal:

Please mention about rice production and disposal

Rice variety	Total Production (monds)	Unit Price (Tk)	Total taka	Straw production	Unit price (Tk)	Total Taka	Grand Total Taka
1	2	3	4	5	6	7	(4+7)
Aus rice							

13. Do you get contact with NGO Workers? **Yes** **No**

If Yes frequency of contact: ……

14. Source of Agriculture related information:

A. Radio B. TV C. NGO Workers D. Extension Workers

E. Neighbors F. Local Elite G. Own

15. Please mention the problems faced by you in rice cultivation:

a)……..

b)……..

c)……..

d)……..

e)……..

16. 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**