

**PROFITABILITY AND RESOURCE USE EFFICIENCY OF
MUSTARD CULTIVATION IN THE SELECTED AREAS OF
TANGAIL DISTRICT IN BANGLADESH**

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MUSTARD CULTIVATION IN THE SELECTED AREAS OF
TANGAIL DISTRICT IN BANGLADESH**

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A Thesis

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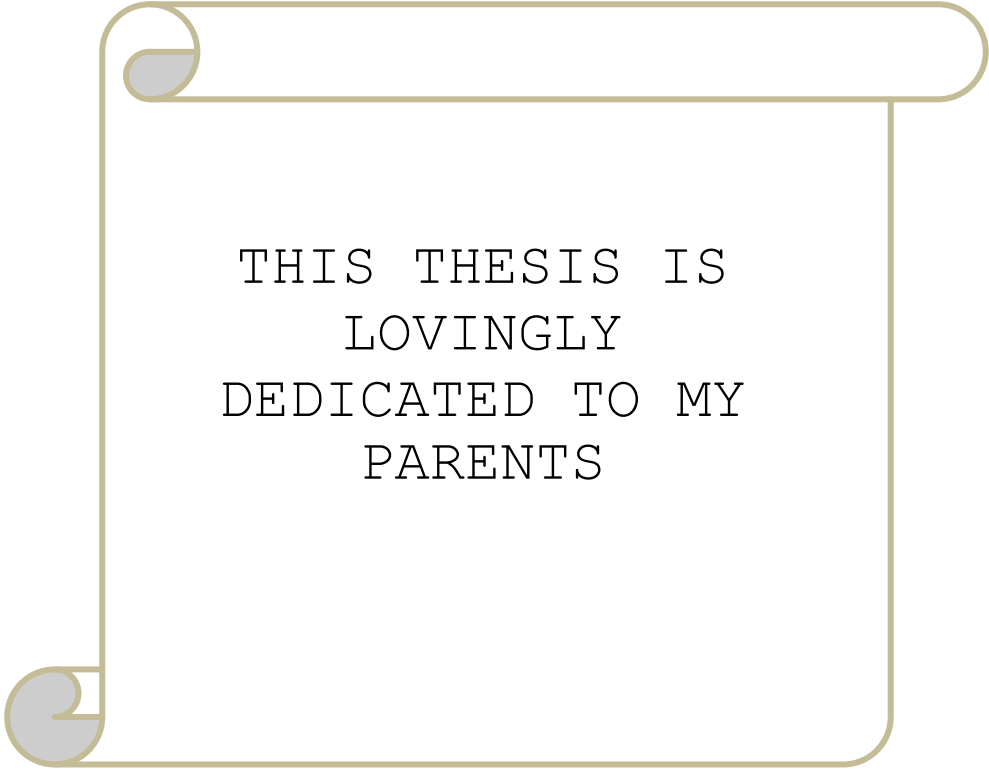
CERTIFICATE

This is to certify that the thesis entitled “**PROFITABILITY AND RESOURCE USE EFFICIENCY OF MUSTARD CULTIVATION IN THE SELECTED AREAS OF TANGAIL DISTRICT IN BANGLADESH**” submitted to the Department of Agribusiness & Marketing, Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka in partial fulfilment of the requirements for the degree of **Master of Science (MS) in Agribusiness & Marketing**, embodies the result of a piece of bona fide research work carried out by Mir Miad Uddin, **Registration No. 12-05151** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated: December, 2019
Dhaka, Bangladesh

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THIS THESIS IS
LOVINGLY
DEDICATED TO MY
PARENTS

PROFITABILITY AND RESOURCE USE EFFICIENCY OF MUSTARD CULTIVATION IN THE SELECTED AREAS OF TANGAIL DISTRICT IN BANGLADESH

ABSTRACT

The objectives of this study were to document the demographical profile of Mustard farmers in Tangail district; to determine the financial profitability of Mustard production in the study area; to determine the resource use efficiency of Mustard cultivation and to find out the major constrains of Mustard cultivation at farm level and suggest some policy guide line. The study was conducted in two villages of Durgapur union under Kalihati upazila of Tangail district. Data were collected by using interview schedule from the randomly selected 70 respondents during 1st August to 30th August, 2019. After analyzing the data, total cost of production was Tk. 47848, Tk. 57082 and Tk. 64519 for marginal, small and medium mustard production respectively. Per hectare gross return was Tk. 70359, Tk. 75264 and Tk. 75934 for marginal, small and medium mustard production, respectively. Per hectare gross margin was Tk. 44760, Tk. 42804 and Tk. 34678 for marginal, small and medium mustard production, respectively. Net return was calculated by deducting gross cost from gross return and these were Tk. 22511, Tk. 18182 and Tk. 11415 for marginal, small and medium mustard production, respectively. Benefit cost ratio was 1.47, 1.32 and 1.18 for marginal, small and medium mustard production, respectively. From Cobb-Douglas production function analysis, it was observed that the coefficients of land preparation cost, seed cost, irrigation cost, MoP cost and pesticides cost were significant at different level of probability for marginal, small and medium mustard production, respectively and the coefficients of urea cost and TSP used was not significant while the coefficients of human labor was negative and insignificant for marginal, small and medium mustard production, respectively. Resource use efficiency indicated that all of the resources were under used for mustard production except overutilization of human labor cost, urea and TSP cost. So there is a positive effect of key factors in the production process of mustard production. This study also identified some of the problems and constraints associated with mustard production. The findings revealed that disease attack was most severe problem followed by high price of fertilizers and climate change was last obstacle of mustard production in the study area. Supply good quality of seed was the first suggestion to overcome the problem.

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December, 2019

The Researcher

LIST OF CONTENTS

CHAPTER	TITLE	PAGE
	ABSTRACT	i
	ACKNOWLEDGEMENT	ii
	LIST OF CONTENTS	iii-v
	LIST OF TABLES	vi
	LIST OF FIGURES	vi
	LIST OF APPENDICES	vi
	ABBREVIATIONS	vii
CHAPTER I	INTRODUCTION	1-5
1.1	Background of the Study	1
1.2	Worldwide importance of Mustard among the oil crops	1
1.3	Mustard Cultivation Areas of Bangladesh	2
1.4	Justification of the Study	3
1.5	Specific objectives of the study	4
1.6	Limitation of the Study	5
1.7	Organization of the thesis	5
CHAPTER II	REVIEW OF LITERATURE	6-12
CHAPTER III	METHODOLOGY	13-23
3.1	Introduction	13
3.2	Methods of Data Collection and Data Collecting Instruments	13
3.3	Selection of the Study Area	13
3.4	Selection of Sample and Sampling Technique	16
3.5	Preparation of questionnaires	16
3.6	Data Collection and processing	16
3.7	Analytical Technique	17
3.7.1	Procedure for computation of Cost and revenue	17
3.7.2	Cost of human labor	17
3.7.3	Cost of power tillers	18
3.7.4	Seed cost	18
3.7.5	Cost of fertilizers	18
3.7.6	Cost of irrigation	18
3.7.7	Interest on operating capital	19
3.7.8	Land use cost	19
3.7.9	Total variable cost	19
3.7.10	Total Fixed cost	20
3.7.11	Total cost	20
3.7.12	Margins of farmer	20
3.7.13	Net farm income farmers	20
3.7.14	Cobb-Douglas production function	20
3.7.15	Undiscounted Benefit Cost Ratio (BCR)	21
3.8	Measurement of Resource Use Efficiency	21
3.9	Problems Faced in Collecting Data	22

CHAPTER IV	SOCIOECONOMIC CHARACTERISTICS OF THE MUSTARD FARMERS	24-29
4.1	Age	24
4.2	Education	24
4.3	Occupation	25
4.4	Experience in mustard cultivation	26
4.5	Social membership	27
4.6	Family size	27
4.7	Annual family income	28
4.8	Land under mustard cultivation	28
CHAPTER V	PROFITABILITY OF MUSTARD CULTIVATION	30-34
5.1	Introduction	30
5.2	Cost of power tillers	30
5.3	Seed cost	30
5.4	Labor cost	30
5.5	Cost of fertilizers	30
5.6	Cost of pesticides	31
5.7	Cost of irrigation	31
5.8	Total Variable Cost	32
5.9	Total Production Cost	32
5.10	Interest on operating capital	32
5.11	Land use cost	32
5.12	Total Fixed Cost	32
5.13	Profitability of mustard cultivation	32
5.14	Production of mustard in the study area	33
5.15	Total revenue	33
5.16	Gross farm income	33
5.17	Net farm income	33
5.18	Benefit cost ratio (BCR)	34
5.19	Concluding Remarks	34
CHAPTER VI	FACTORS AFFECTING AND RESOURCE USE EFFICIENCY OF MUSTARD CULTIVATION	35-39
6.1	Introduction	35
6.2	Factor affecting of mustard production	35
6.3	Resource use efficiency of mustard production	37
6.4	Concluding Remarks	39
CHAPTER VII	PROBLEM FACED BY THE FARMERS IN MUSTARD PRODUCTION	41-48
7.1	Introduction	41
7.2	Problems faced by the farmers	41
7.2.1	Disease attack	41
7.2.2	High price of fertilizer	41
7.2.3	Low price of mustard	42
7.2.4	Lack of storage facilities	42
7.2.5	Lack of quality seed	42
7.2.6	Lack of credit facility	42
7.2.7	High transportation cost	43

7.2.8	Unavailability of fertilizer	43
7.2.9	Lack of irrigation facility	43
7.2.10	Lack of pesticide	43
7.2.11	Lack of adequate transportation facilities	43
7.2.12	High price of pesticides	44
7.2.13	Lack of family labor	44
7.2.14	Natural Calamities	45
7.2.15	Climate change	45
7.3	Farmer's suggestions to solve their problem	45
7.3.1	Supply good quality of seed	45
7.3.2	Required fertilizer at reasonable prize	45
7.3.3	Need credit facilities	45
7.3.4	Development of market facilities	46
7.3.5	Reduce the cost of pesticides	46
7.3.6	Training required for farmer	46
7.3.7	Reduce transportation cost	46
7.3.8	Need agricultural equipment	47
7.3.9	Improvement transport facilities	47
7.3.10	Improve irrigation facilities	47
7.3.11	Develop storage facility	48
CHAPTER VIII	SUMMARY, CONCLUSION AND RECOMMENDATION	49-53
8.1	Summary of the Study	49
8.2	Conclusion and Policy Recommendations	52
	REFERENCES	54-58
	APPENDIX	59-61

LIST OF TABLES

TABLE	TITLE	PAGE
1.1	Shows Area, Yield and Production of Mustard in various region of Bangladesh	2
5.1	Cost of Mustard cultivation in the study area	31
5.2	Profitability of mustard cultivation per hectare	33
6.1	Estimated values of coefficients and related statistics of Cobb-Douglas production function	36
6.2	Estimated resource use efficiency in mustard production	39
7.1	Problems faced by the farmers	44
7.2	Farmer's suggestions to solve their problems	47

LIST OF FIGURES

FIGURE	TITLE	PAGE
3.1	Map of Tangail district showing Kalihati upazila	14
3.2	Map of Kalihati upazila showing the study area	15
4.1	Distribution of the farmers according to their age	24
4.2	Distribution of the farmers according to their education	25
4.3	Distribution of the farmers according to their occupation	26
4.4	Distribution of the farmers according to their experience	26
4.5	Distribution of the farmers according to their social	27
4.6	Distribution of the farmers according to their family size	27
4.7	Distribution of the farmers according to their income	28
4.8	Distribution of the farmers according to mustard cultivation land	29

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX-A	An Interview Schedule on "Profitability and resource use efficiency of mustard cultivation in the selected areas of Tangail district in Bangladesh"	59-61

ABBREVIATIONS

BBS	Bangladesh Bureau of Statistics
GDP	Gross Domestic Product
BCR	Benefit Cost Ratio
NGOs	Non-Governmental Organization
BB	Bangladesh Bank
MP	Murate of Potash
HYV	High Yielding Variety
TSP	Triple Super Phosphate
STW	Shallow Tube Well
DTW	Deep Tube-Well
SPSS	Statistical Package for Social Science
LUC	Land Used Cost
TVC	Total Variable Cost
NR	Net Return
MFC	Marginal Factor Cost
MVP	Marginal Value Product
MPP	Marginal Physical Product
GM	Geometric Mean

CHAPTER I

INTRODUCTION

1.1 Background of the Study

Bangladesh is mainly an agro-based country dominated by crop production. The area of the country is 147570 square kilometers. The population growth rate is about 1.36 % per year and the overall male female ratio is 103:100. The per capita income is 1952 US Dollars in the country (Bangladesh Economic Review, 2019). About 24.9% of the populations live in the extreme poverty measured in the term of their minimum calorie intake per day (Bangladesh Economic Review, 2019).

Agriculture is the main stay of the economy of Bangladesh and this sector contribute about 14.10% of total Gross Domestic Production (GDP). The economy of Bangladesh is based on agriculture which is transforming from traditional to modern system. Bangladesh agriculture has witnessed an all-time high growth rate of 7.62 percent in 1999-2010 (MoF, 2012). A high growth rate achieved in the crop sector enhanced overall growth rate in agricultural sector. Although the contributions of agricultural percentage share declining but total value is increasing in the economy of Bangladesh. About 45.1% of the total national labor forces are employed by the agricultural sector (Bangladesh Economic Review, 2019) and about 70% people of this country are directly or indirectly involved with this sector. The oil seed sub sector accounts 1.37% to Gross Domestic Product (BBS, 2019). Various types of crops are produced in this country. Oil seed crops are treated as minor crops. Due to increase of area under cereal crops for meeting the increasing demand of food-stuff, land under Oil seed crops has declined and price of oil has gone up (Anwar, 2004). The government of Bangladesh has, therefore, provided priority to the agriculture sector to increase the production of Oil seeds by giving subsidy to the farmers on different inputs such as fertilizer; irrigation etc.

1.2 Worldwide importance of Mustard among the oil crops

Mustard is an important oil crop and currently ranked as the world's third important oil crop in terms of area and production. Mustard is one of the most important oilseed crops throughout the world after soya bean and groundnut (FAO, 2013). Worldwide total annual production of Mustard is 630.40 lacks metric ton from an area of 343.30 lacks

ha (FAO, 2013). But it ranks top in respect of area and production among the oil crops grown in many countries. Mustard oil has been using as cooking oil from the time immemorial. The average yield of Mustard is 1500 Kg/ha. Total production and per hectare seed yield of this crop may be increased by using high yielding variety (HYV) and improved production technologies (Gonzales et al., 1993). Oil cake is a nutritious food items for cattle and fish. It is also a good organic fertilizer for crops. Dry Mustard plants may be used as fuel. According to the World agriculture towards 2015/2030 an FAO perspective, Oil seed crops responsible for a good part of agricultural land expansion (MoA, 2011). The three fast growing oil seed crops (soybeans, rapeseed and sunflower) have been responsible for a good part of the expansion of cultivated land under all crops in the developing countries and the world as a whole (Gujrati, 1998). In terms of the expansion of land under the four major oil crops (soybeans, sunflower, Mustard and oil palm) was 63 million ha, that is, these four crops accounted for all the increase in world harvested area and more than compensated for the drastic declines in the area under cereals in the industrial countries and the transition economies (Jabbar and Islam, 1981). The growth of food demand in the developing countries was the major driving force behind the rapid growth of the oil crops sector in the historical period (Islam, 2006). The most of the countries played a major role in these developments. Table 1.1 shows the past and present of oil crops production contribution with 15 years formal prediction in terms of Production of oil crops in oil equivalent.

1.3 Mustard Cultivation Areas of Bangladesh

In Bangladesh there are 30 agro-ecological zones, among them 23 zones are good for Mustard production (BBS, 2019).

Table 1.1 shows Area, Yield and Production of Mustard in various region of Bangladesh

Name of Regions	2015-2016			2016-2017		
	Area (in acre)	Yield (kg/acre)	Production (M. Ton)	Area (in acre)	Yield (kg/acre)	Production (M. Ton)
1. Bandarban Region	766	359	275	598	447	267
2. Chittagong Region	1094	346	378	1091	356	388

3. Comilla Region	17807	427	7606	24093	377	9093
4. Khagrachari Region	268	354	95	299	321	96
5. Nakhali Region	860	236	203	882	239	211
6. Rangamati Region	597	346	207	556	369	205
7. Sylhet Region	3045	456	1387	3051	468	1429
8. Dhaka Region	100468	330	33173	104129	363	37831
9. Faridpur Region	62856	290	18241	63148	292	18412
10. Jamalpur Region	32181	363	11683	30269	350	10586
11. Kishoreganj Region	7862	376	2959	6776	390	2642
12. Mymensingh Region	5730	248	1423	4609	284	1310
13. Tangail Region	71035	311	22160	67414	361	24370
14. Barisal Region	2591	202	524	2636	232	611
15. Jessore Region	48245	321	15510	49762	352	17507
16. Khulna Region	6969	298	2077	4281	318	1363
17. Kushtia Region	30256	503	15228	29428	543	15990
18. Patuakhali Region	333	216	72	344	218	75
19. Bogra Region	26451	405	10717	24659	417	10279
20. Dinajpur Region	21006	381	7997	18068	462	8347
21. Pabna Region	86440	391	33794	84737	410	34768
22. Rajshahi Region	37653	332	12534	64040	339	21681
23. Rangpur Region	13515	331	4474	13384	334	4466
BANGLADESH	578028	351	202717	578028	371	221928

Source: BBS, 2019

1.4 Justification of the Study

In Bangladesh, Mustard is grown in limited area on commercial basis. However, there is a demand for Mustard all over the country. Farmers allocate land and other resources in the production of different crops on the basis of relative financial profitability &

resource efficiency. With the rapid increase in population and urbanization, the demand for oil production has been increasing. To meet up growing demand of oil without importing, cultivable area of Mustard should be increased. The high demand of oil can only be met by increasing its production vertically. While making production decision, farmers consider costs of production against the yield of the crop. So, profitability study on Mustard is expected to reveal valuable information relating to farms and farmers growing this crop. With the importance of Mustard cultivation in Bangladesh, it is necessary to find out the maximum level of Mustard produced per unit of land using the existing level of resources. Efficient use of resources can provide the farmers to have higher production from the available resources. The situation is particularly critical in a country like Bangladesh where per hectare recommended amount is seldom used in production. However, a few systematic financial investigations on oilseed crops were undertaken either by private or government organizations and were not sufficient to satisfy the demand of extension workers, policy makers, research personnel's and farmers. In this context, this study will help to diagnose the problems and prove our understanding on the interrelated problems of farmer's choice making in producing Mustard. The findings of the study will generate basic financial data on the production practices of Mustard. The present study will provide valuable information to the individual farmers and researcher who will conduct further studies of the similar nature and encourage them in conducting more comprehensive and detailed investigation in this particular field of study. Keeping this in view the study was undertaken with the following specific objectives.

1.5 Specific objectives of the study

The specific objectives of the study are as follows;

- a. To document the demographical profile of Mustard farmers in Tangail district;
- b. To determine the financial profitability of Mustard production in the study area;
- c. To determine the resource use efficiency of Mustard cultivation; and
- d. To find out the major constrains of Mustard cultivation at farm level and suggest some policy guide line.

1.6 Limitation of the Study

Considering time, money and other necessary resources available to the researcher and to make the study meaningful and manageable from the research point of view, it was necessary to impose some restrictions as stated below:

1. The investigation was depended on the data given by the selected growers during their interview.
2. For some cases, the researcher faced unexpected interference from the over interested side talkers while collecting data from the target respondents.
3. Due to shortage of time the study could not cover wide areas for collecting necessary information for avoiding inverse relation of the profit.
4. The shortage of money and time that did not allow taking a large numbers of samples to show the real significances among all categories farmers.
5. The farmers always remained busy in field work and it was difficult to collect information from their wife and child without consulting their husband.

1.7 Organization of the thesis

This thesis consists of eight chapters. Chapter I deal with the introduction including the background, justification and objectives of the study. Next, review of related literature is presented in Chapter II. Chapter III deals with the research methodology of the study. The results and the discussion of the study are presented in Chapter IV, V, VI and VII. Finally, Chapter VIII represents the summary, conclusions and recommendations of the study.

CHAPTER II

REVIEW OF LITERATURE

A number of studies have examined financial profitability & resource efficiency of different agricultural crops in Bangladesh. This section presents the literature review on details resource use efficiency and profitability measurement analysis for the cereals and non-cereals using different financial analysis. The main purpose of this chapter is to review some related studies in connection with the present study. Although a number of studies have been done related to Mustard production in Bangladesh, only a few studies have so far conducted related to financial profitability and resource use efficiency of Mustard production in Bangladesh. Again, some of these studies may not entirely relevant to the present study, but their findings, methodology of analysis and suggestions have a great influence on the present study.

Hossain (2013) conducted a study on the farmers' perception on profitability of Mustard cultivation in between aman and boro rice. Findings indicate that majority of the farmers' (59 percent) had high level of perception on profitability of Mustard cultivation in between Aman and Boro rice. Still there were some respondents (41 percent) had medium perception. Thus, it is indicative that there is scope to take necessary steps to bring 41 percent farmers to high level of perception.

Rabbani et al. (2013) found out that the management and technological training is needed to the farmers to increase farm production and income from Mustard cultivation. The author showed that less of proper technological advancement and proper information supply Mustard production level become low and inefficient resource allocation increase the cost of production.

Rayhan et al. (2013) conducted in Sirajganj district of Bangladesh to determine the profitability and resource use efficiency of Mustard production. Both descriptive statistics and functional analysis was done to achieve the objectives of the study. The author showed that the productivity and profitability was satisfactory for Sirajganj Mustard farmers. The author also suggested that if the farmers of Sirajganj district use the resources efficiently it could increase the production level more for the Mustard farmers in the study area.

Haque et al. (2012) conducted a study with three categories of seed producers, namely BADC farms at Dattanagar, Jhenaidah and Tabunia, Pabna as public agency, LAL TEER Seed Company in Lalmonirhat district as private company and BRAC farm in Bogra district as NGO during Rabi season of 2007-08 to know the present status and profitability of hybrid maize seed production. In the study they find the cost of production and the yield of hybrid seed was highest under NGO than that of public agency and private company. Benefit cost ratio (BCR) was higher for the contract growers of public agency. Net return of hybrid maize seed production was 50% higher than that of non-seed production. High price of seed and lack of technical knowledge were major constraints of hybrid maize seed production in the study areas.

Navadkar et al. (2012) attempted to study the resource use structure, to estimate the cost of cultivation and to study the marketing of maize. In the study the estimates of the production functions indicated that, human labour, manures and nitrogen are the important resource variables responsible for increasing the yield. The use of these variables has to be carefully extended by the maize growers to increase the yield.

Begum et al. (2011) conducted a study to assess the costs and returns from the cultivation of selected crops in different locations. He finds the benefit cost ratios over total costs were 1.61, 1.72, 1.62, 3.55, 1.90, 2.17, 3.72, 1.94 and 2.64 for the cultivation of maize, groundnut, mungbean, sweet potato, cabbage, cauliflower, tomato, cucumber and okra respectively. High costs of fertilizers and insecticides were the major constraints to higher production for most of the crops as mentioned by the sample farmers.

Ogunniyi (2011) had done a study to measure profit efficiency among maize producers in Oyo State, Nigeria. He showed that profit efficiencies of the farmers varied widely between 1% and 99.9% with a mean of 41.4% suggesting that an estimated 58.6% of the profit is lost due to a combination of both technical and allocative inefficiencies in maize production. From the inefficiency model, it was found that education, experience, extension and non-farm employment were significant factors influencing profit efficiency. This implies that profit inefficiency in maize production can be reduced significantly with improvement in the level of education of sampled farmers.

Alam et al. (2010) conducted a study in the haor areas of Bangladesh to assess the land utilization status, delineate the productivity and profitability of growing modern rice, evaluate the existing cropping patterns and assess the prospect of possible cropping patterns. , the study revealed that, there are about 1.26 million hectares of cultivated lands in seven haor districts, of which 66% falls under haor area. According to the farmers' assessment, lack of flood control dam and lack of short duration varieties etc. are the major hindrance to the adoption of potential cropping patterns. Construction of community harvest and threshing facilities and flood control devices could be the important public interventions for enhanced agricultural productivity in the haor areas.

Barkat et al. (2010) revealed that smaller farmers were more restricted in their choices and opportunities because of their lack of assets and their financial profits from crop production activities are not moderate. A selective, targeted fertilizer subsidy scheme for only the smaller farmers may be the correct subsidy policy. In recent times, it has happened quite often that farmers have complained of not receiving the required amount of fertilizers and even sometimes not any fertilizer at all at the dealer's shops. The study found huge deficit of fertilizers among small farmers, whereas larger farmers were less likely to be fertilizer-deficit as compared to the smaller farmers. The reasons behind the huge deficit of the fertilizers could be attributed to high price of fertilizers, lack of availability on time, transportation problem and so forth.

Karim et al. (2010) conducted study to assess the existing agronomic practices of hybrid maize cultivation, its profitability, constraints and factors affecting hybrid maize production. It is found that the coefficient of human labour, land preparation, irrigation, urea and borax have significantly impact on gross return. Timely non-availability of seeds, high price of fertilizer and low price of yield were the major problems for hybrid maize production. Farmers cultivated hybrid maize because of higher yield, higher income and easy growing.

Onuk et al. (2010) assessed the economics of maize production among farmers in Mangu Local Government Area of Plateau State, Nigeria. The result of the survey also indicated that men had more access to land than women, thus making them to be more involved in maize production. However, both men and women have experience in maize production and obtained planting materials mostly from previous harvest.

Finally, the study concluded by advocating adequate market with good stable prices for maize farmers products that would enhance maize production in the study area and the country at large.

Moniruzzaman et al. (2009) carried out a study in four major maize growing areas namely Chuadanga, Dinajpur, Bogra and Lalmonirhat during 2006-07 to know profitability level of maize production in Bangladesh. Benefit cost ratios were calculated as 1.58, 2.10 and 2.58 on total cost, variable cost and cash cost basis respectively. As a result, maize cultivation was more profitable. Lack of capital and high price of TSP were the main constraints to its higher production. Farmers in the study area had scope area had scope to increase maize productivity by attaining full efficiency through reallocating the resources.

Rashid et al. (2009) determines financial profitability of selected crops in the different locations in the country and examines the implications on Bangladesh's trade policies and comparative advantages of selected agricultural commodities like rice, wheat, maize, potato and lentil. The border price of wheat, maize, potato and lentil at producer level measured at official exchange rate was mostly higher than the domestic producer price at the investigated years. For successful implementation of trade liberalization policies, Bangladesh must plan accordingly and take appropriate policies to materialize the likely grains in trade by increasing its trade capacity.

Anupama (2005) had done a study in the state of Madhya Pradesh. The study stated the economic efficiency of the maize growers in the state of Madhya Pradesh can be improved by increasing the adoption level of the improved package of practices. This can be made possible by providing good quality seeds of improved maize cultivars and easy and cheap credit for the purchase of critical inputs like fertilizers, plant protection chemicals etc. Additionally, an assured market for their output through forward linkage with agro-processing industries will indirectly reduce the price volatility in maize produce and increase the socio-economic status of the farmers.

Alam (2003) had undertaken a study to examine possibilities of enhancing the sustainable development of diverse agriculture in Bangladesh. The production of maize and potato has experienced a respectable growth rate during the last decade. A field

study conducted in 12 districts on maize, millets, potato, sweet potato, lentil and mungbean suggests that both financial and economical returns to production of those secondary crops are positive. It appears that maize, millets, pulses, potato and sweet potato (CGPRT or secondary crops) have enough potential for crop diversification, employment creation, income generation, reducing malnutrition and poverty alleviation in rural Bangladesh.

Reza (2003) conducted the input-output relationship and resource use efficiency of snake gourd cultivation in a selected area of Gazipur District. The author showed that snake gourd cultivation is profitable for the farmers but resources are not applied efficiently for Snake gourd cultivation in the study area farmers.

Shahabuddin et al. (2002b) examined the cost and return of rice using two indicators: net financial profitability and domestic resource cost ratio and suggested that Bangladesh had achieved efficiency in rice production except for the upland aus and the deep water aman rice. Diversification in favour of non-rice economic activities for both upland and extreme lowland was financially justified.

Zahir (2001) revealed that reduction of subsidy would reduce farmers' profit (net income) and adversely affect crop sector growth. The author suggested that to increase profit and productivity, farmers need support and subsidy on inputs in their cultivation process. The author showed that less of proper technological advancement and proper information supply Mustard production level become low and inefficient resource allocation increase the cost of production.

Das (2000) conducted a comparative analysis of HYV BR-29 and hybrid Alok mustard in Kalihati Upazila of Tangail District. He determined the costs, returns and relative profitability of HYV BR-29 and Alok mustard. In order to attain objectives, 66 farmers from 6 villages were selected as sample. Analysis of costs and returns showed that the total cost of BR-29 was Tk. 13206.75 and that for Alok variety was Tk. 13894.45. Again, return above full cost for BR-29 variety was found to be higher than Alok variety Tk. 6350.61 per acre. Therefore, production of BR-29 variety was found to be profitable compared to Alok variety.

Rahman (2000) conducted a study to determine the economics of Boro mustard production in Melandah Upazilla of Jamalpur district. The major findings of the study were that BR-29 was profitable enterprise from the viewpoints of small medium and large farmers. Per hectare costs of BR-29 were calculated at Tk. 3295.54, Tk. 32485.63 and 33617.40 for small, medium and large farmers respectively. Per hectare Yield of BR 29 were 6290 kg, 6600 kg and 6100 kg, respectively. In general human labor, power tiller, seedling, fertilizers, Irrigations and insecticides emerged as the very crucial contributors to increased income from BR 29 Boro production.

Nantu (1998) conducted a study to identify costs, returns and resource use efficiency in the production of Boro mustard in some selected area of Bangladesh. The costs of production of Boro mustard per hectare were Tk. 25547, Tk. 25857.73, and Tk. 27548.07 for small, medium and large farmers respectively. Per hectare yield of Boro mustard under different farm categories were 2875.85 kg, 3230.95kg and 3152.50 kg respectively. The net returns per hectare were Tk. 2075.09, Tk. 4986.09 and Tk. 2232.48 respectively.

Yao (1997) assessed the cost and benefit of the Thai agricultural diversification policy in 1994–96. He suggested that Mustard was also more profitable as soybeans and mug beans implying that government intervention may incur efficiency losses. Sensitivity analyses showed that potential price changes, increasing water scarcity, and the effects of crop production on the environment were important concerns which justify government intervention.

Ali (1993) undertook a study to examine the profitability of small-scale layer farms in Dhaka city. In this study 30 egg producing farms were selected, of which 16 were small farms and 14 were medium farms. The average number of birds in the small farms was 61 while it was 178 in medium farms. The average annual egg production was 268 and 266 per hen in small and medium farms respectively. He noted that poultry owners earned net returns above cash cost amounting to Tk. 21301.00 in small farms and Tk. 67316.00 in medium farms. On the basis of full cost, poultry owners earned net returns of Tk. 21135.00 in small farms and Tk. 51556.00 in medium farms. Net returns per taka invested stood at Tk. 0.45 in small farms and Tk. 0.84 in medium farms. Gross margins in small and medium farms were estimated at Tk. 16171.00 and 60822.00 respectively.

Most of the above studies mainly focused on cost, return and economic analysis of cereal crops but a little of them were focused on oil seed crops. There is also a very little effort on measuring resource use efficiency of oil seed crops production. Nevertheless, no empirical study has yet been conducted specially on the financial profitability and resource use efficiency analysis of Mustard production. So, the present study, a moderate attempt has, therefore, been taken in this direction and be considered as a pioneering work in this field so far as systematic investigation into the cost, returns and resource use efficiency of this enterprise is concerned in some selected areas of Tangail district.

CHAPTER II

METHODOLOGY

3.1 Introduction

Methodology is an indispensable and integrated part of any research. The reliability of a scientific research depends to a great extent on the appropriate methodology used in the research. Unreliable results may very often be obtained by following an inappropriate methodology. Careful considerations are needed by a researcher before conducting a study. The researcher has great responsibility in describing clearly what sorts of research design, method and procedure is to be followed in selecting the study area, the sampling technique and the analysis and interpretation to arrive at the correct conclusions. A chronological description of the methodology used for this piece of research is presented below:

3.2 Methods of Data Collection and Data Collecting Instruments

Both technical and socio-economic data were needed for this research. The researcher himself was collected the data by interviewing the selected respondents.

The measures taken were:

- ✓ Built-in-check in the interview schedule;
- ✓ Field checking and
- ✓ Independent re-interviewing of the respondents.

3.3 Selection of the Study Area

The study areas are located in the northern region of Bangladesh. The selection of the area in which a research concerning a farm business survey is conducted depends on the particular purpose of the survey and the possible cooperation from the farmers. The purposes would, therefore, be better served in this area where there were various types of farmers available. Tangail district were purposively selected because there were a large number of mustard growers in the areas of Bangladesh and mustard is the main producing crop in these areas besides the researcher had easy access to these areas. The area had relatively homogeneous soil type and topographical conditions. On the basis of higher concentration of mustard production and considering easy road communication, Kalihati upazila under Tangail district was purposively selected for this study. The producer's information was collected from two selected villages namely Dosokia and Kodimhamzani under Kalihati upazila. The study areas are shown by an arrow on the map (Fig.3.1 & 3.2).

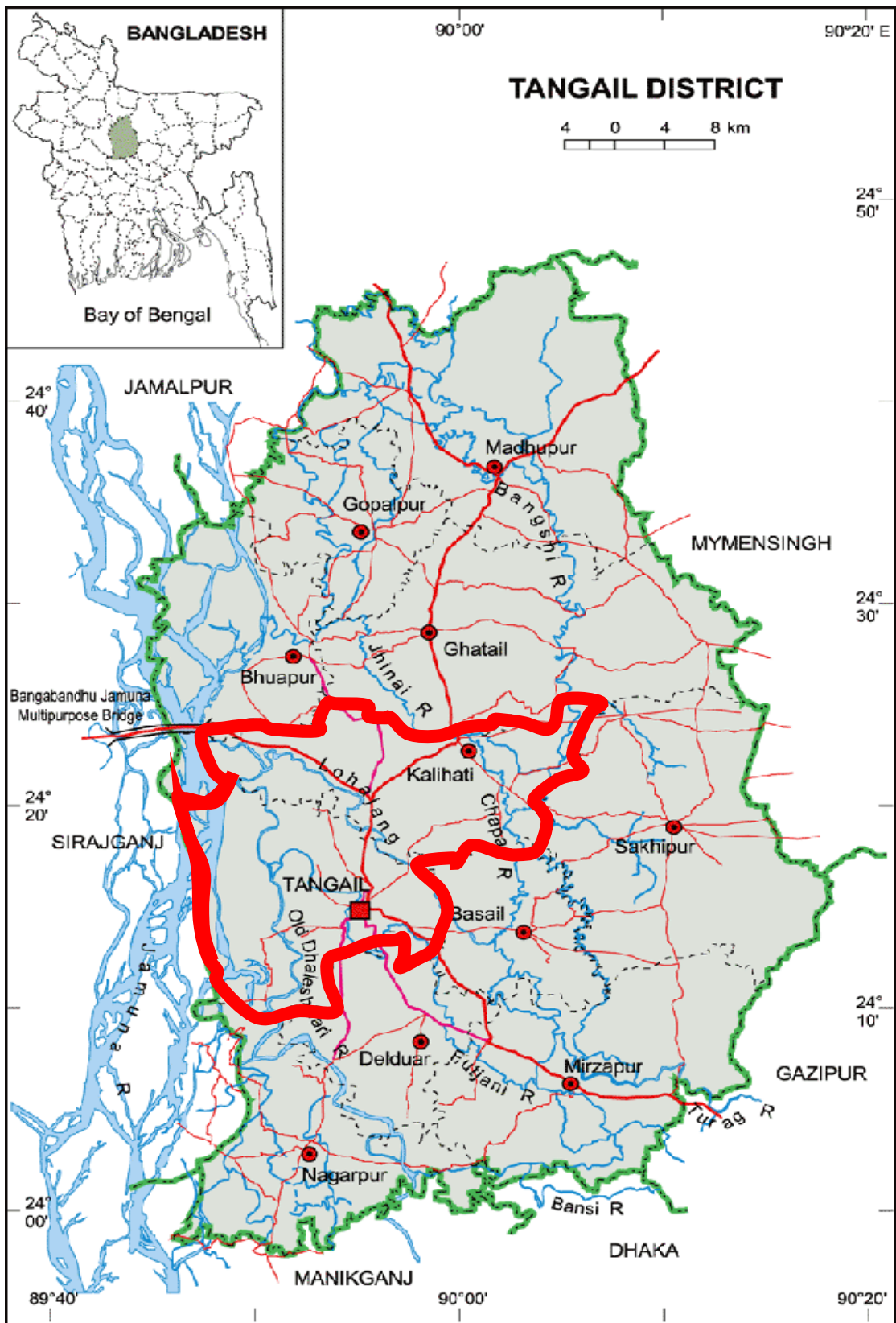


Figure 3.1 Map of Tangail district showing Kalihati upazila

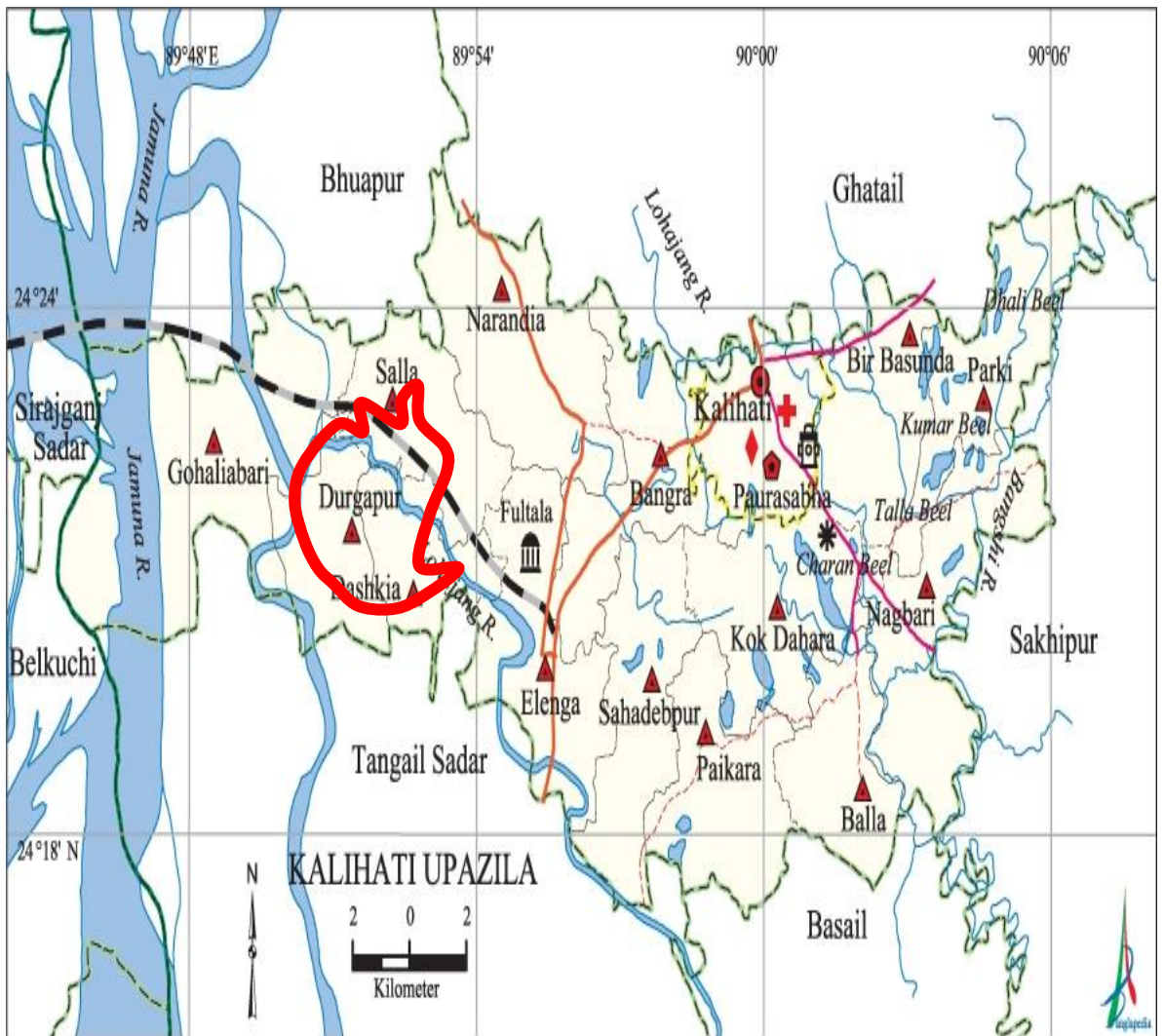


Figure 3.2 Map of Kalihati upazila showing the study area

3.4 Selection of Sample and Sampling Technique

Sampling is an important part of survey work. It was not possible to interview all the farmers of the study area due to time limits and resource constraints. The mustard farmers were selected purposively from the study area. Seventy farmers was selected from two villages as a sample size of the study in Kalihati Upazila under Tangail district.

3.5 Preparation of questionnaires

Once the survey objectives and associated data needs and analyses were specified, a questionnaire was developed to record the information needed for analysis. Attention was given to the general form of the questionnaire to see that the questions followed a logical and appropriate sequence. Care was taken in wording questions to ensure that they were unambiguous and easily understood to ensure cooperation by respondents. According to the objectives of the study three sets of interview schedules were prepared for collecting data. Questionnaire was used for collecting information from mustard farmers. All schedules were pre-tested and finalized after necessary correction, modification and adjustment. Questionnaire had contained such type of questions which are relevant (i.e. cost of production and selling price of mustard etc.) to the study.

3.6 Data Collection and processing

Generally most farmers in Bangladesh do not keep written records on annual or daily transactions or activities. So, it was very difficult to collect data and the researcher had to rely completely on the memory of the farmers. Data for the study were collected from 1st August to 30th August, 2019. Data were collected from the respondents through face to face interviews by the researcher himself. During data collection the objectives of the study were clearly explained to the respondents so that they could respond freely. Producers were interviewed at two selected villages under Kalihati upazila in Tangail district. The respondents were interviewed during their leisure time so that they could respond easily. To overcome errors and to ensure collection of accurate data from the field/study area, all possible measures were taken. Such as, after completion of each interview, each schedule was checked and verified to make sure that answer to each item had been properly recorded. If there were any items which were overlooked or contradictory, the respondents were again interviewed for relevant corrections. Adequate measures were taken to make the information was reliable and accurate and

thereby to make them meaningful for the present study. Secondary data regarding areas, production, market value and other related aspects of mustard production and mustard marketing were collected from various published books, reports and journals. For this study the data obtained refers to last mustard season. After the collection of data, each schedule was verified for the sake of consistency and completeness. Editing and coding were done before putting the data in the master sheets. All the collected data were summarized and scrutinized carefully and necessary summary tables were made from the excel sheets.

3.7 Analytical Technique

Tabular analysis was used mainly based on average, % ages, etc. In order to arrive at a meaningful conclusion a mainly tabular method of analysis was followed. By using arithmetic means and % ages, different costs, gross margins and net profit were calculated in the tabular form.

3.7.1 Procedure for computation of Cost and revenue

The cost of inputs for agricultural production is an important factor which affects the decision making process of farmers. Farmers in the study area used purchased as well as home supplied inputs which were valued at the prevailing market rate and sometimes at government rates in the area during the surveys period or as per the price at which farmers bought the inputs. Pricing of the purchased inputs was easy whereas the prices of home supplied inputs were estimated by using the opportunity cost principle. Opportunity cost of an input is defined as the income which an input is capable of earning in an alternative employment in or outside the farm. The profitability of mustard production was calculated by the following indices.

These indices were previously used by (Hasan et al. 2016). In our study I used this method. In calculating cost of the farmer the following components of costs were considered: (a) Human labor (b) power tillers (c) Seed (d) Fertilizers (e) Pesticides (f) Irrigation (g) Interest on operating capital (h) Land use cost.

3.7.2 Cost of human labor

Human labor is the most important input in producing and marketing every agricultural product. It was required for different operations as land preparation, sowing/

transplanting, weeding, fertilizer application, irrigation using, insecticides, harvesting and carrying, threshing and drying, loading and unloading etc. Usually there were two different types of human labor: (a) family labor and (b) hired labor. Family labor included the farmer himself, the adult males and females as well children of a farmer's family and the permanent labor appointed by him. The cost of hired labor was calculated at the wage rate actually paid by the farmers. In this study, human labor was measured in terms of man-days. The cost of human labor was calculated on the basis of the average wage rate.

3.7.3 Cost of power tillers

In the study area, power tillers were available for cultivating the land. The users of power tillers paid a fixed rate per ha. It was estimated that the average cost of power tiller was Tk. 2943.18 in Kalihati upazila under Tangail District per ha for one time cultivating the crop land.

3.7.4 Seed cost

For growing mustard, farmers used both home supplied and purchased seeds. The costs of home supplied seeds were determined at the ongoing market rate in the study area and costs of purchased seeds were calculated on the basis of actual prices paid by the farmers.

3.7.5 Cost of fertilizers

In general, farmers used a higher level of fertilizer than manure. The farmers used four kinds of fertilizer namely, Urea, Triple Super Phosphate (TSP), Muriate of Potash (MP) and Gypsum in these areas. Costs of these fertilizers were estimated at prevailing market prices during the period of study.

3.7.6 Cost of irrigation

Irrigation was an important input for the production of mustard. In the study area, shallow tube wells were used for irrigation purpose. The cost of irrigation paid at a fixed rate per acre.

3.7.7 Interest on operating capital

Including cash expenses on purchased inputs the operating capital, such as, human labor, land preparation, seeds, manure, fertilizers, and insecticides, irrigation, etc. At the rate of 9 % per annum, interest on operating capital was computed. It was considered that if farmers would take loans from a bank, they would have to pay interest rate of 9 %.

3.7.8 Land use cost

According to the location, topography and fertility of the soil, the cost of land use was different for different plots. The cost of the land use may be estimated by using one of the following alternative concepts:

1. Interest on value of land
2. Rental value of land
3. Forgoing income from alternative use

At present the second method was used. In this research cost of land was considered by taking into account the rental value of land. Some of the selected farmers rented in cultivable land for a season and they had to pay a certain amount of money (per acre basis) as rental value of land. Other farmers produced crops on their own land. If the owners cultivated their own land by themselves, they could also get rental charge by renting out that land. The money which they could receive (per acre) was considered as rental value of land. In computing land use cost, the average rental value of land per acre for a season considered based on the information provided by the farmer in the study area.

3.7.9 Total variable cost

Total variable cost was estimated adding all the variable costs such as seed cost, hired labor cost, power tiller cost, cost of Urea, TSP, MP, Gypsum, cost of pesticide, and Irrigation cost.

Total variable cost = Seed cost + Power tiller cost + Labor cost + Fertilizer cost + Pesticides cost + Irrigation cost.

3.7.10 Total Fixed cost

Total Fixed cost was estimated adding all the fixed costs such as Land use cost and Interest on operating capital. Total Fixed cost= Land use cost + Interest on operating capital.

3.7.11 Total cost

Total cost was summation of Total variable cost and Total Fixed cost.

Total cost (full cost) = Total variable cost + Total Fixed cost.

Enterprise costing was followed in calculating cost and revenue. Economic performances as well as relative profitability of mustard were calculated on the basis of gross margin and net return analysis.

3.7.12 Margins of farmer

Gross margin of farmer is difference between total revenue and total variable cost (Hasan et al. 2016) used this method.

✓ Gross Margin of farmer = Total revenue - Total variable cost.

3.7.13 Net farm income farmers

Per acre net farm income was defined by subtracting the total cost (variable cost + fixed cost) from the total revenue obtained from mustard production.

Net farm income = Total revenue - Total cost.

3.7.14 Cobb-Douglas production function

To determine the contribution of the most important variables in the production process, the following type of Cobb-Douglas production function was used in the study.

$$Y = aX_1^{b1} aX_2^{b2} aX_3^{b3} aX_4^{b4} aX_5^{b5} aX_6^{b6} aX_7^{b7} aX_8^{b8} e^{ui}$$

By taking log in both sides the Cobb-Douglas production function will be transformed into the following double logarithmic form so that it can be solved as a linear relationship;

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + \dots + b_n \ln X_n + u_i$$

Where,

Y = Yield of Mustard (Kg /ha),

a = Constant or Intercept of the function,

X₁ = Land preparation cost (Tk. /ha),

X₂ = Human labor (Man days /ha),

X₃ = Seed (Tk. /ha),

X₄ = Irrigation (Tk. /ha),

X₅ = Urea (Tk. /ha),

X₆ = TSP (Kg /ha),

X₇ = MoP (Tk. /ha),

X₈ = Pesticides (Tk. /ha),

b_i = Coefficient of respective variables,

ln = Natural logarithm,

u_i = Error term and

i = 1, 2 ...n

3.7.15 Undiscounted Benefit Cost Ratio (BCR)

Benefit cost ratio (BCR) of mustard was estimated as the following way

$$\text{Benefit cost ratio (on total cost)} = \frac{\text{Total revenue}}{\text{Total cost}}$$

3.8 Measurement of Resource Use Efficiency

In order to test the efficiency, the ratio of Marginal Value Product (MVP) to the Marginal Factor Cost (MFC) for each input were computed and tested for its equality to 1. i.e., MVP/MFC = 1.

The marginal productivity of a particular resource represents the additional to gross returns in value term caused by an additional one unit of that resource, while other inputs are held constant. When the marginal physical product (MPP) was multiplied by the product mustard per unit, the MVP was obtained. The most reliable, perhaps the most useful estimate of MVP was obtained by taking resources (X_i) as well as gross return

(Y) at their geometric means.

That is,
$$\boxed{\frac{\text{MVP}}{\text{MFC}}} = r$$

Where, r = Efficiency ratio MVP = value of change in output resulting from a unit change in variable input (BDT) MFC = mustard paid for the unit of variable input (BDT)

Under this method, the decision rules are that, when: $r > 1$, the level of resource use is below the optimum level, implying under-utilization of resources. Increasing the rate of use of that resource will help increase productivity. $r < 1$, the level of resources use is above the optimum level, implying over utilization of resources. Reducing the rate of use of that resource will help improve productivity. $r = 1$, the level of resource use is at optimum implying efficient resource utilization.

The most reliable, perhaps the most useful estimate of MVP is obtained by taking all input resources (X_i) and gross return (Y) at their geometric means (Dhawan and Bansal, 1977). All the variables of the fitted model were calculated in monetary value. As a result the slope co-efficient of those independent variables in the model represent the MVPs, which were estimated by multiplying the production co-efficient of given resources with the ratio of geometric mean (GM) of gross return to the geometric mean (GM) of the given resources, that is,

$$\text{MVP}(X_i) = \beta_i \boxed{\frac{\bar{Y}(\text{GM})}{\bar{X}_i(\text{GM})}}$$

Where, $\bar{Y}(\text{GM})$ = Geometric mean of gross return (BDT)

$\bar{X}_i(\text{GM})$ = Geometric mean of different independent variables (BDT) β_i = Co-efficient of parameter $i = 1, 2, \dots, n$

3.9 Problems faced in collecting data

The researcher had to face following problems in the field during the collection of data.

- ✓ The farmers did not keep records of their farming activities. Therefore, the researcher had to depend upon their memory. It was difficult to get information from memory.

- ✓ Most of the farmers in the study area thought that the investigator was a government officer. So, they initially hesitated to answer the questions relating to their income and expenditure. Some were afraid of imposition of new taxes.

- ✓ Sometimes, the farmers were not available at their home because they remained busy with outside work. That is why sometimes more than two visits were required to get information from them.

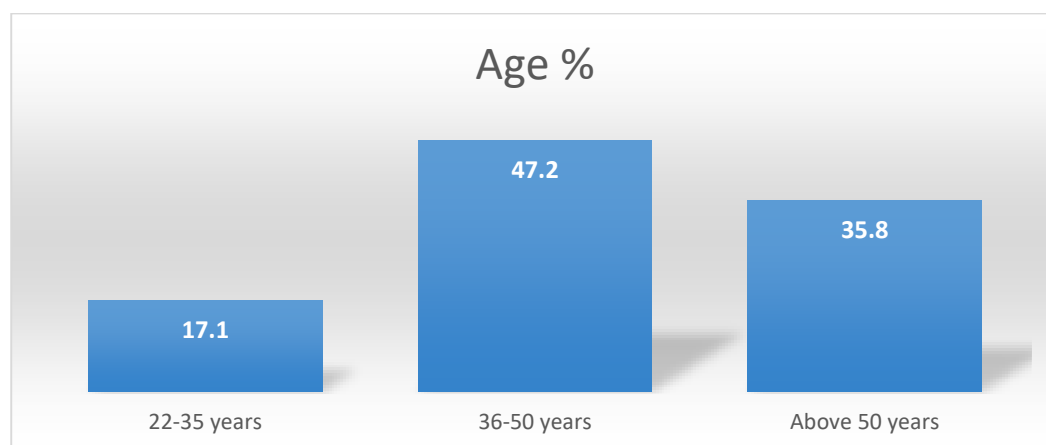
CHAPTER IV

SOCIOECONOMIC CHARACTERISTICS OF THE MUSTARD FARMERS

In this chapter the findings of this study have been discussed in relation to the present findings and also to those found in other studies. Eight characteristics of the farmers were selected for this research. The characteristics include: age, education, occupation, experiences in mustard cultivation, social membership, family size, annual family income and land under mustard cultivation. However, for ready reference, separate tables are provided while presenting categorizations, discussing and /or interpreting results concerning each of the characteristics in this chapter.

4.1 Age

Age of the farmers ranged from 22 to 72 years. On the basis of age, the farmers were classified into three categories: 22-35 years, 36-50 years and above 50 years. The distribution of the farmers according to their age is shown in Figure 4.1.



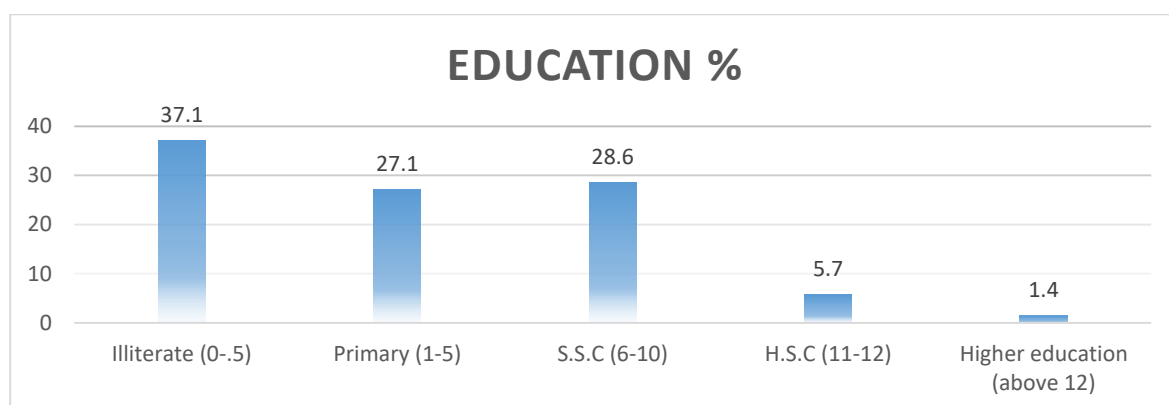
Source: Field Survey, 2019

Figure 4.1 Distribution of the farmers according to their age

Figure 4.1 showed that the highest proportion 47.2 percent of the mustard farmers fell in the 36-50 years age, while 35.8 percent of them fell in the above 50 years age category and 17.1 percent in the 22-35 years age category.

4.2 Education:

The education scores of the farmers ranged from 0 to 16. On the basis of their educational scores, the farmers were classified into five categories, namely "illiterate (0-0.5), primary (1-5), S.S.C. (6-10), H.S.C (11-12) and higher education (above 12). The distribution of the farmers according to their education is shown in Figure 4.2.



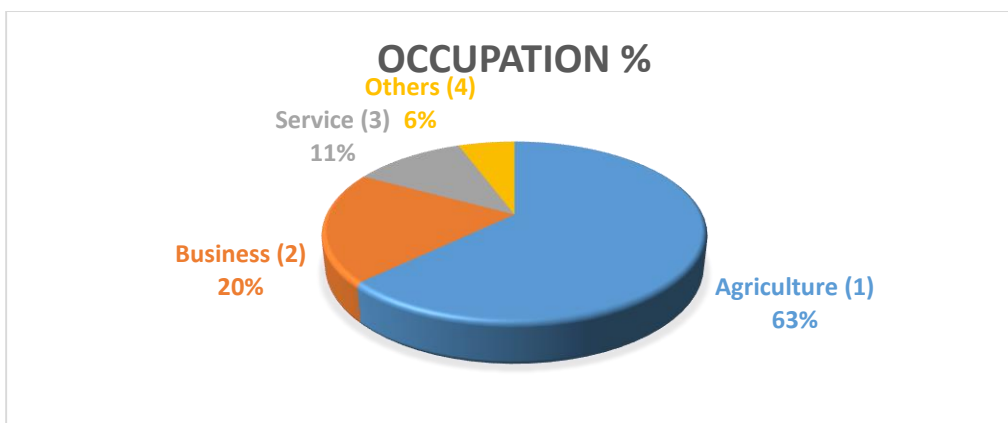
Source: Field Survey, 2019

Figure 4.2 Distribution of the farmers according to their education

Figure 4.2 indicated that the majority (37.1 percent) of the farmers had illiterate compared to 28.6 percent of them having S.S.C level education. About 27.1 percent of the farmers were primary level of education, while 5.7 percent had H.S.C level of education. Only 1.4 percent of the farmers were higher level of education.

4.3 Occupation

Occupation scores of the farmers ranged from 1 to 4. On the basis of their occupation, the respondents were classified into four categories namely, agriculture, business, service and others. The scale used for computing the occupation score of a respondent is given Figure 4.3.



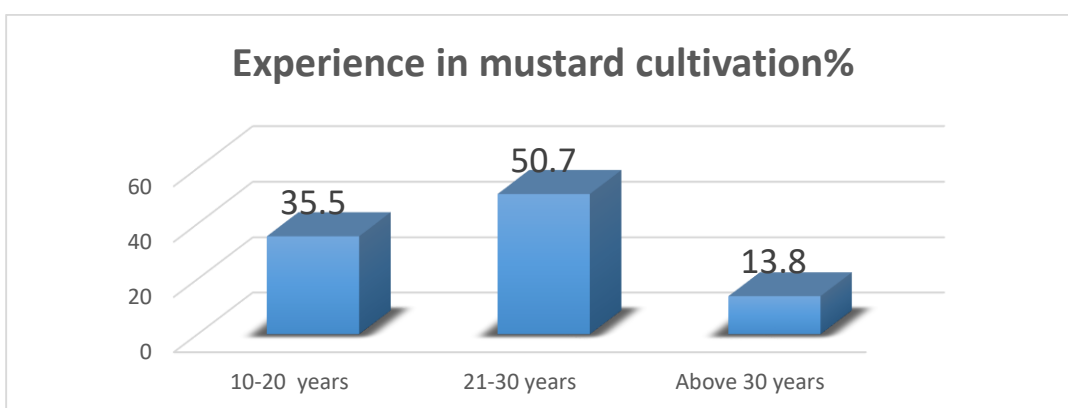
Source: Field Survey, 2019

Figure 4.3 Distribution of the farmers according to their occupation

Data contained in the Figure 4.3 indicated that the highest proportion (63%) of the respondents had agriculture and (20%) had business, (11%) had service holder and 6% had others occupation, respectively.

4.4 Experience in mustard cultivation

Experience in mustard cultivation of the farmers ranged from 10 to 36 years. On the basis of experience, the farmers were classified into three categories: 10-20 years, 21-30 years and above 30 years. The distribution of the farmers according to their experience is shown in Figure 4.4.



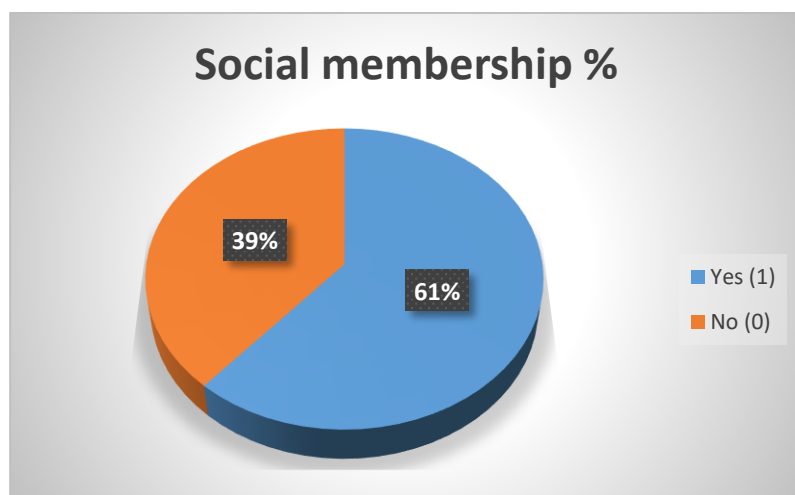
Source: Field Survey, 2019

Figure 4.4 Distribution of the farmers according to their experience

Figure 4.4 showed that the highest proportion 50.7 percent of the mustard farmers had 21-30 years' experience, while 35.5 percent of them had 10-20 years' experience category and 13.8 percent had above 30 years' experience.

4.5 Social membership

The social membership of the farmers were two groups such as yes and no membership. It is evident that about 61 percent of the mustard farmers had social membership and rest of 39 percent of the mustard farmers had no social membership.

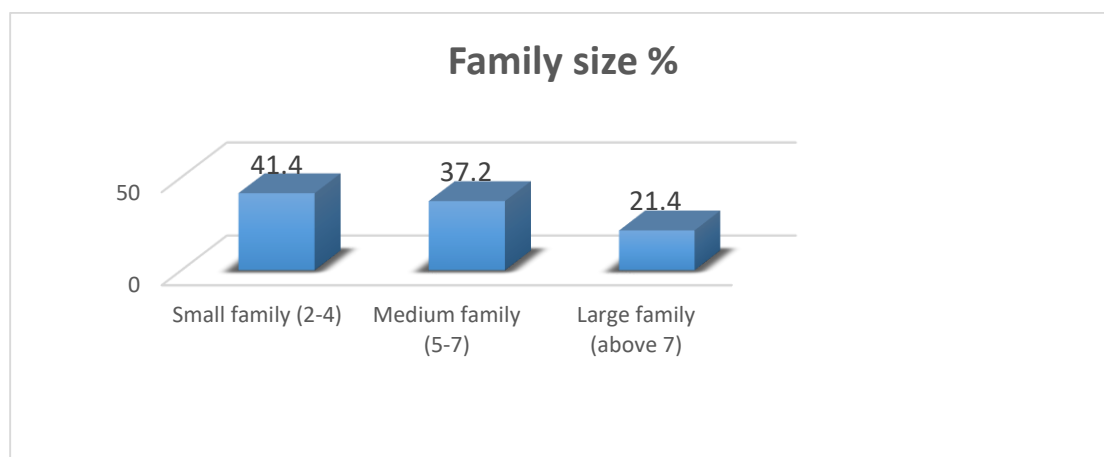


Source: Field Survey, 2019

Figure 4.5 Distribution of the farmers according to their social membership

4.6 Family size

The family size of the farmers ranged from 2 to 11 members. On the basis of their family size the farmers were classified into the following three categories: "small family" (2-4), "medium family" (5-7) and "large family" (above 7). Figure 4.6 contains the distribution of the farmers according to their family size.



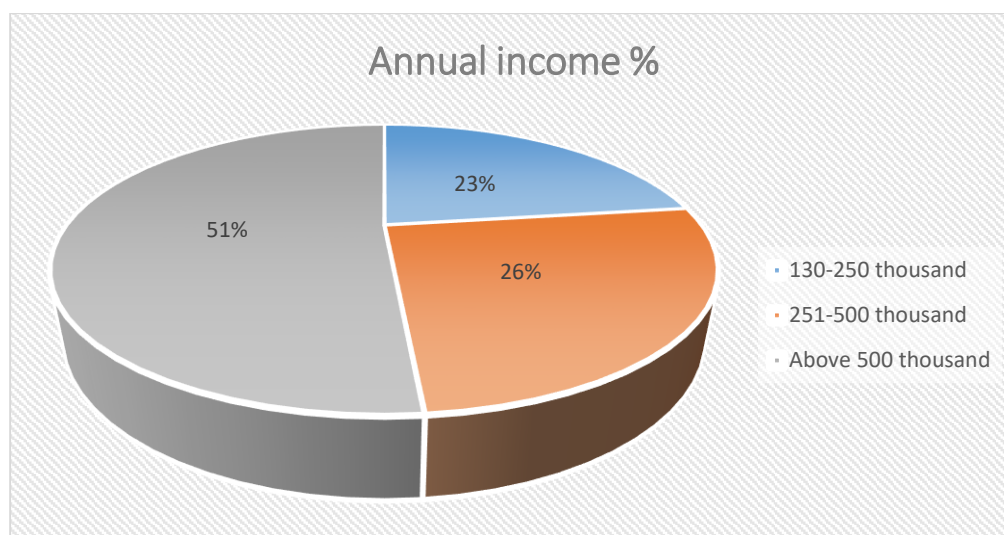
Source: Field Survey, 2019

Figure 4.6 Distribution of the farmers according to their family size

Figure 4.6 showed that the majority of the 41.4 percent of the mustard farmers had "small family" of 2-4 members compared to 37.2 percent of them having "medium family" of 5-7 members. The proportion of "large family" was 18.70 percent.

4.7 Annual family income

Annual family income of the respondents varied from 130 to 750 thousand. The respondents were classified into the following three categories three categories: 130-250 thousand, 251-500 thousand and above 500 thousand. The distribution of the farmers according to their annual family income is shown in Figure 4.7.



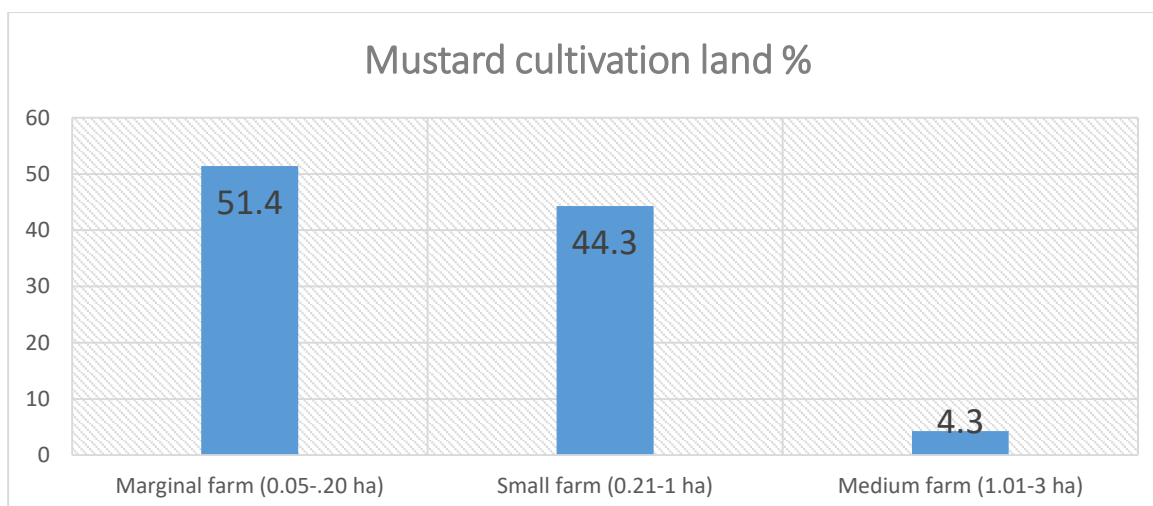
Source: Field Survey, 2019

Figure 4.7 Distribution of the farmers according to their income

Figure 4.7 indicated that more than half (51 percent) of the farmers possessed 51 percent 130-250 thousand income compared to 26 percent of them having 251-500 thousand income and 23 percent of the farmers having above 500 thousand income.

4.8 Land under mustard cultivation

Land under mustard cultivation of the respondents varied from 0.05 to 1.23 hectare. The respondents were classified into the following three categories based on their land under mustard cultivation: "marginal land" (0.05-0.20 ha)", small land" (0.21-1 ha) and "medium land" (1.01-3 ha). The distribution of the farmers according to their land under mustard cultivation is shown in Figure 4.8.



Source: Field Survey, 2019

Figure 4.8 Distribution of the farmers according to mustard cultivation land

Figure 4.8 indicated that more than half (51.4 percent) of the farmers possessed marginal land under mustard cultivation compared to 44.3 percent of them having small land and only 4.3 percent medium land under mustard cultivation.

CHAPTER V

PROFITABILITY OF MUSTARD CULTIVATION

5.1 Introduction

This chapter mainly deals with the estimation and analysis of costs of mustard production. The costs were classified into variable costs and fixed costs. Most of the inputs were valued at the current market price and sometimes governments' price in the study area during the survey period and also the prices at which farmers bought the inputs. But, for some unpaid inputs such as family labor, non-cash price was actually paid and pricing was very difficult in such cases. In these cases, the rule of opportunity cost was followed.

5.2 Cost of power tillers

Average power tillers cost of the Kalihati upazila under Tangail district was Tk. 2134, 2537 and 2813 per ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.3 Seed cost

The costs of home supplied seed were determined at the ongoing market rate in the study area and costs of purchased seed were calculated on the basis of actual price paid by the farmers. Seed cost per ha in Kalihati upazila under Tangail district was Tk. 1332, 2117 and 2196 per ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.4 Labor cost

In this study average labor cost in the Kalihati upazila under Tangail district was Tk. 12484, 14956 and 19338 per ha production of mustard for marginal, small and medium mustard farm respectively (Table 5.1).

5.5 Cost of fertilizers

In general, farmer used higher level of chemical fertilizer than manure. Farmer used four kinds of fertilizer namely urea, triple super phosphate (TSP) and muriate of potash (MP) in the study area. Farmers also used organic fertilizers such as compost. Costs of these fertilizers were estimated on the basis of market price. On an average, total cost

of fertilizer in Kalihati upazila under Tangail district was Tk. 5377, 6460 and 8782 per ha for marginal, small and medium mustard farm respectively (Table 5.1).

Table 5.1 Cost of Mustard cultivation in the study area

Cost items (Tk./ha)	Marginal farm	Small farm	Medium farm
Power tillers	2134	2537	2813
Labor	12484	14956	19338
Seed cost	1332	2117	2196
Irrigation	3510	5571	7154
Urea	2717	3070	3268
TSP	1703	2096	3536
MoP	957	1294	1978
Pesticides	762	819	973
Total variable cost	25599	32460	41256
land rate per season	21423	23767	22234
Interest on operating capital	826	855	1029
Total fixed cost	22249	24622	23263
Total cost	47848	57082	64519

Source: Field survey, 2019

5.6 Cost of pesticides

Mustard growers used insecticides to protect their crop from the attack of pest and diseases. They used insecticides like Diazinon, Furadon, Bashudin, Dimecron, Ronster etc. Costs of these pesticides were estimated on the basis of market price. On an average total cost price of pesticides in Kalihati upazila under Tangail district was Tk. 762, 819 and 973 per ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.7 Cost of irrigation

Farmers used shallow tube well (STW) for irrigation. Irrigation cost differs from land quality. Average cost of irrigation of the farmers in Kalihati upazila under Tangail district was Tk. 3510, 5571 and 7154 ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.8 Total variable cost

In Kalihati upazila under Tangail district, total variable cost was Tk. 25599, 32460 and 41256 per ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.9 Total Production Cost

To get the average total production cost of all the resources used by farmer of Kalihati upazila under Tangail district of mustard per ha were Tk. 44,555.3 and Tk. 42,199.5 respectively (Table 5.1). Total cost is the sum of total fixed cost and total variable cost.

Per acre costs were calculated for all inputs both home supplied and purchased for producing mustard. In calculating the cost of mustard, the following components of production cost were considered.

5.10 Interest on operating capital

Average interest of farmers pay on operating capital in Kalihati upazila under Tangail district was Tk. 826, 855 and 1029 in a season ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.11 Land use cost

In the study area, it was found that most of the farmers had land of their own for producing mustard. Land use cost was calculated on the basis of cash rental value per acre land for the cropping period of four month. It was estimated according to farmers' statement. In Kalihati upazila under Tangail district, average land use cost in a season was Tk. 21423, 23767 and 22234 per ha of land ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.12 Total fixed cost

In Kalihati upazila under Tangail district, total fixed cost was Tk. 22249, 24622 and 23263 per ha for marginal, small and medium mustard farm respectively (Table 5.1).

5.13 Profitability of mustard cultivation

Profitability of mustard cultivation in the study areas are described below:

5.14 Production of mustard in the study area

Farmers in the study areas are produce different types of mustard. Average production of mustard in Kalihati upazila under Tangail district was 1497, 1568 and 1633 kg per ha for marginal, small and medium mustard farm respectively in a cropping season (Table 5.2).

5.15 Total revenue

Average Price of mustard was Tk. 47. 48 and 46.5 per kg in Kalihati upazila under Tangail district. So, revenue from selling mustard in in Kalihati upazila under Tangail district was Tk. 70359, 75264 and 75934 per ha in Kalihati upazila under Tangail district for marginal, small and medium mustard farm. (Table 5.2).

Table 5.2 Profitability of mustard cultivation per hectare

Particulars	Marginal farm	Small farm	Medium farm
Total Production (kg/ha)	1497	1568	1633
Price of mustard (Tk./kg)	47	48	46.6
Total Revenues (Tk./ha)	70359	75264	75934
Total variable cost (Tk./ha)	25599	32460	41256
Gross farm incomes (Tk./ha)	44760	42804	34678
Total cost (Tk./ha)	47848	57082	64519
Net farm income (Tk./ha)	22511	18182	11415
BCR (Total cost basis)	1.47	1.32	1.18

Source: Field survey, 2019

5.16 Gross farm income

Gross farm income equal to total variable cost subtracted from total revenue. In Kalihati upazila under Tangail district total gross farm income was Tk. 44760, 42804 and Tk. 34678 for marginal, small and medium farm respectively (Table 5.2).

5.17 Net farm income

Net farm income equals to total cost subtracted from total revenue. In Kalihati upazila under Tangail district total net farm income was Tk. 22511, 18182 and Tk. 11415 for marginal, small and medium mustard farms (Table 5.2).

5.18 Benefit cost ratio (BCR)

Benefit cost ratio on the basis of variable cost was determined by the ratio of total revenue to total variable cost. In Kalihati upazila under Tangail district, benefit cost ratio was 1.47, 1.32 and 1.18 on the basis of variable cost for marginal, small and medium mustard farm respectively (Table 5.2).

5.19 Concluding Remarks

It was evident from the results that per hectare total variable cost for mustard production were more than per hectare total fixed costs for mustard production. Mustard production provides higher returns to the farmers. Mustard production is gaining popularity in the country gradually due to its high yield potentiality and high demand in the international market. Sample farmers showed their opinion that higher yield and income encouraged them to continue mustard production in the study area.

CHAPTER VI
FACTORS AFFECTING AND RESOURCE USE EFFICIENCY OF
MUSTARD CULTIVATION

6.1 Introduction

An attempt has been made this chapter to identify and measure the effects of the major variables on mustard production. Cobb-Douglas production function was chosen to estimate the contribution of key variables on the production process of mustard cultivation. The estimated values of the model are presented in Table 6.1.

6.2 Factor affecting of mustard production

Land preparation cost (X₁):

It is evident from Table 6.1 that the coefficient of land preparation cost was 0.337 which was significant at 5 percent level for mustard production. That means, 1 percent in cost of this input keeping other factors constant would result in an increase of gross return by 0.337 per cent.

Human labor cost (X₂):

The co-efficient for human labor was -0.082 and was negatively insignificant for mustard cultivation. This indicates that 1 percent increase in human labor cost keeping other factors constant, would decrease the gross returns by 0.082 percent.

Seed cost (X₃):

The estimated co-efficient of seed was 0.230 which was significant at 1 percent level for mustard production. This indicates that an increase of 1 per cent in cost of this input keeping other factors constant would result in an increase of gross return by 0.230 per cent.

Irrigation cost (X₄):

The co-efficient of the variable was 0.422 and significant at 1 percent level. This suggests that an additional spending of 1 percent on irrigation water would enable the farmers to earn 0.422 percent of gross return from mustard cultivation.

Urea cost (X₅):

The estimated value of the co-efficient of urea fertilizer was 0.005 for mustard production and was insignificant. It can be said that 1 percent increase in urea cost keeping other factors constant, would increase the gross returns by 0.005 percent.

TSP cost (X₆):

The estimated value of the co-efficient of TSP fertilizer was 0.008 for mustard farmer and was insignificant. It can be said that 1 percent increase in TSP cost keeping other factors constant, would increase the gross returns by 0.008 percent.

MoP cost (X₇):

The estimated value of the co-efficient of MoP fertilizer was 0.116 for mustard farmer and was significant at 5 percent level. It can be said that 1 percent increase in MoP fertilizer cost keeping other factors constant, would increase the gross returns by 0.116 percent.

Pesticide cost (X₈):

The co-efficient of the variable was 0.011 and insignificant. This suggests that an additional spending of 1 percent on pesticide would enable the farmers to earn 0.011 percent of gross return from mustard cultivation.

Table 6.1 Estimated values of coefficients and related statistics of Cobb- Douglas production function

Explanatory variables	Coefficient	Standard error	p- value
Intercept	2.733	.370	.000
Cost of land preparation (X ₁)	.337	.141	.016*
Cost of human labor (X ₂)	-.082	.121	.480 ^{NS}
Cost of seed (X ₃)	.230	.143	.000**
Cost of irrigation (X ₄)	.422	.155	.006**
Cost of urea (X ₅)	.005	.101	.963 ^{NS}
Cost of TSP (X ₆)	.008	.052	.891 ^{NS}
Cost of MoP (X ₇)	.116	.025	.046*
Cost of pesticide (X ₈)	.011	.047	.002**
R ²	0.928		
Adjusted R ²	0.918		
Return to scale	1.047		
F-value	97.605***		

Source: Field Survey, 2019

Note: ** Significant at 1 percent level; * Significant at 5 percent level and NS: Not Significant

Value of R²:

The co-efficient of multiple determinations, R² was 0.928 for owner farmer which indicates that about 92 percent of the total variation in return of mustard production is explained by the variables included in the model. In other words the excluded variables accounted for 8 percent of the total variation in return of mustard.

F-Value:

The F-value of the equation was highly significant and it implies that the included variables are important for explaining the variation in returns of mustard production.

Returns to Scale

The summation of all the production coefficients indicates returns to scale. For mustard production in farmers the summation of the coefficients was 1.047. This indicated that the production function showed diminishing returns to scale.

6.3 Resource use efficiency of mustard 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 land preparation cost (7.36) for mustard production was positive and more than one, which indicated that in the study area land preparation was under used (Table 6.2). So, farmers should increase the use of land preparation to attain efficiency considerably.

Table 6.2 showed that the ratio of MVP and MFC of human labor (-0.42) for mustard cultivation was negative and less than one, which indicated that in the study area human

labor for mustard cultivation was over-utilization. So, farmers should decrease the use of human labor to attain efficiency level.

The ratio of MVP and MFC of seed was found to be 4.05 for mustard cultivation was positive and more than one, which indicated that in the study area use of seed for mustard production was under-utilization (Table 6.2). So, farmers should increase the use of seed for mustard production to attain efficiency considerably.

Table 6.2 revealed that the ratios of MVP and MFC of irrigation used for mustard cultivation was positive and more than one (3.09), which indicated that irrigation application was under-utilization. So, farmers should increase the use of irrigation to attain efficiency in mustard cultivation.

It was evident from the table 6.2 that the ratio of MVP and MFC of urea (0.14) for mustard cultivation was positive and less than one, which indicated that in the study area use of urea for mustard cultivation was over-utilization. So, farmers should decrease the use of urea to attain efficiency in mustard cultivation.

Table 6.2 Estimated resource use efficiency in mustard production

Variable	Geometric mean (GM)	\bar{Y} (GM)/ \bar{x}_i (GM)	Co-efficient	MVP (Xi)	r=MVP/MFC	Decision rule
Yield (Y)	38833.87					
Land preparation cost (X ₁)	1777.15	21.85	.337	7.36	7.36	Under-utilization
Human labor cost(X ₂)	7558.61	5.14	-.082	-0.42	-0.42	Over-utilization
Seed cost (X ₃)	2207.47	17.59	.230	4.05	4.05	Under-utilization
Irrigation cost(X ₄)	2761.89	14.06	.422	3.09	3.09	Under-utilization
Urea cost(X ₅)	1377.43	28.19	.005	0.14	0.14	Over-utilization
TSP cost(X ₆)	1060.87	30.61	.008	0.29	0.29	Over-utilization
MoP(X ₇)	636.20	61.04	.116	7.08	7.08	Under-utilization
Pesticide cost (X ₈)	478.49	81.15	.011	0.89	0.89	Over-utilization

Source: Field survey, 2019.

The ratio of MVP and MFC of TSP (0.29) for mustard cultivation was positive and less than one, which indicated that in the study areas use of TSP for mustard cultivation was over utilization (Table 6.2). So, farmers should decrease the use of TSP to attain efficiency considerably.

It was evident from the table 6.2 that the ratio of MVP and MFC of MoP (7.08) for mustard cultivation was positive and more than one, which indicated that in the study area use of MoP for mustard cultivation was under-utilization. So, farmers should increase the use of MoP to attain efficiency in mustard cultivation.

It was evident from the table 6.2 that the ratio of MVP and MFC of pesticide (0.89) for mustard cultivation was positive and less than one, which indicated that in the study area use of pesticide for mustard cultivation was over-utilization. So, farmers should decrease the use of pesticide to attain efficiency in mustard cultivation.

6.4 Concluding Remarks

It is evident from the Cobb-Douglas production function model, which the included key variables had significant and positive effect on mustard production except the negative and

insignificant effect of human labor cost, urea and TSP cost. Resource use efficiency indicated that all of the resources were under used for mustard production except overutilization of human labor cost, urea and TSP cost. So there is a positive effect of key factors in the production process of mustard production.

CHAPTER VII

PROBLEM FACED BY THE FARMERS IN MUSTARD PRODUCTION

7.1 Introduction

It is well known that farmers in Bangladesh face various problems associated with mustard production. This chapter attempts to identify and analyze the problems and constraints concerned with the mustard production and ranked the problems according to their responses. Constraints to mustard, production experience says that farmers in Bangladesh cannot get the required quantity of inputs and technical supports and finally the optimum price of their products. They do not have enough funds for mustard cultivation due to their subsistence farming. The major problems of the selected farmers in Kalihati upazila under Tangail district were identified and their responses were represented in.

7.2 Problems faced by the farmers

Farmers face some problems in mustard production. Table 7.1 shows different problems mentioned by the farmers. These were described below:

7.2.1 Disease attack

Problem of attack by pest and disease in the study areas are the main problem for mustard cultivation. When disease attract in the field, it damaged large portion of grain. It is a big loss for the mustard farmers. About 98.5% of the farmers in Kalihati upazila under Tangail district claim that yield become lower because of disease attack. In the rank order, disease attack was the first problem in Kalihati upazila under Tangail district.

7.2.2 High price of fertilizer

Fertilizer is the vital input for the production of mustard. Average 82.5% of the farmers in Kalihati upazila under Tangail district mention that fertilizers price was increasing. So production cost also increases in the study area. In the rank order, problem of high price of fertilizer was 2nd in Kalihati upazila under Tangail district.

7.2.3 Low price of mustard

Low price of rice particularly just after harvesting of the product caused disincentive for the farmers to produce the crops. 72.5% of the farmers in Kalihati upazila under Tangail district responded this problem. In the rank order, low price of mustard was the 3th in Kalihati upazila under Tangail district.

7.2.4 Lack of storage facilities

There was a lack of storage facility for mustard growers was the major problem in the study areas. Most of the products were sold just after harvest at a low price due to lack of proper storage facilities. About 65.0% of the farmers in Kalihati upazila under Tangail district famers reported that lack of storage facilities and high charge for storage discouraged them to produce more mustard. In the rank order, problem of lack of storage facility was the 4th in Kalihati upazila under Tangail district.

7.2.5 Lack of quality seed

High quality of seed is the main input for mustard cultivation. Farmers in the study area could not get high quality of seed. Sometimes seed were mixed with some other particle and could not proper germination. About 62.5% of the farmer in Kalihati upazila under Tangail district thought that lack of quality seed was the big problem for mustard cultivation. The study areas lack of quality seed was 5th in the rank order.

7.2.6 Lack of credit facility

One of the major constraints in agricultural production systems in Bangladesh is low input supply due to lack of money. As the farmers did not possess adequate amount of money for purchasing inputs they had to borrow from others. Sometimes it requires high interest rate. The mustard growers of the study areas reported that lack of fund was a big problem of mustard cultivation. On an average 52.0% of the farmers was in Kalihati upazila under Tangail district faced this problem. The credit need of the poor farmers is mostly meeting from non-institutional sources at prohibitive rates of interest. The result also showed that the credit was necessary mostly for purchasing seed and paying water charge. In the rank order, problem Lack of credit facility was the 6th in the both districts.

7.2.7 High transportation cost

High transportation cost was another problem of the farmer to mustard production and marketing. For higher transportation cost farmers could not accumulate all types of input and could not get better price to sale mustard. So ultimately profit becomes low. About 45.5% of the farmers in Kalihati upazila under Tangail district mention that high transportation cost was another problem of the farmer to mustard production and marketing.

7.2.8 Unavailability of fertilizer

Some areas in the study area farmers claim that some fertilizers were not available to them. So they bought fertilizer in the market which was far from village. Fertilizer unavailability was the problem for the farmers in Kalihati upazila under Tangail district and about 39.5% of the farmers reported. In the rank order, unavailability of fertilizer was the 8th in Kalihati upazila under Tangail district.

7.2.9 Lack of irrigation facility

Irrigation water is one of the most important inputs for mustard production. Yield of mustard varied in the application of irrigation water. They took irrigation facility from other farmer by some rate of amount but it is a problem for timely supply of water. About 34.0% of the farmers in Kalihati upazila under Tangail district reported that they were not received water timely and water charge was much higher for them.

7.2.10 Lack of pesticide

Some areas in the study area farmers claim that some pesticides were not available to them. So they bought pesticides in the market which was far from village. Lack of pesticide was the problem for the farmers in Kalihati upazila under Tangail district. In Kalihati upazila under Tangail district 31.5% of the farmers claim this problem.

7.2.11 Lack of adequate transportation facilities

In the study areas, rickshaw and van were the only means of transportation on the roads. For lack of adequate transportation in the study areas, the farmers had to sell their product in the local market at low price. About 24.5% of the farmers in Kalihati upazila under Tangail district mention that lack of adequate transportation facilities as a

problem. In the rank order, problem of lack of adequate transportation facilities was the 11th in Kalihati upazila under Tangail district.

7.2.12 High price of pesticides

On an average 22.5% of the farmers in Kalihati upazila under Tangail district farmers object that pesticides price are too high. They need to invest huge money to buy pesticides for controlling pest.

7.2.13 Lack of family labor

Lack of family labour was another problem of the farmer to mustard production. Family labour support the farmer to reduce the production cost. The study areas 21.5% of the farmers faced this problem. In the rank order, problem of lack of family labour was the 13th in Kalihati upazila under Tangail district.

Table 7.1 Problems faced by the farmers

List of problems	Kalihati upazila under Tangail district	
	% of farmers	Rank order
Disease attack	98.5	1 st
High price of fertilizer	82.5	2 nd
Low price of mustard	72.5	3 th
Lack of storage facility	65.0	4 th
Lack of quality seed	62.5	5 th
Lack of credit facility	52.0	6 th
High transportation cost	45.5	7 th
Unavailability of fertilizer	39.5	8 th
Lack of irrigation facilities	34.0	9 th
Lack of pesticide	31.5	10 th
Lack of adequate transportation facilities	24.5	11 th
High price of pesticides	22.5	12 th
Lack of family labor	21.5	13 th
Natural calamities	15.5	14 th
Climate change	8.0	15 th

Source: Field survey, 2019

7.2.14 Natural Calamities

Farmers reported that natural hazards, such as. Haze weather in sowing or planting period, rainfall and flood during harvesting period hampered proper production and quality. On an average, 15.5% of the farmers in Kalihati upazila under Tangail district farmers reported that large amount of crops were damaged due to flood.

7.2.15 Climate change

Climate change was another problem of the farmer to mustard production. Climate in Bangladesh were changed over years. For changing Climate, production of mustard changed in the study areas. In Kalihati upazila under Tangail district about 8.0% of the farmers faced this problem.

7.3 Farmer's suggestions to solve their problem

Farmers give some suggestions to solve their problems. Table 7.2 shows different suggestions mentioned by the farmers. These were described below:

7.3.1 Supply good quality of seed

Farmers require good quality of seed for maximize their yield. More than 98.5 % of farmers in the study area suggest that good quality seed is important for mustard production. In the rank order, supply good quality of seed was 1st in Kalihati upazila under Tangail district.

7.3.2 Required fertilizer at reasonable prize

Fertilizer should be available in the study area at a reasonable price. When this important input available in that area at a reasonable price then the farmers apply fertilizer at a required dose and production became higher than before. In Kalihati upazila under Tangail district 92.0% of the farmers suggested that fertilizer should be available at a minimum rate.

7.3.3 Need credit facilities

Credit facilities help the farmers' smooth mustard production. Most of the farmers face this problem. In Kalihati upazila under Tangail district 88.5% of the farmers mention that if various financial institutions help them then the rice production increases in the

area. In the rank order, need credit facilities was 3rd in Kalihati upazila under Tangail district. So it is very important to reduce cost of pesticides.

7.3.4 Development of market facilities

Farmers suggested that market facilities such as floor, tin shed, drainage, water supply, and electricity supply etc. should be arranged by the appropriate government authorities. For purchasing various inputs like seed, fertilizers, insecticides and pesticides need market facilities to the farmers so that farmers can easily buy from it. In on average, 80.5% of the farmers in Kalihati upazila under Tangail district farmers suggest that market facilities help the farmers to buy and sell their product easily. In the rank order, suggestion of develop market facilities was 4th in Kalihati upazila under Tangail district.

7.3.5 Reduce the cost of pesticides

Pesticides also should be available in the study area at a reasonable price. In Kalihati upazila under Tangail district 70.0% of the farmers mention that cost of the fertilizer should be reduced. . In the rank order, suggestion to reduce the cost of pesticides was 5th in Kalihati upazila under Tangail district. So it is very important to reduce cost of pesticides.

7.3.6 Training required for farmer

Agricultural training facilitates the farmers to produce in a proper way. Agricultural training provides necessary information about the various doses and production method to the farmers. In on average, 65.5% in Kalihati upazila under Tangail district farmers mentioned that agricultural training helps the farmers to solve their problems. In the rank order, suggestion of training was 6th in the study areas.

7.3.7 Reduce transportation cost

Transportation cost also should be available in the study area at a reasonable price. In Kalihati upazila under Tangail district 63.0% of the farmers mention that cost of transportation cost should be reduced. . In the rank order, suggestion to reduce the cost of transportation was 7th in Kalihati upazila under Tangail district. So it is very important to reduce cost of transportation.

7.3.8 Need agricultural equipment

In on average 45.5% of the farmers Kalihati upazila under Tangail district required various modern agricultural equipments for maximize their production.

7.3.9 Improvement transport facilities

Transportation facilities should be improved in the study areas. On the basis or priority tillage roads should be developed at least brick bedded road should he made, So that the rickshaws or other vehicles could move easily. About 36.0% of the farmers in Kalihati upazila under Tangail district opined improvement of transportation facilities.

Table 7.2 Farmer's suggestions to solve their problems

Items of suggestions	Kalihati upazila under Tangail district	
	% of farmers	Rank order
Supply good quality of seed	98.5	1 st
Required fertilizer at reasonable prize	92.0	2 nd
Need credit facilities	88.5	3 rd
Development of market facilities	80.5	4 th
Reduce the cost of pesticides	70.0	5 th
Training required for farmer	65.5	6 th
Reduce transportation cost	63.0	7 th
Need agricultural equipment	45.5	8 th
Improve transport facilities	36.0	9 th
Improve irrigation facilities	20.5	10 th
Develop storage facility	12.0	11 th

Source: Field survey, 2019

7.3.10 Improve irrigation facilities

Farmers in Kalihati upazila under Tangail district, 20.5% of the farmers suggest that irrigation facilities help them to reduce cost of production and increase the mustard production. Irrigation facilities should be developed by the local government authority.

7.3.11 Develop storage facility

Low cost storage facilities may be developed at the primary and secondary market by the local government authority to provide storage facilities to the farmers. To get better price need storage facility to the farmers. It was demanded by 12.0% of farmers in Kalihati upazila under Tangail district storage facility should be developed and in the rank order, suggestion to develop storage facility was 11th in Kalihati upazila under Tangail district.

CHAPTER VIII

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Agriculture is the main stay of the economy of Bangladesh and this sector contribute about 14.10% of total Gross Domestic Production (GDP). The economy of Bangladesh is based on agriculture which is transforming from traditional to modern system. Bangladesh agriculture has witnessed an all-time high growth rate of 7.62 percent in 1999-2010. A high growth rate achieved in the crop sector enhanced overall growth rate in agricultural sector. Although the contributions of agricultural percentage share declining but total value is increasing in the economy of Bangladesh. About 45.1% of the total national labor forces are employed by the agricultural sector and about 70% people of this country are directly or indirectly involved with this sector. The oil seed sub sector accounts 1.37% to Gross Domestic Product. Various types of crops are produced in this country. Oil seed crops are treated as minor crops. Due to increase of area under cereal crops for meeting the increasing demand of food-stuff, land under Oil seed crops has declined and price of oil has gone up. The government of Bangladesh has, therefore, provided priority to the agriculture sector to increase the production of Oil seeds by giving subsidy to the farmers on different inputs such as fertilizer; irrigation etc. The specific objectives of the study are as follows;

- a. To document the demographical profile of Mustard farmers in Tangail district;
- b. To determine the financial profitability of Mustard production in the study area;
- c. To determine the resource use efficiency of Mustard cultivation; and
- d. To find out the major constrains of Mustard cultivation at farm level and suggest some policy guide line.

8.1 Summary of the Study

The highest proportion 47.2 percent of the mustard farmers fell in the 36-50 years age, while 35.8 percent of them fell in the above 50 years age category and 17.1 percent in the 22-35 years age category. The majority (37.1 percent) of the farmers had illiterate compared to 28.6 percent of them having S.S.C level education. About 27.1 percent of the farmers were primary level of education, while 5.7 percent had H.SC level of

education. Only 1.4 percent of the farmers were higher level of education. The highest proportion (63%) of the respondents had agriculture and (20%) had business, (11%) had service holder and 6% had others occupation, respectively. The highest proportion 50.7 percent of the mustard farmers had 21-30 years' experience, while 35.5 percent of them had 10-20 years' experience category and 13.8 percent had above 30 years' experience. About 61 percent of the mustard farmers had social membership and rest of 39 percent of the mustard farmers had no social membership. The majority of the 41.4 percent of the mustard farmers had "small family" of 2-4 members compared to 37.2 percent of them having "medium family" of 5-7 members. The proportion of "large family" was 18.70 percent. More than half (51 percent) of the farmers possessed 51 percent 130-250 thousand income compared to 26 percent of them having 251-500 thousand income and 23 percent of the farmers having above 500 thousand income. More than half (51.4 percent) of the farmers possessed marginal land under mustard cultivation compared to 44.3 percent of them having small land and only 4.3 percent medium land under mustard cultivation.

Average power tillers cost of the Kalihati upazila under Tangail district was Tk. 2134, 2537 and 2813 per ha for marginal, small and medium mustard farm respectively. Seed cost per ha in Kalihati upazila under Tangail district was Tk. 1332, 2117 and 2196 per ha for marginal, small and medium mustard farm respectively. In this study average labor cost in the Kalihati upazila under Tangail district was Tk. 12484, 14956 and 19338 per ha production of mustard for marginal, small and medium mustard farm respectively. On an average, total cost of fertilizer in Kalihati upazila under Tangail district was Tk. 5377, 6460 and 8782 per ha for marginal, small and medium mustard farm respectively. On an average total cost price of pesticides in Kalihati upazila under Tangail district was Tk. 762, 819 and 973 per ha for marginal, small and medium mustard farm respectively. Average cost of irrigation of the farmers in Kalihati upazila under Tangail district was Tk. 3510, 5571 and 7154 ha for marginal, small and medium mustard farm respectively.

In Kalihati upazila under Tangail district, total variable cost was Tk. 25599, 32460 and 41256 per ha for marginal, small and medium mustard farm respectively. In Kalihati upazila under Tangail district, total fixed cost was Tk. 22249, 24622 and 23263 per ha for marginal, small and medium mustard farm respectively. Average production of

mustard in Kalihati upazila under Tangail district was 1497, 1568 and 1633 kg per ha for marginal, small and medium mustard farm respectively in a cropping season. Revenue from selling mustard in in Kalihati upazila under Tangail district was Tk. 70359, 75264 and 75934 per ha in Kalihati upazila under Tangail district for marginal, small and medium mustard farm. Kalihati upazila under Tangail district total gross farm income was Tk. 44760, 42804 and Tk. 34678 for marginal, small and medium farm respectively. In Kalihati upazila under Tangail district total net farm income was Tk. 22511, 18182 and Tk. 11415 for marginal, small and medium mustard farms. Kalihati upazila under Tangail district, benefit cost ratio was 1.47, 1.32 and 1.18 on the basis of variable cost for marginal, small and medium mustard farm respectively.

In this study, Cobb-Douglas production function model was used to determine the effects of key variable inputs. The most important eight explanatory variables were included in the model to explain the gross income or return of mustard cultivation. Most of the variables in the production function were significant in explaining the gross return except the negative and insignificant effect of human labor cost. The coefficient with expected sign indicates the selected inputs contributed positively to the gross return. The values of the coefficient of multiple determination of mustard cultivation was 0.928 which implied that about 92 percent of the total variation in the gross return could be explained by the included explanatory variables of the model. Production function for mustard cultivation exhibits increasing returns to scale (1.047). This means that, if all the variables specified in the model were increased by 1 percent, gross return would also increase by 1.047 percent. The F-value for the mustard cultivation was 97.605 which were highly significant at 1 percent level. Resource use efficiency indicated that all of the resources were under used for mustard production except overutilization of human labor cost, urea and TSP cost. So there is a positive effect of key factors in the production process of mustard production.

The present study also identified problems and constraints of mustard production and marketing .The major problems of the farmers were lack of quality seed, lack of skilled labor, low price of mustard, disease attack, high price of fertilizers, unavailability of fertilizers, lack of irrigation facilities, lack of transportation facilities, high transportation cost, lack of storage facility, natural calamities, high price of pesticides

and lack of credit facility. To solve their problems their suggestions were need good quality of seed, need marketing facility, training required for farmer, need agricultural equipments, need storage facility, need transport facilities, reduce transportation cost, required fertilizer at reasonable prize, improve irrigation facilities, need credit facilities and reduce the cost of pesticides. On the other hand, the major problems of the intermediaries were lack of transportation facility, lack of storage facility, high storage cost, high transportation cost, and lack of credit, low price, unstable price and excessive raining. To solve their problems their suggestions were develop transport facilities, develop storage facility, reduce storage cost, reduce transportation cost, need credit facility, need high price of mustard and need stable pricing. lack of capital, high prices of inputs and low price of output, , lack of irrigation facilities, lack of quality seed, storage problem, High transportation cost etc. In order to solve these problems they suggested for further research in the direction of improving and maintaining the quality of seed and agricultural inputs should be available to them. They also suggested for some kind of assistance to improve supplementary irrigation facilities and to stabilize the price, require market facilities, develop storage facilities, need credit facilities.

8.2 Conclusion and Policy Recommendations

It may be concluded that mustard production is highly profitable. If modern inputs and production technology can be made available to farmers in time, yield and production will be increased which can help farmers to increase income and improve livelihood standards. It can help in improving the nutritional status of rural people. The results however, clearly showed that per hectare yield of mustard production are still low among other mustard production Asian countries. There is an ample opportunity to improve per hectare yield of mustard production. To enhance the productivity, efficiency and effectiveness of mustard production, the following recommendations are made as a part of present study which acts as a formulating strategy for enhancing mustard production in Tangail district.

- ✓ Institutional credit should be made available to the farmers and all intermediaries to meet their production and marketing requirements. The rate of interest of credit should be reduced.
- ✓ To ensure supply of quality seeds, fertilizers, and pesticides to the farmers at subsidized price.

- ✓ For farmers and traders village link roads should be developed by the local government.
- ✓ Storage facilities should be improved at primary and secondary market by establishing public as well as private godowns and warehouses.
- ✓ The input price should be fixed at certain reasonable level and the government should ensure the supply.
- ✓ Standard system of weight should be introduced in the trading of mustard.
- ✓ Marketing facilities should be increased at market place.
- ✓ Sufficient number of procurement centers should be established and temporary purchasing centers may be opened by government and non-government organizations to purchase mustard directly from the farmers. Seasonal price variation of mustard should be controlled by the government through controlling the supply to make the mustard market efficient.
- ✓ Market information should be made available to the farmers and intermediaries regularly. If they get the market information about their produce, they would be able to know the real situation of rice markets and could decide what to do at that time.

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APPENDIX-A

Departmental of Agribusiness and Marketing
Sher-e-Bangla Agricultural University

An Interview Schedule on Profitability and resource use efficiency of mustard cultivation in the selected areas of Tangail district in Bangladesh

Sample no.

Village.....

Union.....

Upazila.....

District.....

a. Socio-Economic Characteristics:

Respondent name	Age	Education (Years)	Farm's Experience	Occupation	Societal Membership (Yes/No)

Occupation: 1=Agriculture, 2=Business, 3=Service, 4=Others

b. Total Family Members:

Male:

Female:

Total members:

c. Farm size:

Please indicate the area of your land in your possession

Types of land	Area (Ha)
a. own cultivated land	
b. rented in	
c. rented out	
d. mortgaged in	
e. mortgaged out	
Total=(a+b+c+d+e)	

3. Annual Income:

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

4. Cost and return:

- a. Total area of mustard cultivation _____ ha
- b. Total area of survey land _____ ha
- c. Human Labor requirement (man/day) _____

Name of items	Mustard		Wage rate
	No. of labor		
	Own	Hired	
Land preparation			
Manure and Fertilizer			
Irrigation			
Pest Management			
Harvesting			
Carrying and Storing			
Sunning and Drying			
Total			

d. Materials inputs used:

Inputs	Unit price (Tk/kg)	Amount (kg/survey plot)	TK/Survey plot
Seed			
Manure			
Fertilizer			
a. Urea			
b. TSP			
c. MP			
d. Gypsum			
e. Zinc			
Pesticide			
Irrigation			
Others			
Total=			

5. Amount of mustard

Please mention about mustard production.

Mustard Production	Total Production (mounds)	Unit Price (TK)	Total Taka

- 6. Please mention the problem faced regarding mustard cultivation
 - a)
 - b)
 - c)
 - d)
- 7. What are your suggestions to overcome the above problems?
 - a)
 - b)
 - c)

- d)
- e)

Thank you for your kind co-operation.

Dated.....
interviewer

Signature of the