FINANCIAL ANALYSIS OF MUSTARD CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT

MD. SHOHORAB SARKAR

DEPARTMENT OF DEVELOPMENT AND POVERTY STUDIES

SHER-E-BANGLA AGRICULTURAL UNIVERSITY

DHAKA-1207

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BY

MD. SHOHORAB SARKAR

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Approved by:

_____   _____

Prof. Dr. Ashoke Kumar Ghosh   **Hasan Mahammad Sammy**

Dept. of Development and Poverty Studies   **Dept. of Agricultural Statistics**

Supervisor   **Co-Supervisor**

_____

Fatema Sarker

Chairman

Examination Committee

DEPARTMENT OF

DEVELOPMENT AND POVERTY STUDIES

Sher-e-Bangla Agricultural University

Sher-e-Bangla Nagar

Dhaka-1207

CERTIFICATE

This is to certify that thesis entitled, "*FINANCIAL ANALYSIS OF MUSTARD CULTIVATION IN SOME SELECTED AREAS OF NILPHAMARI DISTRICT*" submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of *MASTER OF SCIENCE (M.S.) in DEVELOPMENT AND POVERTY STUDIES*, embodies the result of a piece of bona-fide research work carried out by *MD. SHOHORAB SARKAR*, Registration no. *13-05628* under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Date:

Place: Dhaka, Bangladesh

_____

Prof. Dr. Ashoke Kumar Ghosh

Department of Development and Poverty Studies

Sher-e-Bangla Agricultural University, Dhaka-1207

Dedicated to

My Beloved Parents

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ABSTRACT

Climatic condition is conducive to cultivate mustard in Bangladesh and there are ample opportunity to improve the current situation of production, since now the demand of oilseeds is high. But financial analysis of production of this crop remains unnoticed most of the time. For assessment of the profitability a field level review was directed with 100 mustard cultivators, who were chosen purposively and interviewed with pretested questionnaire from Nilphamari district during the period March to April in 2020. Applying the Cobb-Douglas production model the results suggested that farmers earned 36347.08 Tk ha^{-1} by producing 1414.23 kg ha^{-1} mustard with the Benefit Cost Ratio (BCR) 1.62. Irrigation, machinery, seed, urea, TSP, ZnSO$_4$ and Cow dung had a significant positive effect on the yield of mustard while human labour and MoP had negative insignificant effect. Mustard cultivation is profitable in Bangladesh and has the potentiality to minimize import cost of oilseeds. Mustard production can be increased further by ensuring adequate supply of labor at peak period with reasonable wage rate, incentive price of produce for farmers, sufficient drainage system after flood, collateral free and easy access to credit, crop insurance to mustard growers.

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INTRODUCTION

1.1   Background of the Study

Agriculture is Bangladesh's most reliable engine of development, a key to industrialization, food security, and a lifeline to a well-regulated country that ensures sustainability and poverty alleviation. Agriculture is the backbone of Bangladesh's economy, accounting for about 12.15 percent of total GDP (Bangladesh Economic Review, 2021). Bangladesh's economy is based on agriculture, which is transitioning from a traditional to a modern system. In 2019, Bangladesh agriculture experienced an all-time high growth rate of 8.12%. The crop sector's high growth rate boosted the agricultural sector's overall growth rate. Although agricultural contributions as a percentage of GDP are decreasing, the total value of Bangladesh's economy is increasing. The agricultural sector employs about 38.3% of the total national labour force (Bangladesh Economic Review, 2021), and about 70% of the country's population is directly or indirectly involved with it. Oilseed production increased from 6.6 lakh tonnes in 2009 to 11.54 lakh tonnes in 2020, according to the agriculture ministry. The oil seed sub-sector accounts for 1.17 percent of total GDP (BBS, 2020). Mustard or rapeseed (Brassica spp. L.) is a thermo and photosensitive oilseed crop that is grown all over the world. Asia produces 41.50 percent of mustard seed, placing it first in terms of production percentage share, followed by the United States (FAO STAT, 2018). Oilseeds were cultivated on less than 2.20 percent of total arable land in Bangladesh's (BBS, 2019). Mustard is the most important oilseed in Bangladesh, with production increasing from 1994 to 2018, with only minor fluctuations in total production and area under cultivation (FAO STAT, 2018). Mustard accounted for more than 69.94 percent of all oilseeds cultivated, followed by sesame, groundnut, and soybean (BBS, 2019). The demand for edible oil and oilseeds is on the rise as the world's population grows Alam (2003). Rapeseed and mustard are commonly referred to as 'Mustard,' and it is a major oilseed crop in Bangladesh, accounting for about 80% of total oilseed area and more than 60% of total oilseed production. It is a cold-loving crop that is harvested during the rabi season. Bangladesh is primarily an agro-based country, with crop production dominating. Mustard oil can be a pressed cooking oil or a spicy essential oil known as mustard volatile oil. Mustard seeds are ground, mixed with water, and the resulting volatile oil is distilled

to extract the essential oil. It's also possible to make it by drying and distilling the seed. Although certain cultures utilize pressed mustard oil as a cooking oil, its sale is limited in several countries due to high quantities of erucic acid. There are also erucic acid-free mustard seed varieties available. This country produces a wide variety of crops. Minor crops such as oil seed crops are treated as such. Because of the increased area under cereal crops to meet the rising demand for food, land under oil seed crops has declined, and the price of oil has increased. The following Table 1.1 shows the share of agriculture in GDP over the years.

Table 1.1 Share of Agriculture in GDP over the Years (%)

Year	Agriculture	Crop	Oil Seed
2009-10	14.65	10.79	1.05
2010-11	14.27	10.5	1.03
2011-12	13.7	10.01	1.03
2012-13	13.09	9.49	1.29
2013-14	2.81	9.28	1.37
2014-15	12.32	8.87	1.36
2015-16	11.7	8.35	1.29
2016-17	11.12	7.86	1.25
2017-18	10.67	7.51	1.19
2018-19	10.15	7.06	1.18
2019-20	9.83	6.76	1.17

Source: Bangladesh Economic Review, 2020

1.2   Mustard Oil Crops' Global Importance

Mustard is a significant oil crop, and it is currently the world's third-largest oil crop in terms of both area and production. Mustard is grown on an area of 343.30 hectares and produces 630.40 metric tons per year. However, it is the most widely grown oil crop in many countries, both in terms of area and yield. Since the dawn of time, mustard oil has been used as a cooking oil. Mustard produces 1500 kg per hectare on average. Using a high yielding variety (HYV) and improved production technologies, this crop's total production and per-hectare seed yield can be increased (Barkat *et al.* 2010). Oil cake is a nutrient-dense feed for livestock and fish. It's also an excellent organic fertilizer for plants. Mustard plants can be used as a source of dry fuel. According to the FAO's World Agriculture Outlook 2015-2030, oil seed crops are responsible for a large portion of agricultural land expansion (MoA, 2011). Soybeans, rapeseed, and sunflower are three fast-growing oil seed crops that have contributed significantly to the expansion of cultivated land under all crops in developing countries and around the world (Yao, 1997) .The expansion of land under the four major oil crops (soybeans, sunflower, mustard, and oil palm) was 63 million ha, accounting for all of the increase in world harvested area and more than compensating for the dramatic declines in the area under cereals in industrial and transition economies. The rapid growth of the oil crops sector in the historical period was largely fueled by rising food demand in developing countries. *Brassica napus L.* and *Brassica rapa L.* dominate the commercial supply globally. Both species have spring and winter forms, which are distinguished by the need for vernalization. These species' seeds are high in oil, containing 40 percent or more, and produce meals with 35 to 40 percent protein. Rapeseed has more than twice the oil content of soybeans but a lower protein content. In 2015/16, global rapeseed production was estimated to be 68 million tonnes, down 4–5% from the previous two years' bumper harvests, but still second only to soybeans in terms of major oil crop production (ETIP Bioenergy, 2014). The world market for oilseeds is growing at a rapid pace. The global production of major oilseed seeds is on the rise. It has been at a level of 500 million tons since 2016, which is 20% higher than the 2012 level. The following shows the dynamics of production of major oilseeds in the world, million. tons. When looking at the dynamics of global production of basic oilseeds, all groups of crops show a positive trend, except for cotton, which saw

a 17 percent decrease in production in the reporting year compared to 2012. The ever-increasing demand for protein feed in the following is the main factor that has led to the expansion of oilseed production (Figure 1.1)
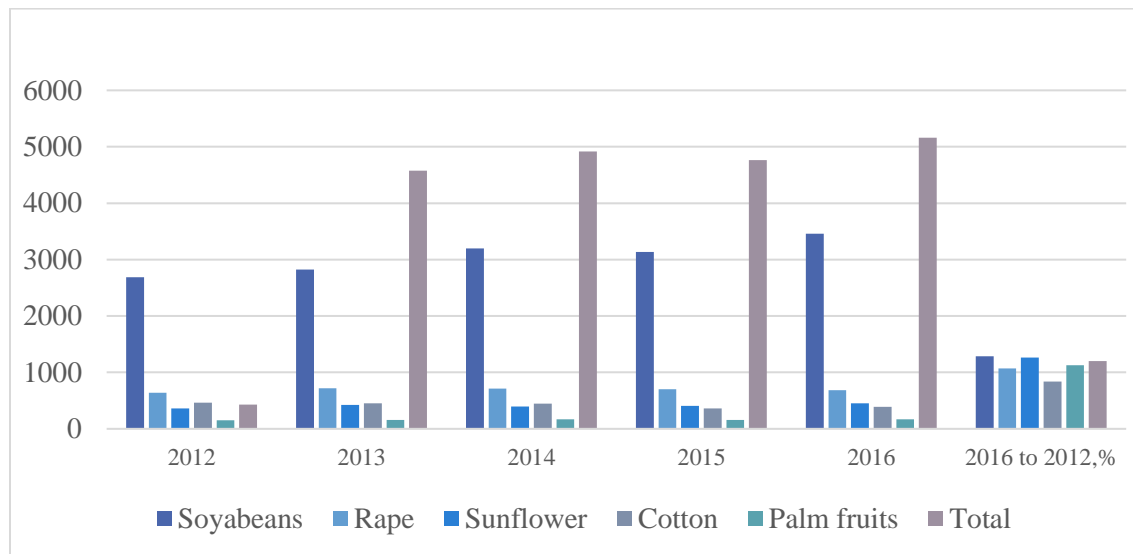
Figure 1.1 Dynamics of Production of Major Oilseeds in the World, million tons.

1.3   Importance of Oil Seed in Bangladesh

Because of the increased area under cereal crops to fulfill rising food demand, land under oil seed crops has shrunk, and oil prices have risen. Mustard is Bangladesh's main oil-producing crop. The seeds have a fat content of 40-44 percent, a protein content of 25 percent, and a nitrogen content of 6.4 percent. White mustard seeds, in addition to the oil derived from them, can be ground into flour for nourishment. Black mustard seeds produce oil and flour, which is mostly used in pharmaceutical products (Thomas *et al*., 2012). Only 5-6 percent of the world production of oil crops is used for seed (oilseeds) and animal feed, while about 8 percent is used for food. The remaining 86 percent is processed into oil (FAO, 2022). The fat content of oil crops varies widely. Fat content ranges from as low as 10-15 percent of the weight of coconuts to over 50 percent of the weight of sesame seeds and palm kernels. Carbohydrates, mainly polysaccharides, range from 15 to 30 percent in the oilseeds, but are generally lower in other oil-bearing crops. The protein content is very high in soybeans, at up to 40 percent, but is much lower in many other oilseeds, at 15-25 percent, and is lower still in some other oil-bearing crops. It is one of the most important oilseed crops in Bangladesh, out of all the oilseed crops.

The government of Bangladesh has given importance to the agriculture sector to improve oil seed output by providing farmers with subsidies on various inputs such as fertilizer and irrigation (BBS 2019). Mustard's byproduct, oil cake, is a nutrient-dense feed for cattle and fish. It's also an excellent organic fertilizer. It is a key source of cooking oil in Bangladesh, providing one-third of the country's edible oil needs (Ahmed, 2008). Most of the oil supply in the market is maintained by importing it from other countries at a significant expense in foreign exchange (Hossain et al., 2006).

In 2016, the average amount of edible oil consumed per person was 15.3 kg. The country's yearly consumption of oils and fats is approximately 30.3 lakh tonnes, with imports accounting for 92% (BBS, 2017) of that total. In fiscal year 2019-20, Bangladesh imported 27.73 lakh tonnes of edible oil, fats, and oil seed worth $2.12 billion. (BBS, 2021). "The domestic edible oil industry is worth more than $2 billion, and the 25 local refineries have a combined capacity of around 55.7 lakh tonnes, about double the current demand." In four years, edible oil consumption has climbed by 39%, from 22.2 lakh tonnes in 2015 to 30.8 lakh tonnes in 2019. Meanwhile, throughout the previous two decades, the country's domestic market for edible oil has risen at a rate of between 7% and 12% per year. (BBS, 2020)

1.4   Mustard Oil Cultivation Areas of Bangladesh

The following Table 1.2 shows area, yield and production of mustard in various region of Bangladesh.

Table 1.2 Area, Yield and Production of Mustard in various region of Bangladesh.

Division/Region	2016-17		2017-18		2018-19	
	Area(acres)	Production(m.tons)	Area(acres)	Production(m.tons)	Area (acres)	Production
Barishal	4604	1952	4810	2133	4795	2175
Chattogram	44382	26534	34013	21753	37926	22018
Dhaka	255917	101967	203091	82882	142386	59694
Khulna	94547	43482	87184	41934	61121	30401
Mymensing	29642	12664	36524	14370	34174	14573
Rajshahi	325597	137574	321112	148089	320410	147417
Rangpur	69990	33439	66656	34070	62114	31504
Sylhet	6581	5248	6484	5305	4316	3958
Bangladesh	831260	362860	759874	351537	667242	311740

Source: BBS, 2019

1.5   Justification of the Study

Mustard is commercially filled in Bangladesh's restricted areas. Mustard, on the other hand, is gaining popularity across the country. Farmers allocate land and other resources to various crops based on their relative financial profitability. With the rapid growth of the population and urbanization, there has been a surge in interest in oil production. To meet the growing demand for oil without having to import it, the cultivable area of mustard should be increased. The rising popularity of oil necessitates an increase in its

production. Farmerss weigh the costs of creation against the harvest yield when deciding on a creation option. In this regard, mustard productivity study is expected to reveal important information about homesteaders and ranchers who are growing this crop. Given the importance of mustard development in Bangladesh, it's critical to figure out how much mustard can be produced per unit of land using current resources. Farmerss can get more production out of their available assets if they use their assets efficiently. The situation is particularly critical in a country like Bangladesh, where the suggested sum per hectare is only occasionally used in practice. However, a couple of methodical economic studies on oilseed crops were attempted by private or government organizations and were insufficient to meet the needs of augmentation workers, strategy producers, research teams, and ranchers. In this case, this research will aid in the diagnosis of the problems and demonstrate our understanding of ranchers' preferred interrelated issues in the production of mustard. The findings of the study will provide crucial financial data on mustard's manufacturing practices. This review will give significant data to the singular ranchers and scientist who will direct further investigations of the comparable nature and support them in leading more far reaching and point by point examination in this field of the review.

Objectives of the Thesis

1) To document the socio-economic profile of mustard farmers on study area in Nilphamari district.
2) To examine profitability of mustard production in the study area.
3) To determine the factors affecting of mustard cultivation.
4) To find out the major constrains of mustard cultivation at farm level and provide some recommendations for the welfare of the farmers.

1.6   Organization of the Thesis

There are eight chapters in this thesis. The first chapter covers the introduction, which includes the study's background, justification, and goals. In Chapter II, a review of related literature is presented. The study's research methodology is discussed in Chapter III. The study's findings and discussion are presented in Chapters IV, V, VI, and VII. Finally, Chapter VIII contains the study's summary, conclusions, and policy recommendations.

CHAPTER II

REVIEW OF LITERATURE

2.1   Introduction

A literature review is an attempt to examine the findings in order to provide proper guidance in the design of future research problems and the validation of new findings. It also aids in the successful completion of the research project by providing a wealth of knowledge and information about the proposed study. In connection with the current study, the literature and research of major previous works were searched because this knowledge and information can be used to help design future research problems and validate new findings. The review of literature, however, was not limited to Bangladeshi works; it also included works from other countries to provide a broader perspective.

2.2   Mustard Related Studies

Alam (2003) conducted research into the possibilities of enhancing Bangladesh's diverse agriculture's long-term development. During the last decade, maize and potato production has increased at a respectable rate. A field study of maize, millets, potato, sweet potato, lentil, and mungbean production in 12 districts found that the financial and economic returns on those secondary crops are positive. In rural Bangladesh, maize, millets, pulses, potato, and sweet potato (CGPRT or secondary crops) appear to have sufficient potential for crop diversification, job creation, income generation, malnutrition reduction, and poverty alleviation.

Alam et al. (2010) carried out research in Bangladesh's haor areas to assess land utilization, delineate the productivity and profitability of growing modern rice, evaluate existing cropping patterns, and assess the prospect of future cropping patterns. According to the study, there are approximately 1.26 million hectares of cultivated lands in seven haor districts, with 66 percent falling within the haor area. Farmers believe that the lack of a flood control dam, as well as a lack of short-duration varieties, are the main obstacles to the adoption of potential cropping patterns. Construction of community harvest and threshing facilities, as well as flood control devices, could be important public interventions in the haor areas for increased agricultural productivity.

Begum et al. (2011) conducted research to determine the costs and returns of cultivating specific crops in various regions. He discovered that the benefit cost ratios over total expenses for maize, groundnut, mungbean, sweet potato, cabbage, cauliflower, tomato, cucumber, and okra production were 1.61, 1.72, 1.62, 3.55, 1.90, 2.17, 3.72, 1.94, and 2.64, respectively. According to the sample farmers, high fertilizer and insecticide prices were the biggest stumbling blocks to increased output for most of the crops.

Barkat *et al.* (2010) revealed that smaller farmers have fewer options and opportunities due to a lack of assets, and their financial profits from crop production activities are insufficient. The correct subsidy policy may be a selective, targeted fertilizer subsidy scheme for only the smaller farmers. Farmers have frequently complained in recent years about not receiving the required amount of fertilizers, and in some cases, no fertilizer at all, from dealer's shops. Small farmers had a huge fertilizer deficit, according to the study, whereas larger farmers were less likely to be fertilizer-deficient than small farmers. The reasons for the massive fertilizer shortage could include high fertilizer prices, a lack of timely availability, transportation issues, and so on.

Barker and Hayami (1976) revealed that a subsidy applied to modern inputs that were being used inefficiently, such as fertilizer, can be more profitable than supporting product prices. Farmers, according to the authors, must use modern inputs while maintaining proper doses in order to achieve efficiency.

Rabbani *et al.* (2013) conducted on his study that farmers require managerial and technological training to increase farm production and income from mustard cultivation. The author demonstrated that when there is a lack of proper technological advancement and information supply, mustard production levels fall, and inefficient resource allocation raises production costs.

Rashid *et al.* (2009) determined the financial profitability of selected crops in various parts of Bangladesh, as well as the implications for Bangladesh's trade policies and comparative advantages of agricultural commodities such as rice, wheat, maize, potato, and lentil. At the investigated years, the border price of wheat, maize, potato, and lentil at the producer level, measured at the official exchange rate, was mostly higher than the

domestic producer price. Bangladesh must plan appropriately and implement appropriate policies to materialize the likely grains in trade by increasing its trade capacity in order to successfully implement trade liberalization policies.

Rayhan *et al.* (2013) revealed that the profitability and resource use efficiency of mustard production, a study was conducted in Bangladesh's Sirajganj district. To achieve the study's goals, descriptive statistics and functional analysis were used. The author demonstrated that the productivity and profitability of Sirajganj mustard farmers were satisfactory. The author also suggested that if the farmers of Sirajganj district made better use of their resources, mustard farmers in the study area could produce more.

Reza (2003) evaluated in a selected area of Gazipur District, researcher investigated the input-output relationship and resource use efficiency of snake gourd cultivation. The author demonstrated that snake gourd cultivation is profitable for farmers, but that resources are not being used efficiently in the study area.

Sukume *et al.* (2000) conducted in Zimbabwe, the cost and return on crop production were calculated. In the small scale commercial sector, the author demonstrated that a greater number of crops were economically viable in each zone. Groundnut and mustard were the most efficient crops in the communal sector, followed by sunflower, finger miller, and cotton in all zones. The author also claimed that the financial system, which had been in place for decades, had caused severe distortions by providing net subsidies to farmers in areas far from major consumption centers.

Yao (1997) evaluated the cost and benefit of Thailand's agricultural diversification policy. He also claimed that mustard was more profitable than soybeans and mug beans, implying that government intervention could result in efficiency losses. Potential price changes, increasing water scarcity, and the environmental effects of crop production were all identified as major concerns that justified government intervention, according to sensitivity analyses.

Zahir (2001) stated that lowering the subsidy would lower farmers' profit (net income) and have a negative impact on crop sector growth. Farmers need support and subsidies on inputs in their cultivation process, according to the author, in order to increase profit and productivity. The author demonstrated that when there is a lack of proper

technological advancement and information supply, mustard production levels fall, and inefficient resource allocation raises production costs.

2.3   Concluding Remarks

Most of the studies, according to the above discussion and review, focused on mustard cultivation cost, return, profitability, marketing, and productivity. Only a few integrated studies on mustard profitability and factors affecting production have been conducted in Bangladesh. As a result, it's likely that this research will be conducted with those considerations in mind. The review of literature was helpful in re-designing methodological aspects to overcome the limitations of previous studies. Based on previous research, the researcher believes that a profitability and factors affecting analysis of mustard cultivation in Bangladesh within the current development context is necessary, as it will aid policymakers in understanding the current situation and developing programs to increase mustard production and improve the livelihood of Bangladesh's rural people. A few studies on mustard have been conducted, according to the review. For a variety of reasons, the results of these studies vary greatly. The economics of mustard cultivation has received little attention. As a result, the current study aims to gather information on mustard cultivation in Nilphamari district of Bangladesh. On the other hand, researcher believed that the findings of this study would provide useful updated information, which would help the policy makers and researcher for further investigations.

CHAPTER III

METHODOLOGY

The methodology for the study is discussed in this chapter. The appropriate methodology used in the research has a big impact on the reliability of a scientific study. Farm management research typically entails gathering primary data from working farmers. Methodology is primarily concerned with the detailed sequential steps of research work, such as the selection of study areas, study period, data sources, data processing, and analytical techniques.

Any systematic study's methodology should be carefully considered. The use of proper methodology is a requirement for good research. The nature of the study and its objectives will determine how primary data will be collected. Because it is less expensive and time consuming, the survey method will be used for this study.

3.1   Method of Investigation

A survey-based research deals with collection of information from individual respondents. There are three main methods by which farm survey data can be gathered. These are:

i   Direct observing

ii   Interviewing respondents

iii   Record kept by respondents.

The approach chosen is influenced by the nature of the study topic, the availability of research funds, time constraints, and other factors. In order to meet the study's objectives, the survey method was used to collect information from respondents. The survey method has two main advantages: it allows for quick analysis of a large number of cases and it is more widely applicable. The disadvantage of the survey method is that it is completely reliant on the respondents' perceptions. Bangladeshi farmers, overall, do not keep written records or account for their agricultural activities. Furthermore, Bangladesh's rural population is still largely illiterate. As a result, conducting a survey for any scientific farm management research is challenging. Repeated data collection visits were made to reduce

errors, and if any omissions or conflicts were discovered, the farmers were contacted again to obtain the necessary information.

3.2   Selection of the Study Area

Selection of the study area is an important step. To get data easily accessible and achieve the objectives of the present study, a preliminary survey was conducted in Nilphamari Sadar Upazila. Preliminary findings have come to the fact that 2 villages namely Sangolshi and Sonaray were selected for the study. The selection of the study area was based on the following considerations:

i   Mustard cultivation is practiced by the farmers of these villages.

ii   This area is suitable for the study in terms of time and available resources.

iii Easy accessibility and good communication facilities.

iv   Expecting the respondents to cooperate in obtaining reliable data.
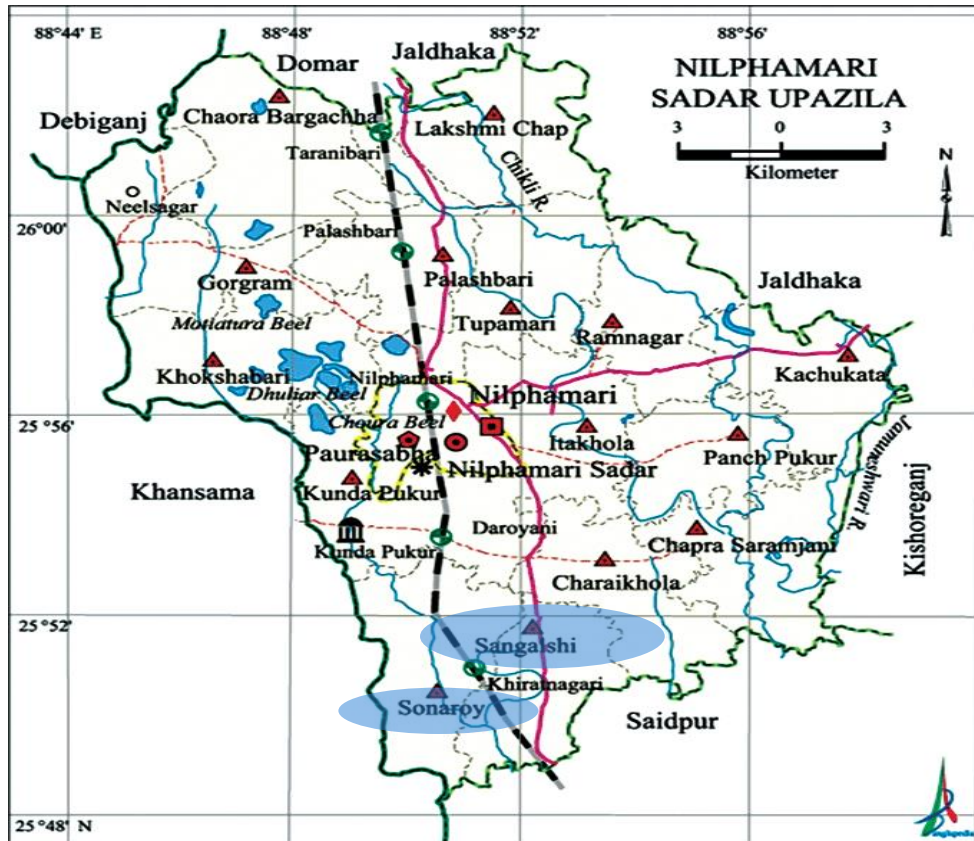
Figure 3.1 Study Area of Nilphamari Sadar Upazilla

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3.3 Selection of the Samples and Sampling Technique

In most cases, it is not practical to conduct a survey that covers all farmers and including too many farmers in a survey is not worthwhile because it takes more time and money to complete. A total of 100 mustard farmers were chosen by simple random sampling techniques.

3.4 Preparation of Survey Schedule

A preliminary survey schedule was created to collect data in order to meet the study's goal. The draft schedule was pre-tested in the research field by the researcher himself. Various portions of the draft schedule were enhanced, changed, and updated as a result of the actual and practical experiences gained from pre-testing. The following items were taken into account while preparing the questionnaire:

a) The respondent's name and family structure, as well as information on their education and occupation.

b) The pattern of land use.

c) The number of assets and their current worth.

d) Input costs, which include the cost of human labour, housing, all fertilizer charges, and other additional costs.

g) Mustard cultivation returns.

f) A problem that mustard growers are facing.

3.5 Period of Data Collection

The researcher himself collected necessary data from the respondents during the months of March to April in 2020 through personal interview.

3.6 Collection of Data

The relevant data were gathered by personally visiting each farm and interviewing them using a pre-tested interview schedule to meet the study's objectives. The majority of people don't keep track of what they are doing. As a result, actual data collection is difficult, and the researcher must rely on the respondent's memory. Before beginning the

actual interview, each respondent was given a brief overview of the study's goals and objectives. The question was asked in a methodical and straightforward manner, with the results recorded on the interview schedule. The interview schedule was checked and verified after each interview to ensure that information for each of the items had been properly recorded. To reduce the number of inaccuracies, data were collected in local units. After that, they were converted to the correct standard unit.

Because of the variables and types of respondents, both qualitative and quantitative data collection methods were employed. There were two types of data used in the study: primary and secondary data. Primary data were collected by interviewing the chosen respondents. The information was gathered over a two-month period. After the data were collected, it was properly edited and examined. Secondary data were gathered from BBS, books, journals, newspapers, articles, and the internet, among other places.

3.7   Editing and Tabulation of Data

The filled schedules were edited for analysis after the primary data were collected. These numbers were double-checked to make sure there were no errors or inconsistencies. All the information gathered was analyzed and summarized. The Microsoft Excel, SPSS, and STATA programs were used for data entry and analysis. Finally, a few relevant tables were created based on the need for analysis to meet the study's objectives.

3.8   Analytical Technique

Data were analyzed with the purpose of fulfilling the objectives of the study. Both descriptive and statistical analysis was used for analyzing the data.

3.8.1   Descriptive Analysis

The most common methods for determining the respondent's socio-demographic profile were tabular and graphical analysis. The cost, returns, and profitability of mustard cultivation were calculated using the tabular technique of analysis. Simple measures like average, percentage, and ratio were calculated using it. Mustard production practices and input use, as well as cost and returns, were all tabulated.

3.9   Financial Profitability of Crops

The most common method of determining and comparing the profitability of different farm enterprises is cost and return analysis. In estimating the level of profitability in crop production the following formula was used:

$$\prod = P_1Q_1 + P_2Q_2 - \sum W_iX_i - TFC \qquad\qquad (1)$$

Here,

$\prod$= Profit per hectare for producing the crop;

P_1 = Per unit price of the output;

Q_1 = Quantity of output obtained (per hectare)

P_2 = Per unit price of by-product (Tk.)

Q_2 = Quantity of by –product obtained (per hectare)

W_i= Per unit price of the ith input used for producing the crop (Tk.)

X_i = Quantity of the ith input used for producing the crop (Tk.) and

TFC = Total fixed cost (Tk.)

3.10   Calculation of BCR

BCR is the ratio of gross return and total cost. It indicates that the benefit of per unit of cost. BCR was calculated by using following formula:

$$BCR = \frac{Gross\ Return}{Total\ Cost} \qquad\qquad (2)$$

3.11   Cost Items

The cost of inputs is an important factor that plays an important role in financial decision making for performing and income generating activity. Respondents in the study area used purchased inputs as well as home supplied inputs. The cost of purchased inputs and home supplied inputs were not calculated separately. The cost of mustard cultivation can be broadly classified under the following two heads:

a) Variable cost
b) Fixed cost

a) Variable cost

This mainly includes the following heads:

    i.   Cost of seed

    ii.   Labour cost

    iii.   Fertilizer cost

    iv.   Machinery cost and

    v.   Interest on operating capital

b) Fixed cost

This mainly include only: Land use cost

Cost of seed

Mustard farms spent the majority of their money on seed. The cost of seed is the monetary value of all mustard seed purchased or saved by farmers during mustard cultivation in the previous year.

Fertilizer cost

Fertilizer was one of the largest and the major cost items of mustard cultivation. Cost of fertilizer included (Urea, TSP, MoP, Gypsum, Zinc Sulphate, Cowdung, Pesticides etc.). Fertilizer costs were calculated at the prevailing local market rates. It is estimated according to the cash price paid by the farmers per kg.

Human labour cost

Another important input in the production of mustard was the cost of human labour. Because hired labour was used heavily in this cultivation, the labour cost includes both family and hired labour. The opportunity cost principle was used to estimate the wage rate of labour, with eight adult male hours equating to one man-day.

Machinery cost

The costs of machinery services were obtained by calculating the mustard farmers' actual costs. Almost all the farmers in the study area used a power tiller and other machinery for land preparation and threshing. They mostly used a power tiller that they had rented. Fuel

and a driver were provided by the owner of a power tiller for land preparation and threshing. The cost of the machinery included a service charge.

Land use cost

The cost of land use varied depending on the location, topography, and soil fertility. From land preparation to harvesting, land was used for mustard cultivation for four months. The cost of land use was calculated in this study by using the cash rental value of land, which would have been another option for accounting for the cost of land use.

Interest on operating capital

The amount of money needed to meet the expenses on hired or purchased inputs was considered as operating capital in this study. Interest on operating capital was calculated at the rate of 12 percent per annum. Interest on operating capital was calculated by using the following formula (Mia et al., 2013)

$IOC = AIit$

Here,

IOC= Interest on operating capital

i= Rate of interest

AI= Total investment/2

t= Total time period of a cycle

3.12   Return Items

Return items were as follows:

    (i)   Return from selling mustard.

    (ii)   Return from selling by-product.

3.13   Procedure for Evaluation of Return

Per hectare gross return was calculated by multiplying the total amount of product by their respective average market price. Gross return per hectare consisted of the value of

main product and the value of by-product. Net return was measured by deducting all direct cash and non-cash expenses from the gross return.

3.14 Cobb-Douglas Production Function

Cobb-Douglas regression model was used to estimate the production function and find out the factor affecting mustard production in the selected district. To measure the contribution of the most important variables in the production process of mustard, the following type of Cobb-Douglas production function was used in the study.

$$Y = a\, X_1^{b1}\, X_2^{b2}\, X_3^{b3}\, X_4^{b4}\, X_5^{b5}\, X_6^{b6} e^{ui}$$

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:

$$lnY = lna + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4 + b_5 lnX_5 + b_6 lnX_6 + b_7 lnX_7 + b_8 lnX_8 + b_9 lnX_9 + u_i \tag{3}$$

Here,

Y = Yield of Mustard (Kg/ha),

a= Constant or Intercept of the function,

X_1= Human labour Cost (Tk./ha),

X_2 = Irrigation Cost (Tk./ha)

X_3 = Machinery Cost (Tk./ha)

X_4 = Seed (Kg/ha),

X_5 = Urea (Kg/ha),

X_6= TSP (Kg/ha)

X_7= MoP (Kg/ha)

X_8= Zinc Sulphate (Kg/ha)

X_9= Cow dung (Kg/ha)

bi = Coefficient of respective variables,

ln = Natural logarithm,

ui = Error term and

i = l, 2 ... n

<center>**CHAPTER IV**</center>

<center>**SOCIO ECONOMIC STUTUS OF MUSTARD PRODUCING FARMERS**</center>

4.1 Introduction

This chapter deals with the socioeconomic characteristics of the sample farmers. Socioeconomic characteristics of the farmers are important in influencing production planning. People differ from one another in many respects. Behaviour of an individual is largely determined by his/her characteristics. There are numerous interrelated and constituent attributes that characterize an individual and profoundly influence development of his/her behaviour and personality. However, it was not possible to collect detailed information regarding the demographic characteristics of the sample farmers. Some important characteristics were considered in this study such as family size and composition, educational status, occupation, and ownership pattern etc. A brief description on these aspects is presented under the following sections.

4.2 Age Distribution of the Sample Mustard Farmers

The age of the sample farmer plays an important role in describing the demographic profile of the area. Mustard cultivation is also influenced by the age of the farmer. The age of a farmer was measured from his birth to the time of interview. It was calculated using actual years. Farmers in the study area were divided into three categories based on their age.

a) Young aged farmers (20-35) years,

b) Middle aged farmers (36-45) years and

c) Old aged farmers (46-above) years.

<center>21</center>
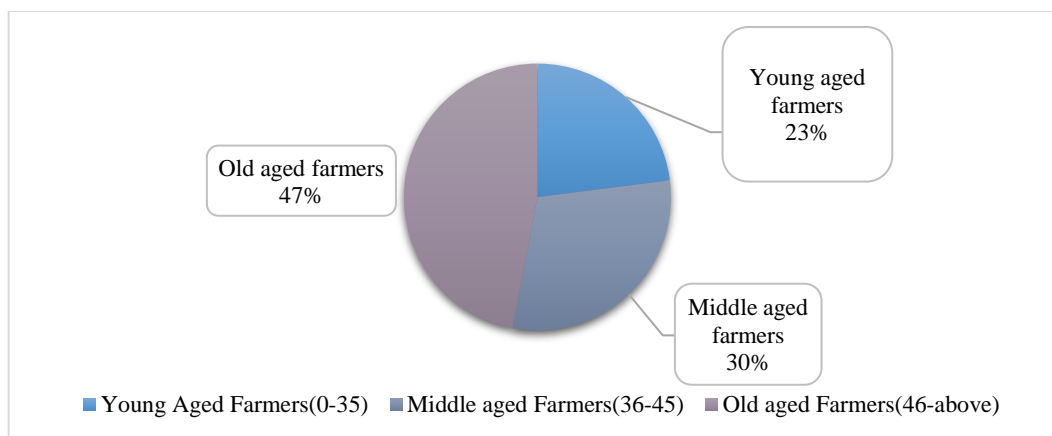
Figure 4.1 Age Distribution of the Sample Farmers

Age distribution of the selected mustard Farmers is presented in (Figure 4.1). It is evident from the table that the highest number of mustard Farmers (47%) belongs to the Old aged group. 30% belongs to middle aged and 23% belongs to the young aged group.

4.3   Educational Status of the Mustard Producing Farmers

Education is commonly regarded as a barometer of a community's social progress. It is critical in reducing poverty and inequality, improving health, and facilitating the application of knowledge. Efficiency is synonymous with education. Farmers' education aids in improving their skill and productivity. Education plays a critical role in accelerating agricultural development and has a significant impact on new farming technology and scientific knowledge.

Table 4.1 Literacy Status of the Mustard Farmers

Literary level	Frequency	Percent
Writing name	12	12.0
Primary	33	33.0
Secondary	32	32.0
HSC	7	7.0
Graduate	8	8.0
Uneducated	8	8.0
Total	100	100.0

Table 4.1 shows that about 12 percent of mustard farmers can write their names, 33 percent have a primary education, 32 percent have a secondary education, 7 percent have completed their H.S.C level education, 8% have completed their graduate level education, and 8% have no education at all.

4.4   Family Size of the Sample Farmers

Data presented in Figure 4.2 indicate that most of the respondent's family (66%) belonged to medium size family (5-8) category, (1-4) considered as small size family (24%) while only about 10% of the respondents belonged to large family size (>8) category. The average family size in total was 4.85. Where 2.45 was the average male member and average female member was 2.10.
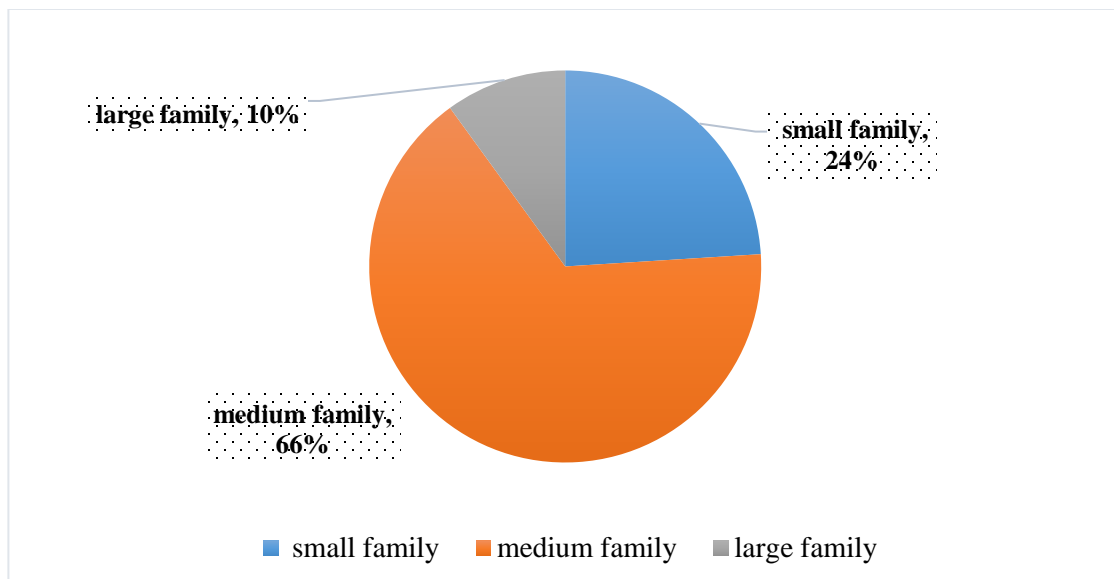
Figure 4.2 Family Size of the Sample Farmers

4.5   Nature of Cultivation Mustard Farmers

An individual's occupation was defined as the work that he did for the entire year. The distribution of occupations is fascinating because it varies so much depending on how involved people are and how much money they make at their current job. In addition to mustard cultivation, the farmers in this study worked in a variety of jobs. Mustard farming was discovered to be mustard farmers' primary source of income. Others had the opportunity to participate in other activities. The occupation status of the sample farmers is depicted in (Table 4.2).

Table 4.2 Occupational Status of mustard Farmers

Nature of Cultivation	Percentage (%)
Mustard + Others Crops	64
Mustard + Livestock	15
Mustard + Fish Culture	7
Mustard + Business	6
Mustard + Labour	6
Mustard + Services	2
Total	**100**

Source: Field Survey, 2020

It is obvious from the Table 4.2 that 64 percent farmers were involved in mustard and Others crops cultivation. Around 15% involved in mustard and livestock farming, 7% involved in mustard and fish cultivation, 6% involved in mustard and business, 6% involved in mustard cultivation along with day labour and about 2% involved in mustard cultivation and other services.

4.6   Mustard Land Ownership Pattern of Selected Sample Farmers

Due to inheritance laws, most agricultural lands in Bangladesh are divided and subdivided into small plots. Mustard-producing farmers' ownership patterns were divided into three categories: single ownership, leased in, and mortgaged in. In mustard farming, about 75% of mustard farmers were sole proprietors, 11% were leased in owners (Table 4.3).

Table 4.3 Category of Mustard land ownership

Category	Percentage (%)
Single Ownership	75
Leased in	11
Leased out	1
Mortgage in	10
Mortgage out	3
Total	100

4.7 Credit Facilities of the Respondent

Available amount of funding is an important factor for any kind of farming. The sources of credit facilities for mustard producing farmers include Banks, NGOs, Relatives, Friends, Neighbors and their own fundings. The following Figure 4.3 shows that about 55% of the respondents took credit and another 45% did not take any credit or loan.
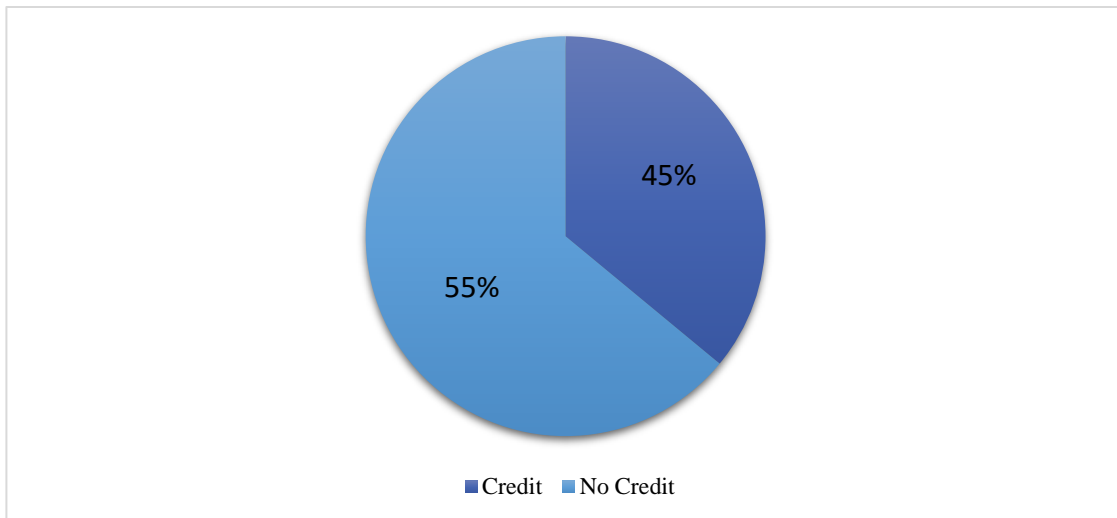
Figure 4.3 Credit Facilities of the Farmers

4.8 Size of Land Holdings of the Sample Farmers

In this study, the farm size is classified based on the cultivated land during the survey period and the operational definitions of small medium and large farms have been considered as, farmers having land of 50 to 100 decimal consider as small farmers, 101 to 250 decimal as medium farmers and 251 and above as large farmers (Kazal *et*. *al*., 2013). According to the sample farmers, land holdings include own land, homestead area, pond owned, pond area, leased in, leased out, mortgage in, and mortgage out. Total land holdings = (own land + cultivated land + homestead + pond + leased in + mortgage in) – (leased out +mortgage out).

Table 4.4 Farming category of the sample farmers

Land Holdings and Category	Percent
Small sized farm (>50-100 decimal)	19
Medium size farm (100-250 decimal)	53
Large size farm (251-above decimal)	28
Total	**100**

Source: (BBS, 2008)

4.9 Training Facilities of the Respondents

Different organizations like Bangladesh Agricultural Development Corporation (BADC), Rural Reconstruction Foundation (RRF), Jagoroni Foundation etc. provide training facilities to the mustard farmers. Figure 4.4 shows that about 70% of the sample farmers did not take any training and 30% took training on mustard cultivation.
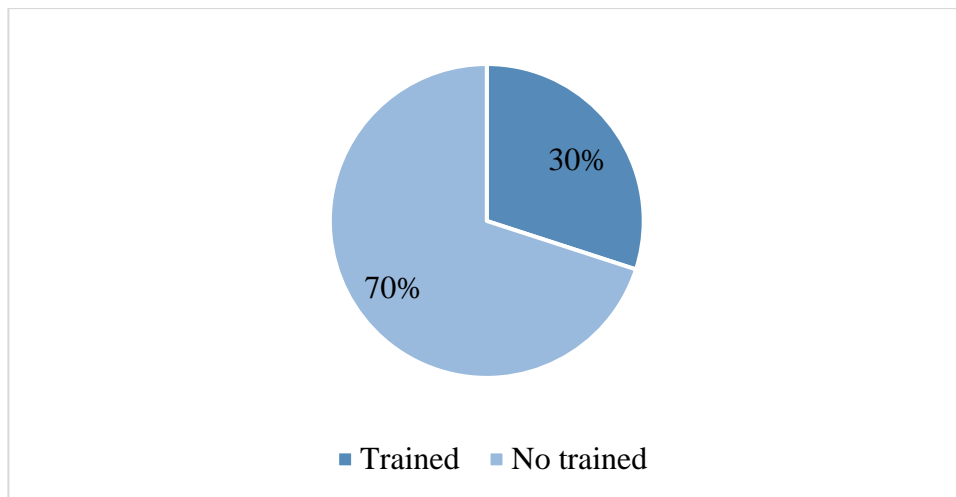
Figure 4.4 Training Facilities of Sample Farmers

4.10 Economic Situation of the Mustard Cultivars

Yearly income has increased greatly after mustard cultivation. In the study area income ranges from 1 lac to above 3 lac. So, the yearly income category of the respondents were

divided into less than 1 lac, 1-3 lac and above 3 lac. Only 21% farmer's yearly income was less than Tk. 1 lac. 65% farmers' yearly income was between TK. 1 lac to TK. 3 lac. 14% farmers' yearly income was greater than Tk.3 lac. (Table 4.5)

Table 4.5 Yearly Income of the Farmers

Income category	Percentage (%)
Less than 1 Lac	21
1 Lac to 3 Lac	65
Above 3 Lac	14
Total	**100**

Source: Field Survey, 2020

4.11   Expenditure of the Sample Farmers

Mustard farmers spend different amounts of money each year. The expenditures of mustard farmers were classified as follows in this study: cloth, house repairs, medical purposes, food, festival, and others.
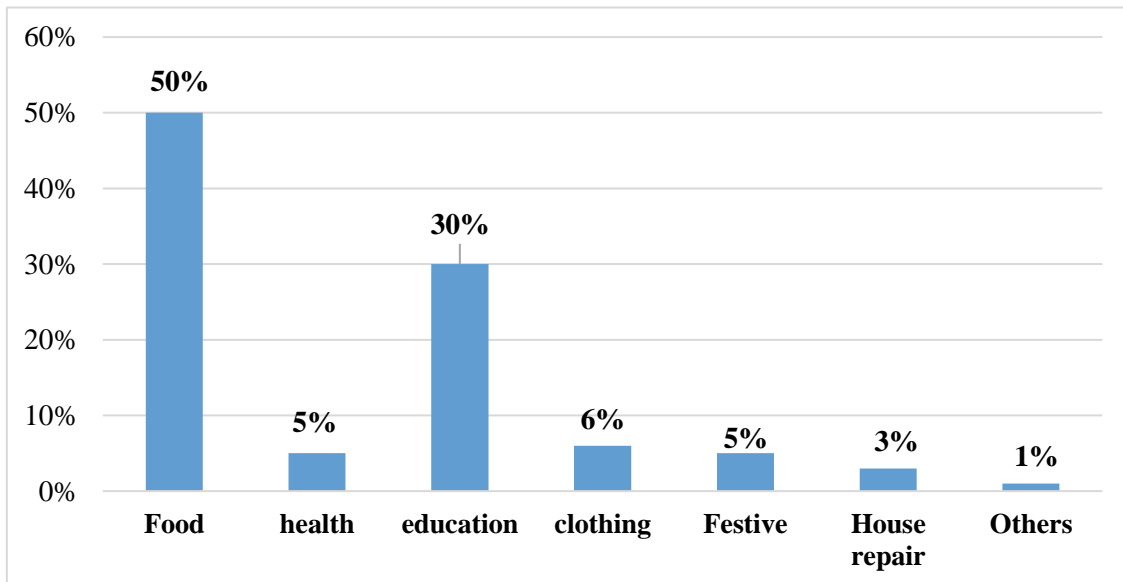
Figure 4.5 Expenditure of Mustard Cultivating Farmers

On mustard cultivation, Figure 4.5 represents that food, education, cloth, house repair, medical purposes, festival, and other expenditures accounted for 50 percent, 30 percent,

6 percent, 3 percent, 5 percent, 5 percent, and 1 percent of mustard cultivating farmers' expenditures, respectively.

4.12 Concluding Remarks

This chapter analyzed the socioeconomic attributes of the sample farmers. The findings of analysis clearly indicate the socioeconomic characteristics from each other in respect of age distribution, education, occupation, ownership pattern, training, credit etc.

CHAPTER V

COST AND RETURN FROM MUSTARD CULTIVATION

5.1   Introduction

This chapter tries to figure out how much it costs to grow mustard, how much it pays back, and how profitable it is. Fertilizer, seed, labour costs, land costs, and cost of operating capital @12% in 4 months are among the costs. On the other hand, the gross return on mustard cultivation included both product and by-product sales. All calculations were done hectare by hectare.

Cost is important in every production process because it helps farmers make the best decisions. This chapter focuses on the estimation and analysis of mustard production costs. The costs were divided into two categories: variable costs and fixed costs. Most of the inputs were valued at current market rates, as well as government rates in the study area at the time of the survey, or the prices at which farmers purchased the inputs. However, for some unpaid inputs, such as family labour, a non-cash price was paid, making pricing extremely difficult. The rule of opportunity cost was applied in these cases.

Gross return, gross margin, net return, and undiscounted benefit-cost ratio are discussed in this chapter in terms of mustard cultivation per hectare yield. As a result, a financial return on mustard production was calculated from the perspective of farmers. For the study period, all returns were accounted for. Below is a brief description of how the individual costs and returns in this study were calculated. For analytical advantages, the cost items were classified into two categories: a) Variable cost b) Fixed cost

5.2   Variable Costs of Mustard Cultivation

5.2.1   Human labour cost

One of the most important variable inputs in the manufacturing process is human labour. Various activities and management of the selected farms, such as land preparation, weeding, sorting, grading, harvesting, and so on, require human labour. Human labour was divided into two categories: hired labour and family labour. Calculating the cost of

hired labour is simple. The opportunity cost concept was used to calculate the cost of family labour.

The opportunity cost of family labour was assumed to be wage rate per man in this study, i.e., the wage rate paid by the farmers to hired labour for working a man-day. The labour of women and children was converted into man-equivalent day by presenting a ratio of 2 children day = 1.5 women days = 1 man equivalent day (Miah, 2010). In this study a man-day considered to be 8 hours of work. For avoiding complexity, average rate has been considered. Labour wage rate varies with respect to different seasons. In the study area it varied from Tk. 450 to 550 per man-days. Thus, the computed average rate was Tk. 500 per man-days for mustard cultivation. Use of human labour and its relevant cost incurred were shown in (Table 5.1). Per hectare labour cost for mustard cultivation was Tk. 6663 which constituted 20.2% of total variable cost respectively.

Table 5.1 Per Hectare Variable Cost of Mustard Cultivation

Variable Cost Items	Unit	Quantity	Price	Cost (Tk)	Percentage of total variable
Human Labour	Man-days	13.3	500.0	6663.0	20.2
Irrigation	Tk.			3909.0	11.8
Land Preparation	Tk.			1150.0	3.5
Machinery	Tk.			1451.0	4.4
Seed	Kg	7.9	164.9	1305.2	4.0
Urea	Kg	197.7	16.0	3163.1	9.6
TSP	Kg	148.3	21.5	3182.0	9.6
MoP	Kg	125.1	15.9	1992.8	6.0
Gypsum	Kg	119.8	11.3	1356.1	4.1
Zinc Sulphate	Kg	7.4	138.1	1020.9	3.1
Zinc	Kg	8.4	153.4	1288.6	3.9
Cow dung	Kg	2552.9	0.7	1825.6	5.5
Pesticide	Tk.			3531.6	10.7
Interest on Operating Capital	Tk.			1184.7	3.6
Total Variable Cost				**33023.7**	**100.0**

Source: Field Survey, 2020

5.2.2 Cost of irrigation

Water is needed at the appropriate time for the proper growth of mustard. So, cost of irrigation was computed based on prevailing market rate. Average per hectare irrigation cost of mustard was calculated Tk. 3909 which was 11.8 percent of total variable cost (Table 5.1).

5.2.3   Land preparation cost

Land preparation cost incurred was shown in (Table 5.1). The per hectare land preparation cost for mustard was Tk. 1150 which constituted 3.5 percent of total variable cost.

5.2.4   Machinery cost

Machinery cost incurred was shown in (Table 5.1). The per hectare machinery cost for mustard was Tk.1451 which constituted 4.4 percent of total variable cost. Machinery cost of mustard was a little higher than usual cost.

5.2.5   Seed cost

Seed is a major input of mustard cultivation in the study area. There was a variation in the per unit price of seed from location to location and time to time. But cost was calculated based on actual price paid by the farmers. The average seed for mustard cultivation needed 7.92 kg/ha and average price of seed is Tk 164.89/kg. The per hectare average costs of mustard cultivation seed was estimated Tk 1305.23 which constituted 4.0 percent of total variable cost (Table 5.1). Almost all the farmers collected seed from previously cultivated and sometimes they purchased seed from local market.

5.2.6   Cost of fertilizer

Fertilizer is an important input for mustard cultivation. mustard farmers applied various kinds of fertilizer such as Urea, TSP, MoP, Gypsum, Zinc sulphate, Zinc, Cow dung etc. Uses of these fertilizers influence in increasing the growth of mustard. The cost of fertilizer was estimated by using the prevailing market rate which was actually paid by the farmers. The prices of these fertilizers were assumed to be same in all categories of farms. The average prices of Urea, TSP, MoP, Gypsum, Zinc sulphate, Zinc, Cow dung were Tk.164.9 per kg, Tk. 16 per kg, Tk. 21.5 per kg, Tk 15.9 per kg, Tk 11.3 per kg, Tk. 138.1, Tk153.4 per kg, Tk 0.7 per kg respectively in the study area.

The estimated costs of fertilizer are shown in (Table 5.1). It was observed that mustard farmers incurred cost of Tk. 3163.1 for Urea, Tk. 3182 for TSP, Tk. 1992.8 for Mop on Tk 1356.1 for Gypsum, Tk 1020.9 for zinc sulphate, Tk 1288.9 for Zinc, Tk 1825.6 for Cow dung on an average they constituted 9.6 percent, 9.6 percent, 6.0 percent, 4.1 percent, 3.1 percent, 3.9 percent and 5.5 percent of total variable cost respectively.

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5.2.7 Cost of pesticides

Costs of Insecticides incurred were shown in (Table 5.1). The average per hectare costs of insecticides for mustard cultivation was Tk. 3531.6 which constituted 10.7 percent of total variable cost.

5.2.8 Interest on operating capital

Interest on operating capital was determined based on opportunity cost principle. The operating capital represented the investment on different farm operation over the period because all the cost was not incurred at the beginning or at any single point of time. The cost was incurred throughout the whole production period; hence, at the rate of 12 percent per annum interest on operating capital for four months was computed mustard production (Interest rate was taken according to the bank rate prevailing in the market during the study period). The following standard formula was used to calculate interest on operating capital. (Miah, 1992).

Interest on Operating Capital (IOC) = Alit

Al= Total investment/3,

t= Time period of a cycle

i= interest rate which was 12 percent per year during the study period. The interest on operating capital of mustard cultivation was estimated at Tk. 1184.74 which constituted 3.6 percent share of total variable cost (Table 5.1).

5.3 Fixed Costs

5.3.1 Land use cost

Farmers used the land in accordance with the terms of the lease agreement. The term leasing cost refers to the cost incurred by mustard cultivators in obtaining a land lease that would be used for mustard production for a set period. Leasing cost varies from one place to another depending on the location, soil fertility, topography of the soil and distance from the sources of water etc. Leasing cost was the single highest cost item in the study areas. The value of own land was calculated as opportunity cost concept. The rental value of per hectare land of mustard was estimated Tk.25500 total fixed cost. (Table 5.2).

Table 5.2 Per Hectare Fixed Cost of Mustard Cultivation

Fixed Cost Items	Cost (Tk/ha)	Percentage
Land use cost	25500	100
Total Fixed Cost	25500	100

Source: Field Survey, 2020

5.4 Total Fixed Cost

5.4.1 Total costs

In the study area it was estimated that per hectare total variable cost for mustard cultivation was Tk. 33023 which is comprises about 56 percent of total costs and total fixed was 25500 which comprises about 44 percent of total cost (Table 5.3).

Table 5.3 Per Hectare Total Cost of Mustard Cultivation

Cost Items	Cost (Tk./ha)	Percentage of total cost
a. Total variable cost	33023	56
b. Total fixed cost	25500	44
Total cost (a+b)	**58523**	**100**

Source: Field Survey, 2020

5.5 Returns of Mustard Cultivation

5.5.1 Gross return

Per hectare gross return was calculated by multiplying the total amount of production by their market prices. On average farmers in the study area harvested 1414.23 kg of mustard seed per hectare. Gross return was found to be Tk 94870 per hectare. On an average gross margin and net return of all was found to be Tk. 64067.45 and Tk. 38567.45 per hectare respectively (Table 5.4).

Table 5.4 Gross Margin and Benefit Cost Ratio of Mustard Cultivation

Sl. No.	Items		Amount (tk./ha)
A.	Gross Returns (GR)		
	Yield (Kg/ha)	**Price/kg**	89732.89
	1414.23	63.45	
	By-product (Tk./ha)		5137.89
	Gross Returns		94870.78
B.	Total variable costs (TVC)		33023.7
C.	Total fixed costs (TFC)		25500.00
D.	Total costs (TVC+TFC)		58523.70
E.	Net return (GR-TC)		36347.08
F.	Gross margin (GR-TVC)		61847.08
G.	Benefit-cost Ratio (BCR)= GR/TC (Full cost basis)		1.62
K.	Benefit-cost Ratio (BCR)= GR/TVC (Cash cost basis)		2.87

Source: Field Survey, 2020

5.5.2 Net return

Farmer's income is the general term for net return. Net return is an important factor in determining the profitability of mustard production. The difference between gross return and total costs is known as net return. Per hectare net return of mustard was estimated at Tk. 36347.08 indicates that mustard production is profitable for this study area (Table 5.4).

5.5.3 Gross margin

Farmers usually want to gain maximum return over variable cost of production. The probable reason may be that estimation of fixed cost of production is difficult to determine. Thus, gross margin analysis has been considered to calculate the relative

profitability of mustard cultivation. The gross margin of mustard cultivation was estimated at Tk. 61847.08 (Table 5.4).

5.5.4 Benefit cost ratio (BCR)

Benefit cost ratio was calculated by dividing gross return by total cost. It implies return per taka invested. It helps to analyze financial efficiency of the farm. It was evident from the study, the benefit cost ratio on full cost basis of mustard cultivation was 1.62 implying that Tk. 1.62 would be earned by investing Tk. 1.00 for mustard production. Again, the benefit cost ratio on cash cost basis was 2.87 for mustard cultivation. So, mustard cultivation was found profitable for farmers of this study areas (Table 5.4).

5.6 Concluding Remarks

Farmers benefit from mustard cultivation because it yields higher profits. Though mustard cultivation requires a large initial investment, it is gradually gaining popularity in the country due to its high yield potential and high demand in the international market. Farmers in the study stated that higher yield and income encouraged them to continue growing mustard.

CHAPTER VI

FACTORS AFFECTING YIELDS 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   Functional Analysis for Identifying the Factors Affecting in Production

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

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

6.3   Estimated Values of the Production Function Analysis

Estimated values of the co-efficient and related statistics of the Cobb-Douglas production function of mustard cultivation are presented in (Table 6.1). Major characteristics and interpretations of the values and the major findings are presented below:

      a. F-value was used to measure the goodness of fit for different types of inputs.

      b. The coefficient of multiple determinations (R^2) indicates the total variations of output explained by the independent variables included in the model.

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

d. Stage of production was estimated by returns to scale which was the summation of all the production elasticity of various inputs.

The estimated coefficients and related statistics of the Cobb-Douglas production function for mustard cultivation are shown in (Table 6.1).

Table 6.1 Cobb-Douglas regression estimates for Mustard production

Variables	Co-efficients	Standard error	T-value
Constant	3.37***	0.56	5.96
Human Labour	0.02	0.06	0.30
Irrigation	0.08**	0.04	2.07
Machinery	0.09	0.08	0.87
Seed	0.34***	0.09	3.61
Urea	0.16*	0.09	1.78
TSP	0.16*	0.08	1.87
Mop	-0.11	0.10	-1.06
Zinc Sulphate	0.24***	0.06	3.91
Cow dung	0.02	0.06	0.30
Adjusted R^2		0.93	
F-value		155.00	
Return to scale		0.98	
Observations (n)		100	

Note: *** indicates Significant at 1%, ** indicates significant at 5% and * indicates 10% level of significance.

6.4   Interpretations of Results

Effect of human labour (X_1): From the Table 6.1 it was found that the value of coefficient of the human labour was positive and insignificant for mustard. The value of the coefficient was .02 indicating that it has no severe effect on the production of mustard.

Effect of irrigation(X_2): It was observed from the regression analysis that the coefficient of the irrigation was positive and significant at 5 percent level of significance which indicates that at 1 percent increase in the application of irrigation remaining other factors constant would increase the yield of mustard by .08 percent (Table 6.1).

Effect of machinery(X_3): From the Table 6.1 it was found that the value of coefficient of the machinery was positive and insignificant for mustard. The value of the coefficient was 0.07 indicating that it has no severe effect on the production of mustard.

Effect of Seed(X_4): It was observed from the regression analysis that the coefficient of the seed was positive and significant at 1 percent level of significance which indicates that at 1 percent increase of seed remaining other factors constant would increase the yield of mustard by 0.34 percent (Table 6.1).

Effect of Urea(X_5): It was observed from the regression analysis that the coefficient of the urea was positive and significant at 10 percent level of significance which indicates that at 1 percent increase in the application of urea remaining other factors constant would increase the yield of mustard by 0.16 percent (Table 6.1).

Effect of TSP(X_6): It was observed from the regression analysis that the coefficient of the TSP was positive and significant at 10 percent level of significance which indicates that at 1 percent increase in the application of TSP remaining other factors constant would increase the yield of mustard by 0.16 percent (Table 6.1).

Effect of MoP(X_7): From the Table 6.1 it was found that the value of coefficient of the MoP was negative and insignificant for mustard. The value of the coefficient was -0.11 indicating that it has no severe effect on the production of mustard.

Effect of $ZnSO_4$(X_8): It was observed from the regression analysis that the coefficient of the $ZnSO_4$ was positive and significant at 1 percent level of significance which indicates

that at 1 percent increase in the application of $ZnSO_4$ remaining other factors constant would increase the yield of mustard by 0.24 percent (Table 6.1).

Effect of Cow dung(X_9): It was found that the value of coefficient of the Cow dung was positive and insignificant for mustard. The value of the coefficient was 0.02 indicating that it has no severe effect on the production of mustard (Table 6.1).

6.5   Adjusted R^2

Here the term adjusted means adjusted for the degrees of freedom. The adjusted R^2 for mustard cultivation was found to be 0.93 which indicates that about 93 percent of the variations of the output were explained by the explanatory variables included in the model (Table 6.1).

6.6   Returns to Scale in Mustard Cultivation

Returns to scale reflect the degree to which a proportional change in all inputs caused change in the output. It shows three types of value:

1. Constant Return to scale (=1)
2. Increasing Return to scale (>1) and
3. Decreasing Return to scale (<1)

The summation of all the production coefficients of mustard cultivation was equal to 0.98. This means that production function for mustard cultivation exhibits decreasing returns to scale. This means that, if all the variables specified in the model were increased by 1 percent, yield would also be decreased by 0.98 percent for mustard (Table 6.1).

6.7   F-value

The F-statistic was computed to denote the overall goodness of fit of any fitted model. The F-value for mustard cultivation was estimated at 155 which was significant at 1 percent level. It means that the explanatory variables included in the model were important for explaining the variation in yield of mustard cultivation (Table 6.1).

6.8   Concluding Remarks

Except for the insignificant effects of machinery cost, cow dung, the Cobb-Douglas production function model revealed that the included key variables had a significant and

positive effect on mustard cultivation. As a result, key factors in the mustard cultivation production process had a positive effect.

CHAPTER VII

CONSTRAINTS OF MUSTARD CULTIVATION

Agriculture is an integral part of Bangladesh's economy. Farmers in Bangladesh are currently dealing with a variety of economic and technical issues during their harvesting season. The purpose of this study was to identify some of the major constraints to mustard cultivation.

1.   Economic Problems

2.   Technical Problems

3.   Natural Problems

4.   Marketing problems

7.1   Economic Constraints

Capital, inputs, financial status, price, wage, and other economic situation that farmers face in producing mustard were among the issues they faced. In the following section, we'll go over these drawbacks.

7.1.1   Lack of capital

Farmers in the study area were mostly poor. Majority of the farmers were of medium size, and their financial situation was volatile. Around 85% of the farmers in the study area said they didn't have enough operating capital. Among all the economic problems, the lack of capital is the most significant problem.

7.1.2   High wage rate

Another issue for the study's sample farmers was the high wage rate. The wage rate was extremely high during harvest season. According to Table 7.1, this issue impacted approximately 52 percent of farmers. A higher wage rate was ranked as the second most serious issue among economic issues. All farmers faced a problem with high wage rates during mustard cultivation.

7.1.3 Low price of output

To meet their household expenses, most farmers were forced to sell their produce shortly after harvest. Table 7.1 shows that 72 of the farmers were affected by this issue. The third most serious issue among the economic issues was the low price of output.

Table 7.1 Economic problems of Mustard cultivation

Problems	No. of Respondents	Percentage
Lack of capital	85	85
High wage rate	52	52
Low price of output	72	72
High price of inputs	37	37
Lack of credit facilities	49	49

7.1.4 Higher input price

Table 7.1 shows that 37% farmers faced the problem of higher input price. Among all the farmers faced the problem of high input price during mustard cultivation.

7.1.5 Lack of credit facilities

About 49% of the farmers opined they did not get adequate credit facilities from the authority. Most of the farmers faced problem of lack of credit facilities during mustard cultivation (Table 7.1).

7.2 Technical Problems

Technical problems are related to production techniques and technologies which are discussed below:

7.2.1 Lack of machinery support in proper time

Mustard is sown and harvested in a very short amount of time by farmers. It's critical to have the right equipment on hand when it comes to land preparation. The study area's farmers lacked adequate machinery for land preparation and threshing. Approximately

75% of all farmers stated that they did not receive timely machinery support. It came out on top of all technical issues (Table 7.2).

7.2.2 Shortage of labour in peak period

Mustard production relies heavily on having enough labour and experience. There was a severe shortage of hired labour in the study area during harvest season. Table 7.2 shows that approximately 64% of all farmers complained about insufficient labour during land preparation, weeding, and mustard harvesting. Among all technical issues, it was the second most serious.

Table 7.2 Technical Problems for Mustard farmers

Problems	No. of Respondents	Percentage	Rank
Lack of machinery in proper time	75	75	1
Shortage of labour in peak period	64	64	2
Lack of cooperation by block supervisor	53	53	3
Low yield	50	50	4
Lack of quality seed	43	43	5
Lack of technological knowledge	35	35	6
Fertilizer crisis in time	32	32	7
Problems of harvesting and drying	30	30	8

7.2.3 Lack of cooperation by block supervisor

Farmers in the study area complained that instead of receiving assistance, they did not see the block supervisor. They claimed that their region's agricultural assistance did not provide them with adequate assistance. Table 7.2 shows that about 53% of all farmers reported that they did not get support by BS in proper time. As a result, in the study area lack of cooperation by block supervisor ranked 3rd most acute problem among the technical problems.

7.2.4 Low yield

Low yield is a major problem for all the farmers in all kinds of agricultural crops. In the study area Table 7.2 shows that 50% of all farmers faced this problem. They reported that they did not get desire amount of output. It ranked 4th among all the technical problem.

7.2.5 Lack of quality seed

Table 7.2 shows that about 43% of all farmers faced this problem. Lack of quality seed ranked 5th among all the technical problem.

7.2.6 Lack of technological knowledge

Agriculture is a branch of science that deals with the continuous production of food and fibers. As a result, proper knowledge and technology are required to obtain the desired results from the soil as well as nature. In the study area Table 7.2 shows that about 35 % of all farmers faced this problem. Thus, lack of knowledge of improved technology ranked 6th among all the technical problems.

7.2.7 Fertilizer crisis

In the study area some farmers faced fertilizers crisis. About Mustard production relies heavily on having enough labour and experience. There was a severe shortage of hired labour in the study area during harvest season. Table 7.2 shows that approximately 64% of all farmers complained about insufficient labour during land preparation, weeding, and mustard harvesting. Among all technical issues, it was the second most serious.

Table 7.2 of all farmers faced this problem. It ranked 7th among all the technical problems.

7.2.8 Problems of harvesting and drying

Harvesting and drying is a problem for all the farmers in all kinds of agricultural crops. In the study area, Table 7.2 shows that 30% of all farmers faced this problem. They reported that they did not get desire amount of output. It ranked 4th among all the technical problem.

7.3   Natural Problems

Farmers in the study area faced several serious environmental issues. Natural problems are those that cannot be protected, but for which precautions can be taken to mitigate losses. These difficulties are listed below:

7.3.1   Non suitable temperature

The temperature has been steadily rising over the last year. As a result, farmers face difficulties during crop production. In the study area, Table 7.3 shows that about 70% of all farmers reported this problem. The problem of non-suitable temperature ranked 1st most acute problem among all the natural problems.

7.3.2   Seasonal change

Seasonal change that is not predictable is a major issue in the agricultural sector. It causes problems for farmers in the study area during crop production. According totable 7.3, approximately 65 percent of all farmers reported this issue. It came in second place out of all the natural problems.

7.3.3   **Attack of insect and disease**

Mainly insect and disease are active on the discomfort climate and environment of crops. Table 7.3 shows that about 56% of all farmers reported this problem. The problem of attack and diseases into the field ranked 3rd acute problem among all the natural problems.

Table 7.3 Natural Problems for Mustard farmers

Problems	No. of Respondents	Percentage (%)	Rank
Non suitable Temperature	70	70	1
Seasonal change	65	65	2
Attack of insect and disease	56	56	3

7.4   Marketing Problems

Farmers face marketing issues primarily after crop cultivation, when it is necessary to gain benefit during post-harvest periods. In terms of marketing, the sample farmers in the study area have some issues. Table 7.4 showed that regarding marketing, Seasonality in

demand (reported by 98 percent of farmers), frequent power outages affecting irrigation of the standing crop, adequate cold storage facilities (reported by 92 percent of farmers), price fluctuations (reported by 93 percent of farmers), and transportation and communication were among the most common constraints expressed by the sample growers (reported by 24 percent farmers). One of the most serious issues facing large farmers is the lack of a proper marketing channel for reaching the available market. About 32% of respondents said there was no available market for selling their product at a fear price.

Table 7.4 Marketing problems faced by the mustard cultivators

Relating to Marketing Problems	No. of Respondents	Percentage
Price fluctuation	93	93
Seasonal demand	98	98
Transportation and communication	24	24
Lack of storage or container	92	92
Low price of the product	32	32

Source: Field Survey, 2020

7.5   Suggestions to Overcome the Problems

Mustard farmers who identified their own problems also proposed ways to improve the current system of mustard production and pricing. To address the issues raised, the farmers proposed the following measures.

7.5.1   Supply of credit on easy terms

Farmers require cash at the time of cultivation. As a result, mustard farmers should be able to access institutional credit to increase production volume. The government should make such services available through Bangladesh Krishi Bank (BKB) and other commercial banks.

7.5.2 Supply of inputs and machinery

Mustard farmers should be provided with an adequate number of inputs and machinery, including HYV mustard seeds, on a timely basis at subsidized prices by the government and responsible authority, agriculture extension officer (AEO), and block supervisors (BS). Mustard growers should also be assured that fertilizer and pesticides are delivered on time and at a reasonable price.

7.5.3 Improvement of transportation facilities

Transportation facilities in the study areas should be improved. Village roads should be prioritized for development, with at least brick-bedded roads to allow rickshaws and automobiles to freely move. It would also assist in transportation cost savings. Local government administration may be able to create such facilities.

7.5.4 Formation of farmers' organization

Farmers' organizations must be established in order to improve farmers' bargaining power. It would assist farmers in dealing with middlemen and ensuring a higher return on mustard production.

7.5.5 Improvement of market facilities

The appropriate Government authorities should arrange for market facilities such as a pucca floor, a tin shed, drainage, water supply, and electricity supply, among other things, to facilitate proper mustard markets in the study area.

7.6 Concluding Remarks

Of course, aforementioned issues are intertwined, and as a result, they must be addressed holistically through integrated programming for the overall development of mustard cultivation. The problems that farmers face was ranked according to percentages. Seasonal demand, a lack of cold storage, and price fluctuations were reported as the main constraints for mustard production by the majority of farmers. Huge investment requirements, a lack of cold storage, and seasonal demand were reported as the main constraints for mustard production by the majority of farmers.

CHAPTER VIII

SUMMARY AND CONCLUSION

This chapter summaries the thesis and provides conclusions according to the important findings of the study and suggests some recommendations for mustard production.

8.1   Summary

Mustard is Bangladesh's most important oil crop, coming in second only to soya bean and groundnut as the world's most important oilseed crops. The profitability, resource efficiency, and marketing outlet of mustard production are all critical to its future success. Individual farmers and researchers who will conduct similar studies in the future will benefit from the current study, which will encourage them to conduct more comprehensive and detailed investigations in this field. It will help planners and policymakers develop micro-level policies for the development of oilseeds in the country, especially mustard production. Keeping this in view the study was undertaken with the following specific objectives.

a) To document the socio-economic profile of mustard farmers on study area in Nilphamari district.
b) To examine profitability of mustard production in the study area.
c) To determine the factors affecting of mustard cultivation.
d) To find out the major constrains of mustard cultivation at farm level and suggest some policy guideline.

To achieve the study's objectives, 100 mustard growers were chosen at random from the study area. During the months of March and April 2020, the researcher conducted personal interviews with the respondents to obtain the necessary information. A preliminary survey was conducted in Nilphamari Sadar Upazila to achieve the study's objectives. According to preliminary findings, the study will focus on two villages: Sangolshi, Sonaray. After the data collection was completed, the raw data were entered into the computer using the appropriate software, such as MS Excel, MS Word, STATA, and SPSS. Using simple statistical measures like means, percentages, and ratios, the tabular technique was used to classify data in order to derive meaningful findings. A

production function analysis was also carried out to explore the contribution and productivity of the individual inputs.

According to the demographic profile of the study area, It is evident from the table that the highest number of mustard farmers (47%) belongs to the Old aged group. 30% belongs to middle aged and 23% belongs to the young aged group. The educational status of the mustard farmers was classified into six categories: Uneducated, Writes name only, Up to primary, Secondary and HSC and Graduate. It is evident from that out of 100 mustard farmers, about 12 percent can write name, 33 percent farmers had primary education, 32 percent farmers had secondary level education, 7 percent farmers had completed H.S.C level education, 8 percent farmers had completed their graduate level education, 8 percent had no education at all. The average family size in total was 4.85. Where 2.45 was the average male member and average female member was 2.10. It is evident that 64 percent farmers were involved in mustard and other crops cultivation. Around 15% involved in mustard and livestock farming, 7% involved in mustard and fish cultivation, 6% involved in mustard and business, 6% involved in mustard cultivation along with day labour and about 2% involved in mustard cultivation and other services. Land holding of small sized farm was (50-100) decimal, medium size farm was around (100-250) decimal, large size farm was (251-above) decimal. The mustard farmers had maximum expenditure on food and education. To determine the profitability of mustard cultivation both the inputs and outputs were valued at market price during the study period. Cost and returns were worked out to estimate profitability of mustard production. Per hectare total cost, gross return, net return and gross margin were Tk. 58523.70, Tk. 94870.78, Tk. 36347.08 and Tk. 61847.08. Undiscounted benefit cost ratio of mustard was 1.62 (Full cost basis) and 2.87 (Cash cost basis) respectively.

To determine the effects of key variable inputs, the Cobb-Douglas production function model was used. To explain the gross yield of mustard cultivation, the most important explanatory variables were included in the model. Most of the variables in the mustard cultivation function were significant in explaining the yield except the insignificant effect of human labour, Machinery, Mop and Cow dung. The coefficient with expected sign indicates the selected inputs contributed positively to the yield. Production function for mustard cultivation exhibits decreasing returns to scale 0.98. This means that, if all the

variables specified in the model were increased by 1 percent, yield would also be decreased by 0.98 percent for mustard. The F-value for mustard cultivation was estimated at 155 which were highly significant at 1 percent level.

One of the purposes of this study was to identify some of the major constraints to mustard cultivation. The findings revealed that mustard growers were primarily confronted with economic, technical, natural, and marketing issues.

Mustard farmers who identified their own problems also proposed ways to improve the current mustard production and pricing system, such as offering favorable credit terms, providing inputs and machinery, improving transportation, forming farmer organizations, and improving market facilities.

8.2   Conclusions and Recommendations

Based on the findings of the study in some selected areas of Nilphamari district the following conclusion may be drawn:

i.   Most of the sample farmers were on old aged group 46 years and above.

ii. Agriculture is the main occupation of most of the farmers.

iii. Among the cost items highest cost incurred for human labour. Production cost is higher for large farmers compare to small and medium farmers.

iv. BCR was found significant on the study area.

v.   Most of the inputs had positive and significant effect on the yield of mustard.

vi. Lack of capital, lack labours in peak period, lack of machinery supply in proper time, higher wage rate, temperature fluctuation are the most severe problems of mustard cultivation in the study area.

It is possible to conclude that mustard farming is profitable. Yield and production will increase if modern inputs and production technology are made available to farmers in a timely manner, allowing farmers to increase their income and improve their living standards. Year-round mustard cultivation has a lot of room for improvement in terms of yield per hectare. Bangladesh has a competitive advantage because of its favorable climate and topography, as well as low labour costs and low capital investment, all of

which are assisting the sector's growth. We can seize markets both at home and abroad by taking advantage of the favorable environment and comparatively better opportunity.

i. As mustard cultivation is profitable in the study area, other farmers can be encouraged to cultivate mustard to the similar kind of climatic condition.

ii. As using more pesticides have some health hazards as well as some negative effect on other cultivable land. It is suggested to use less pesticides for cultivation.

iii. The factors which have negatively affect the production of mustard can be reduced.

iv. Farmers should be given encouraged by DAE officers to use appropriate dose of fertilizer and proper irrigation and allocate their resources optimally and timely for increasing brinjal production.

v. Despite certain restrictions, the study's results suggest that famer should be encouraged to enlarge mustard farming on this particular area because farmers may earn a great net return from mustard farming.

vi. Farmers should be given encouraged by DAE officer to use appropriate dose of insecticides which is badly impact on consumers many disease

vii. The study's results suggest that farmers should be used integrated pest management rather than overused of pesticide.

viii. Increasing mechanical use to reduce the shortage of labour.

ix. For reducing environmental complexity crops insurance for farmer and creating some new both drought and water resistant by several agricultural research institution.

x. Government should take necessary show effects of overused pesticides and taken some measure which have positive significant impact on yield.

xi. The government should take appropriate steps to ensure that farmers receive fair prices for their output.

xii. The government should develop well-structured marketing facilities and ensure good transportation facilities by making infrastructure.

xiii. Mustard farmers had to sell their product at low or moderate price during the harvesting or just after harvest.

xiv. Furthermore, study should emphasis on developing varieties that are appropriate for this arrangement

xv. Farmers should be given training, adequate extension services, information, and the tools they need to deal with new and changing circumstances.

xvi. Additional fact study is needed to identify the appropriate observes for loss reduction in handling, transportation, storage, and processing of quality mustard in the value chain.

The current research was conducted in a small area of the Nilphamari district. Similar studies could be carried out in other parts of the country to get a complete picture of the mustard cultivation in Bangladesh, which will aid in policy formulation.

8.3   Limitations of the Study

It's a common occurrence that no study is complete without some limitations. The research I conducted is extremely important. I did my best during the writing of this paper. Considering the researcher's time, money, and other necessary resources to make the study meaningful and manageable from a research standpoint. However, I ran into several issues while conducting this research. The problems are-

i. Most of the data collected through interview of the farmers so sometimes they were not well-cooperated with the interviewer.

ii. The information was collected mostly through the memories of the respondents which may not always be correct.

iii. Secondary data are extremely difficult to collect and may be contradictory. All the information is not based on valid data.

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APPENDIX

SOME COMMONLY USED ABBREVIATIONS AND SYMBOLS

BBS	Bangladesh Bureau of Statistics
BCR	Benefit Cost Ratio
BER	Bangladesh Economic Review
BRAC	Bangladesh Rural Advancement Committee
JCF	Jagorani Chakra Foundation
et al.	Et alia (for others)
etc.	Et cetra
FY	Financial Year
GDP	Gross Domestic Product
Ha	Hectare
Kg	Kilogram
NGO	Non-Government Organization
SPSS	Statistical Package for the Social Science
STATA	South Texas Art Therapy Association
Tk.	Taka, Bangladeshi currency
%	Percentage
>	Greater Than
<	Less Than

Department of Agricultural Economics

Sher-e-Bangla Agricultural University

An Interview Schedule on

Financial Analysis of Mustard Cultivation in Some Selected Areas of Nilphamari District

Sample No.:

1. Identification of the Farmer:

Name of the Farmer: ………………………………………………………………..

Age: ………….

Village: ………………………………………………………………………………….

Union: ……………………………. Upazilla: …………………………………………

2. No. of the family member:

Male: Female:

3. Socio-economic Information:

Sl. No.	Relation with the Household	Sex (M=1, F=2)	Age	Education (Year of Schooling)	Occupation		Income (Monthly)
					Main	Subsidiary	
1.							
2.							
3.							
4.							
5.							
6.							
7.							

A. Family details:-

B. Farm size / Size of land holdings:

Land Type	Area in Decimal
Own land	
Land for mustard cultivation/ Cultivable land	
Rented In	
Rented Out	
Leased In	
Leased Out	
Mortgage In	
Mortgage Out	

C. Yearly total income:

SI No	Income source	Income
1	Other crops	
2	Livestock Rearing	
3	Business	
4	Small job	
5	Foreign earnings	
6	Others	

4. Production cost

A. Human Labour Requirement and cost

Name of items	No. of labour (quantity)		Total labour	Wage rate (tk/Man-days)	Total cost
	own	Hired			
Land preparation					
Sowing					

Fertilizer application					
Weeding					
Pesticides/Insecticides application					
Irrigation					
Harvesting					
Drying					
Threshing					
Carrying					

B. Machinery Inputs:

Inputs		Unit	Cost/Unit	Total
Power Tiller/Tractor	Owned			
	Hired			
Carrying	Owned			
	Hired			
Other(specify)				

C. Materials and inputs used

Inputs		Unit Price	Mustard	
			Amount (kg/unit)	Taka/unit
Seed	Owned			
	Purchased			
Manure	Owned			
	Purchased			
	1. Urea			
	2. $ZnSO_4$			

Fertilizer	3. TSP			
	4. MP			
	5. Gypsum			
	6. Zinc			
Pesticides				
Insecticides				
Irrigations				
Others				

 i) Have you received any training on mustard cultivation?

Yes: ………………….. No: ……………………... (Put tick mark)

If yes then-------

ii) From where you received the training?

………………………………………………

iii) Involvement of mustard cultivation in terms of year? (Age of farm): …………..

iv) Involvement of women in mustard cultivation: yes……….. No………….

v) Are you a member of any organization?

Yes; ………….. No: ………………. (Put tick mark)

If yes then------

Name of the Organization: ……………………………..

Vi Month of sowing seed …………………….

vii) Month of mustard harvesting…………………….

5. Total Output

Name of crop	
Variety	
Area (in decimal)	

Outputs	production	consume	Sold	Kept as seed	Price/kg	Total
Product (Kg)						
By-product (Kg)						
Others (Kg)						

6. Source of Credit Facilities:

Are you taking loan from others?

Yes: ……………………. No: ……………………. (Put tick mark) if yes---

Sources	Amount (Tk.)	Monthly Installment	Interest Rate	Installment Period
Banks				
NGOs				
Friends and Relatives				
Neighbors				
Money Lender				

14. Please mention the problems faced by you in mustard cultivation

a) ………………………………………………………………………..

b) ………………………………………………………………………..

c)………………………………………………………………………..

d)………………………………………………………………………..

e) ………………………………………………………………………..

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

a) …………………………………………………………………………………

b) ………………………………………………………………………..

c)………………………………………………………………………..

d)………………………………………………………………………..

e) ………………………………………………………………………..

Thank you for kind co-operation

 Date:

 Signature of the interviewer: