A COMPARATIVE FINANCIAL STUDY BETWEEN POTATO AND MUSTARD PRODUCTION IN SELECTED AREAS OF GAIBANDHA DISTRICT

MD. MAHABUBUR RAHMAN

DEPARTMENT OF AGRICULTURAL ECONOMICS

SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA-1207

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BY

MD. MAHABUBUR RAHMAN

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APPROVED BY:

Prof. Dr. Md. Mizanur Rahman Sarker
Dept. of Agricultural Statistics
Sher-e-Bangla Agricultural University
Dhaka-1207
Supervisor

Dr. A. S. M. Anwarul Huq
Director General
Bangladesh Jute Research Institute
Dhaka-1207
Co-Supervisor

Prof. Gazi M. A. Jalil
Chairman
Examination Committee
Dept. of Agricultural Economics
Sher-e-Bangla Agricultural University
Dhaka-1207

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

CERTIFICATE

*This is to certify that the thesis entitled "**A COMPARATIVE FINANCIAL STUDY BETWEEN POTATO AND MUSTARD PRODUCTION IN SECLECTED AREAS OF GAIBANDHA 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 in Agricultural Economics, embodies the result of a piece of bona fide research work carried out by **Md. Mahabubur Rahman**, Registration No. **12-04852** 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, received during the course of this investigation has been duly acknowledged.

Dated:
Dhaka, Bangladesh

Prof. Dr. Md. Mizanur Rahman Sarker
Dept. of Agricultural Statistics
Sher-e-Bangla Agricultural University
Dhaka-1207
Supervisor


Dedicated To
My Beloved Parents

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ABSTRACT

The present study was designed with a view to analyze the comparative financial aspects of the selected crops such as potato & mustard production. A total of 120 potato & mustard producing farmers were randomly selected from six villages under Gobindogonj and Polashbari Upazila of Gaibandha district. Mainly tabular analysis was done to achieve the major objectives of the study. Cobb-Douglas production function model was also used to identify and measure the specific effects of the factors on production. The findings of the study revealed that the productions of selected crops were profitable. The per hectare total costs of production of potato and mustard were Tk. 136826 and Tk. 52976, respectively and the corresponding gross incomes were Tk. 215000 and Tk. 63623, respectively. The estimated net return of producing potato and mustard were Tk. 78174and Tk. 10647, respectively. The results indicate that potato farmers received the higher gross return and net return compared to mustard producers. Functional analysis revealed that the variation of yield was greatly influenced by the human labour, fertilizers, pesticide and irrigation. These factors were directly or jointly responsible for the variation of yields. The study also revealed that the farmers faced various types of problems, such as lack of irrigation facilities, shortage of human labour, high price of fertilizers and insecticides, non-availability of quality seeds, low market price of product at harvest period, lack of storage facilities and inadequate transportation facilities. Based on the findings of the study, some recommendations were made for the development of potato and mustard production and to increase the income of the farmers.

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ABBREVIATIONS AND ACRONYMS

SAU = Sher-e-Bangla Agricultural University

GDP = Gross Domestic Product

BBS = Bangladesh Bureau of Statistics

LFS = Labour Force Survey

R & D = Research & Development

BARI = Bangladesh Agricultural Research Institute

BINA = Bangladesh Institute of Nuclear Agriculture

FAO = Food and Agriculture Organization

MoA = Ministry of Agriculture

BAU = Bangladesh Agricultural University

BADC = Bangladesh Agricultural Development Corporation

HYV = High Yielding Variety

BCR = Benefit Cost Ratio

OLS = Ordinary Least Squares

TSP = Triple Super Phosphate

MoP = Muraite of Potash

IOC = Interest on Operating Capital

VC = Variable Cost

FC = Fixed Cost

CHAPTER I

INTRODUCTION

1.1 Contribution of agriculture to the national economy

Bangladesh is an agro-based country and agriculture is the principal source of income and employment. This sector directly contributes 14.23% of total GDP (BBS, 2018). Agricultural sector has been playing a key role in the overall socio-economic development of Bangladesh since the independence of the country. The sector contributes a large in employment generation, GDP growth, and the growth of other industries. The current section of this paper discusses the role of agriculture sector in the economy in Bangladesh.

In order to assess the overall situation of employment, Bangladesh Bureau of Statistics (BBS) conducts the Labor Force Survey (LFS). According to the latest survey of BBS titled "Labor Force Survey 2017", the number of economically active population above 15 years is 6.35 crore. Out of this, as many as 6.35 crore people (male 4.35 crore and female 2 crore) are engaged in a number of professions, the highest 40.6 percent still being in agriculture (BBS, 2018).

According to the Labor Force Survey 2016-17, the total labor force of over 15 years of age was 6.35 crore with agriculture being the highest 40.6 percent as the source of employment. According to LFS-2017, it is observed that 40.7 percent (25.5percent in agriculture and 15.2 percent in others of labor force) is engaged in self-employment while it was 41.98 percent in FY 2015-16 (BBS, 2018).

It is apparent that combined contribution of all sub-sectors (crops, livestock, fisheries, and forestry) of agriculture was around 14.23 percent of GDP in 2017-18 of which fisheries sector accounts for 3.56 percent. The crop sub sector alone contributes for 10.67 percent of GDP (BBS, 2018). Also the impact of agricultural growth on rural wages is an important element in the process because for the poor households, a major share of

income originates from wage labor in agricultural activities. Rice, Jute, Sugarcane, Potato, Pulses, oil, Wheat, Tea and Tobacco are the principal crops. The crop sub-sector dominates the agriculture sector contributing about 53 percent of total production. Fisheries, livestock and forestry sub-sectors are 25 percent, 10.75 percent and 11.25 percent respectively (BBS, 2018).

Bangladesh is endowed with a favorable climate, soil and ample labor force for the production of a variety of crops throughout the year. Thus enough opportunities exist for crop diversification balancing the production of major crops with the introduction of minor crops such as potato and mustard, which may also contribute to enhance farmer's income and to help maintaining a better soil structure for longer period.

1.2 Economic importance of potato and mustard production

1.2.1 Potato

Rice is the staple food in our country. In spite of being an agriculture based country, Bangladesh is to import food grain, at the cost of hard earned foreign exchange almost every year. Import of food grain increases when production is adversely affected by various natural calamities like flood, hailstorm, cyclone etc. During shortage of rice, potato is suitable as a security crop due to its high carbohydrate content. In some countries of the world such as Holland and Peru, people use potato as main food.

Potato is an important food crop in tropical and subtropical countries. It is the fourth most important crop in Bangladesh. It is important and popular crop because of its quick economic return and multiple uses. It has a greater scope and potentiality for food security and poverty alleviation occupying a dominant position in both area and production among the vegetable growers in Bangladesh. Almost every family in Bangladesh consumes potato as a vegetable throughout the year. As a cheapest source of carbohydrates it is used, though not so extensively, as a supplement of the diet rice. Potato can play an important role as an alternative and a multipurpose food crop of Bangladesh. It has the desirable characteristics of high yield, nutritious or delicious food and palatable in taste. It is one of the most important sources of carbohydrates and

contains an appreciable amount of vitamin B and C and some other materials. In Bangladesh soil and climatic condition has offer high potential of potato production. Bangladesh produces potato in about 477400 hectares of land with an average yield of 20.41 ton per ha (BBS, 2018).

Production of potato has been increasing rapidly compared to cereal crops like rice and wheat (Azimuddin *et al*., 2009). Potato cultivation under the institutional loan was a profitable business (Majid, 2004). Potato tuber follows only rice and wheat in world as an important food crop for human consumption. It is used as a popular vegetable by both the poor and rich people in Bangladesh. Potato growing is one of the promising farming businesses to the farmers due to its higher yield, diversified use, low risk involvement and high profitability. But it is most difficult for the farmers to maintain the production cost (Awal, 2013). In Bangladesh, potato occupies a dominant position in both area and production among the vegetables growers. However, compared to other crops, cost of production of potato is relatively high (Ahmed, 2001).

Realizing the above situations, the government of Bangladesh has been maintaining a crop diversification strategy to reduce the dependency on rice by increasing the consumption and production of potato. In Bangladesh, the amount of cultivable land is gradually decreasing because of infrastructural and industrial development activities. For that reason, production strategies require to be formulated according to the demand of the situation and time so that farmers can increase food production. The cultivation of potato was a profitable business and the medium farm was more profitable than the small and marginal farms (Sarkar and Yesmin, 2014).

1.2.2 Mustard

Mustard oil plays an important role as a fat substitute in our daily diet. This oil is widely used as cooking ingredients for improving the taste of a number of food items. There are various essential fatty acids in vegetable oils. The value and utility of vegetable oil primarily depends on its fatty acid composition. Among the fatty acid Linoleic and linolenic acids are very important for normal growth and functioning of all tissues. These acids are present in mustard oil. Erucic acid which is considered harmful is present in

mustard oil. Besides human diet, mustard oil is used as medicinal ingredients. Mustard oil cake is used as a feed for cattle and fish. It is also used as a good source of organic manure.

An acute shortage of edible oils has been prevailing in Bangladesh during the last several decades and spending on edible oils and oilseed imports has been increasing to meet the country's demand. In 2014-15, the value of imported oilseeds and edible oils was Tk. 27,612 million (US$354 million) and Tk. 122,772 million (US$1,574 million) which were 0.87 percent and 3.88 percent of the total value of imports (Tk.31, 65,162 million or US$40,579 million) respectively (Bangladesh Bank 2015). Besides, the area under oilseeds cultivation is decreasing over time due to various economic and technical reasons (Miah, Rashid and Shiblee, 2014).

Bangladesh government has given emphasis on R&D (Research and Development) of oilseed crops and invested a lot of money for attaining self- sufficiency in oils. Bangladesh Agricultural Research Institute (BARI) and Bangladesh Institute of Nuclear Agriculture (BINA) has released a number of improved varieties of these crops. Adoption of these varieties has created additional employment and income, and saved foreign exchange for the country.

Rapeseed-mustard (Brassica spp) or mustard is a major oilseed crop in the world which is grown in 53 countries across six continents including India which is the second largest producer after China (Boomiraj et al., 2010). Mustard is also the most dominant oilseed crop in Bangladesh and has experienced expansion in area, production and yield over time while facing fierce competition of land for production of cereals, e.g., rice, wheat and maize. For example, the total cropped area of mustard has increased from 317,800 ha in 2001 to 294,206 ha in 2014; production from 238,000 t to 296,000 t; and yield from 0.75 t/ha to 1.20 t/ha during the same period (BBS, 2016). In fact mustard alone covers 80% of the total area under oilseed crops (Miah *et al*., 2015). The country is producing about 0.36 million tons of edible oil per year as against the total requirement of 1.4 million tons (Mallik, 2013). As a consequence, Bangladesh remains as a net importer of oils and the demand for oil will increase substantially in the future in response to increase

in population and changes in dietary habits and nutritional awareness. For example, import of mustard oil has increased from BDT 2.42 million in 2006 to BDT 50.59 million in 2014, which is extraordinarily high (BBS, 2016). One of the main reasons may be the replacement of high volume of palm oil import as observed during 2006 with mustard and soybean oils for consumption as observed during 2010 (BBS, 2014). Mustard is a predominantly winter crop and is sown during mid-October to November and harvested during late January to end of February. Given the future scenario of climate warming, it is recognized that the winter crops, such as mustard, other oilseeds and vegetables, are likely to be relatively more vulnerable to rising temperatures, which will add further pressure on increased demand for oils. For example, Boomiraj et al., (2010) noted that mustard production in India is likely to reduce in the future under both irrigated and non-irrigated condition and recommended adaptation of late sowing strategy and/or developing longer duration varieties to cope.

Therefore, it is an urgent need to take immediate actions for increasing the production of oil seed to reduce the import cost. As mustard is the main oil crop of Bangladesh, its increased production may meet domestic consumption and can contribute to the national economy.

1.3 Area, production and yield of potato and mustard

1.3.1 Potato

At present potato is the leading vegetable crop in Bangladesh. It occupies the position after rice and wheat in respect of production and area allocation because of its high yield, durability and popularity. A world picture of potato, wheat and rice in respect of area, productivity and production is shown in the Table 1.1

Table 1.1: World productions of potato, rice and wheat in 2014

Crops	Area, 000'ha	Yield, kg/ha	Production, 000' metric tons
Potato	17949	16470	295632
Rice	150305	3747	563188
Wheat	224374	2624	588842

Source: FAO Production Yearbook, 2014

A comparative picture of area, production and yield/ha of some major potato producing countries is shown in the Table 1.2, It is evident from Table 1.2 that yield of potato in Bangladesh is far behind that of Japan, Turkey, Iran and Indonesia. Bangladesh has a great scope to increase per hectare yield by introducing high yielding varieties and proper management.

Table 1.2: Area, production and yield of potato of some major potato producing Asian countries in 2014

Countries	Area, 000'ha	Yield, kg/ha	Production, 000' metric tons
Bangladesh	136	11397	1553
China	3002	15920	47789
Indonesia	48	17390	840
Iran	170	19412	3300
Japan	104	32692	3400
Myanmar	22	10724	237
Pakistan	105	13619	1426
Philipines	7	13846	90
Turkey	205	25927	5315
Nepal	108	8997	972
Kazakistan	165	7665	1263

Source: FAO Production Yearbook, 2014

In Bangladesh total area production and yield of potato increased significantly during the last three decades.

1.3.2 Mustard

Mustard is also the most dominant oilseed crop in Bangladesh and has experienced expansion in area, production and yield over time while facing fierce competition of land for production of cereals, e.g., rice, wheat and maize. For example, the total cropped area of mustard has increased from 317,800 ha in 2001 to 294,206 ha in 2014; production from 238,000 t to 296,000 t; and yield from 0.75 t/ha to 1.20 t/ha during the same period (MoA, 2007; BBS, 2016).

The area of oil crops varied slightly in different years shown in table 1.3. As most of the oil crops are grown during robi season, the year to year variation depends on the receding time of flood water and the end of monsoon rain.

Table 1.3: Area and production of oil seeds 2014-15 to 2016-17

Crops	2014-15		2015-16		2016-17	
	Area (acres)	Production (M. Ton)	Area (acres)	Production (M. Ton)	Area (acres)	Production (M. Ton)
Sesame(Till)	8530	2970	99592	36921	92671	33999
Rape & Mustard	802882	359452	787025	361909	831260	362860
Groundnut	78464	56713	88245	62264	91188	66060
Linseed	17320	4865	16207	4475	13257	4164
Soya bean	118326	91496	124289	92181	155351	96921
Coconut	9152	383833	5878	374269	9602	408635
Other Oil Seed	3294	2148	4009	2229	3425	1913
Grand-Total	1037918	901477	1125245	934248	1196834	974552

Source: BBS, 2017

Bangladesh Agricultural Research Institute (BARI) has developed eight verities of mustard having high yield potential with better package of management practices. Bangladesh Institute of Nuclear Agriculture (BINA) and Bangladesh Agricultural University (BAU) has developed four varieties and two varieties of mustard respectively. Meanwhile Bangladesh Agricultural Development Corporation (BADC) has released one variety of mustard. Though the national average yield of mustard is 0.739 t/ha, the potentiality of the developed varieties is 2.4 t/ha (Mondal, 2000).

1.4 Justification of the study

Farmers of Bangladesh are traditionally inclined to rice production. Though agro-climatic condition of Bangladesh is suitable for the cultivation of a large variety of crops, but 77 percent of gross cropped area is at present confined to the production of rice. At the initial stage irrigated HYV boro was grown in the land which was kept fallow during rabi season and now it has replaced almost all the other crops like potato, pulses and oil seed. Though the yield of irrigated HYV boro paddy increased significantly over the last few years, the net return from irrigated HYV boro paddy decreased because of low market price and high cost of production. So, there is a great scope to reintroduce winter crops like potato and mustard.

Bangladesh has to import a large amount of edible oil every year. In the recent years the import of edible oil has drastically increased and at the same time price of it has increased simultaneously. Increasing the total oil seed production, the import cost for vegetable oils and fats can be reduced. Moreover mustard oil has a great demand within the country and is preferred by the people of Bangladesh due to its pungency.

Secondly, potato is also important as vegetables and food crop in Bangladesh. It is considered as a main vegetable in Bangladesh. It may also be used as a substitute of rice and that can meet up nutritional deficiency.

The government of Bangladesh has been pursuing a crop diversification strategy to reduce the dependency on rice cultivation. Considering the above situation oil seed and potato may provide additional opportunities to supply food and nutrition for the people of

Bangladesh.

While making production decision, fanners consider costs of production against the yield of the crop. The rate of adoption and sustainability of any crop depend upon its economic profitability. So economic study on such potential crops is very pertinent. An economic study on HYV of potato and mustard is expected to reveal valuable information relating to farms and farmers growing these crops.

Enterprise studies have some dynamic aspects in the sense that the parameters that affect costs, returns and profitability change rapidly. Moreover, technology, inputs prices, output and output prices do not remain constant. So the findings derived from the previous studies, may not be relevant for all time. Enterprise studies are, therefore, necessary after short intervals to update the knowledge on profitability. So, updating knowledge on profitability of potato and mustard is one of the justifications of this study.

The results of the study are expected to be helpful to the farmers and policy makers in providing a basis for their production plans and decisions. The study may be helpful to the extension workers to learn about various problems related to mustard and potato production and to suggest the farmers for ensuring problems in their fields.

1.5 Objectives of the study

The main objectives of the study are:

(i) to investigate the socioeconomic profile of potato and mustard growers;
(ii) to determine and compare of the costs and financial returns of producing potato and mustard;
(iii) to estimate the factors affecting the yield and financial returns of potato and mustard; and
(iv) to identify problems and constraints faced by the farmers in producing potato and mustard.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to review the past research works which are related to the present study. A few economic studies were performed on potato and mustard separately. However, some important studies related to the present study conducted in the recent past are discussed below.

Aslam (1995) conducted a study on a comparative economic analysis of winter crop production in an area under Gauripurthana in the district of Mymensingh. He studied economic aspects of winter crop such as potato, brinjal, bottle gourd, bean, cucumber, sweet potato, mustard and ground nut. He found that the per hectare gross expenses of HYV potato, LV potato, brinjal, bottle gourd, bean, cucumber, sweet potato, mustard and ground nut were Tk.43956,Tk. 34892,Tk. 41893,Tk. 45219, TK. 42224, Tk.27362, Tk.20475 and Tk. 11970 while the per hectare gross return and net return were Tk.77000 and Tk.3303, Tk. 53648 and Tk.18756, Tk.72061 and Tk.30168,Tk.80261 and Tk.12524, respectively. He also found that the variation in yield was greatly influenced by the use of human labour, animal labour, application of fertilizers and date of transplanting and sowing. The factors were directly or jointly responsible for variation in winter crop yields area of Norshingdi district. He included winter vegetables namely cauliflower, cabbage, tomato, radish, bean and bottle gourd. He conducted his study in three villages namely Jalalabad, Baroycha and Hossen Nagar of Narayanpur union under Balbo thana of Norshingdi district. He found that per hectare gross expense of cauliflower were Tk. 50875; while the per hectare gross return, net returns above gross expenses and cash expenses were Tk. 68580, TK.17750 and Tk. 43665,respectively. Gross expense for producing per hectare of cabbage was Tk. 51794 of which cash and non-cash expenses shared 49 percent and 59 percent, respectively. Net return above gross expenses and net return above cash expenses were Tk. 69848, Tk.18052 and Tk. 44509 per hectare, respectively. Gross expense for producing per hectare of tomato was Tk. 5505, while the per hectare gross return, above cash expenses were Tk. 46200, Tk. 12500, and Tk.30220, respectively. The per hectare gross expense and gross return of bean production were

estimated at Tk.38772 and Tk.47513 while the per hectare net returns above gross and cash expenses amounted to Tk. 8741 and TK.35475, respectively. Gross expenses for producing bottle gourd per hectare were Tk. 43614 while the per hectare gross return, net returns above gross expenses and net return above cash expenses were Tk. 58480, TK.14866, and TK. 40989 , respectively.

Arif (1998) conducted a study on HYV potato in three villages of Comilla district. He studied both irrigated and non-irrigated potato production. He has shown that, there was no significant difference in terms of total cost and gross return in two different situations. The study revealed that total cost per hectare was Tk. 64833.83 with irrigation and Tk. 63697.08 without irrigation. Gross return per hectare was Tk. 99902.04 with irrigation and Tk. 98097.02 without irrigation and net return per hectare was Tk. 35068.21 under irrigated condition and Tk. 34399.94 without irrigation.

Alam (2003) carried out an experiment to study the effects of planting time and nitrogen on growth, yield and storability of summer onion. Both date of planting and variety showed significant influence on the growth and yield of summer onion. The highest yield of 11.32 t/ha was obtained from 11 April planting. Nitrogen also showed significant effect on the yield of summer onion. The highest yield (12.69 t/ha) was obtained from the treatment combination of 11 April planting x 92 kg N/ha. The highest percentage of weight loss (40.72 percent), rotting (19.13 percent), and sprouting (4.72 percent) were recorded from 12 May planting. The treatment combination of 11 April planting time x BARI Piaz-3 x 0 kg N/ha showed the lowest percentage of weight loss (22.89 percent), rotting (8.17 percent) and sprouting (1.33 percent).

Bashak (1992) conducted a study An Economic Analysis of Potato Cultivation in three villages of Bogra district. He estimated that per hectare total costs were Tk. 29117.38 and 32787.38 for local variety and HYV of potato respectively. Per hectare net returns on full costs basis for local variety and HYV were found to be Tk.15377.92 and 22555.62 and on cash cost basis per hectare costs were Tk. 31629.49 and 40107.49 respectively. Average returns to each Taka spent on full costs and cash costs basis were Tk.1.53 and Tk.3.43 for local variety and Tk.1.69 and Tk.3.62 for HYV respectively.

Bavanthade *et al.* (1993) conducted a study on onion production in Amravati district under Maharastra State in India. Sixty-eight farmers were selected from 6 villages in the Amravati District. The holdings were classified according to their area of production. Average areas for Group 1,11 and HI were 209.54, 241.07 and 255.3 ha, respectively. The production costs for A (running costs), B (A+ fixed costs) and C (B+ family labour input) were 13164.85, 19020. 23 and 19668.123 Rs/ha, respectively. On an average, the loss during harvest and storage was 73percent, the yield was 2335.3 q/ha, and the gross return was 33878.44 Rs/ha. At cost C, the cost: benefit ratio was 1:1.70, the production cost was 83.61 Rs/q and the profit was 59.19 Rs/q, using the prevailing average price of 142.8 Rs/q.

Bhuyan (1999) conducted an experiment on the effect of planting time, mulch and irrigation on the growth and yield of garlic. In this experiment it was found that the highest yield was obtained from 25 October planting (3.92 t/ha) followed by 9 November (3.58 t/ha), 25 November (3.55 t/ha), and 8 December (3.08 t/ha). December 23 planting gave the lowest yield (2.31 t/ha). It was observed that earlier planting gave the highest plant highest, number of leafs per plant, diameter of bulb, weight if individual bulb.

Bulbul (2003) studied the effect of planting time and different mulches on the growth and yield of some garlic germplasm. A result revealed that earlier planting date (November 24) was found to be better for higher yield. And the highest yield (4.32 t/ha) was obtained from water hyacinth mulch. The combination of November 24 planting and germplasm G19 with water hyacinth mulch gave the highest yield (4.61 t/ha).

Chadha (1990) conducted a study on onion and garlic in India. Area and production of onion and garlic in the world and India, export from other countries and factors limiting production and productivity in India are described. The research infrastructure, varietal improvement and production technology of onions and garlic in India, Kharif onion cultivation in North and East India, seed production and distribution, post-harvest technology, all year round production of onions, disease and pest control, and future research requirements are discussed.

Fariduzzaman (1996) conducted a comparative profitability study on three mustard varieties namely, Sonali and Shampad which were HYV and Tory-7 which was local variety under improved management and farmer's management. The study areas he selected were Jhenidah, Kushtia, Dinajpur, Laxmipur, Mymensingh, Gazipur, Shariatpur, Narasingdhi and Narayangonj. He found that under improved management per hectare yield of Sonali, Sampad and Tori - 7 were 1633.66, 1688.77 and 1205.92 kg and their corresponding net return were estimated at Tk 7209.63, 8927 and 5978.90 respectively. Whereas under fanner's management per hectare yield of mustard of different varieties were relatively lower.

Hussain *et al.* (1983) conducted a study on mustard production in some areas of Pabna, Dhaka and Brahmanbaria. The average yield of mustard was estimated 1140 kg per hectare. Average gross return and net return were Tk 7182 and 4760 per hectare respectively while the average gross cost was Tk 5774. The study has shown that return to cash cost ratio of mustard was 2.97.

Hakim (1993) made a study on comparative economic analyses of HYVs potato in Bogra sadar thana. He found that per hectare yield of Cardinal and Multa varieties were 20600 and 17860 kg respectively. He estimated that per hectare gross costs of Cardinal and Multa were Tk 32097.25 and 30818.50; gross returns were Tk 61092.55 and 57812.80, and their net return were Tk 28995.30 and 26994.30 respectively. The study revealed that human labour, animal labour, manure, fertilizer, irrigation, pesticide and seed affected the yield, cost and net returns considerably.

Haque (1993) conducted a comparative economic study of growing potato as a third crop in addition to two rice crops in some area of Bogra district. He found per hectare yield of HYV potato and LYV potato were 17560 kg and 12124 kg, respectively. Per hectare gross cost for producing HYV and LYV potato were estimated at Tk 30528 and 27146, gross returns were Tk 49168 and 33947 and their net returns were Tk 18640 and Tk 6801 respectively. He considered nine cropping pattern. All the cropping patterns were rice based, of which 6 were with potato and the rest 3 were without potato. The highest net

return was earned from HYV potato based cropping pattern and the lowest net return was earned from without potato cropping pattern.

Hossain (1995) conducted a study on "An Economic Investigation on Jute Growing Farmers in Tangail District." He examined the profitability of growing jute from the view point of small, medium and large farmers. The medium farmers received the height net return per hectare in jute cultivation due to proper use of inputs than small and large farm size groups. The average net return of jute production were Tk 5044.13, Tk5369.86 and Tk4908.08 per hectare and their corresponding BCR (undiscounted measure) were 1.34, 1.31and 1.28 , respectively. Cobb-Douglas production model was estimated to determine the effect of key factors on production of jute. Functional analysis showed that production coefficient of using human labour, seeds and fertilizers were significant at 1 percent level of confidence.

Hossain (1996) carried out an experiment in Bangladesh agricultural University, Mymensingh. Plant highest, leaf number, pseudostem and bulb diameter, dry matter content of foliage, bulb weight and bulb yield were found significantly higher for mulched plants.

Hossain (1997) studied effect of intercropping groundnut with onion at varying planting arrangement at agricultural research station, Shyampur, Rajshahi, Bangladesh during the Rabi season of 1993-94 and 1994-95. Six treatment viz., sole groundnut (1:0), sole onion (0:1), one row of onion in two rows of groundnut (1:1), two rows of groundnut altered with two rows of onion (2:2), three rows of groundnut altered with two rows of onion (3:2) and four rows of groundnut altered with two rows of onion were studied. Highest groundnut yield and onion bulb yield were obtained from their respective sole crop.

Harun and Rashid (2002) studied the production potential and profitability in TPS-garlic intercropping system at different spacing and row arrangement. The spacing for TPS was 50x50 cm, while that of garlic were 10 x 10 cm, 15x10 cm, and 15x15 cm. The row arrangements were single, double, and alternative. The highest gross return (Tk. 169590/ha), net return (Tk. 74782/ha), LER (1.38) and BCR (1.80) were recorded from

potato + garlic at 15 x 15 cm spacing as double row arrangement.

Hasan (2005) conducted a study on an economic analysis of contract farming for production and export of high value vegetables in Bangladesh. The overall finding of the study was that the export quality of fresh vegetables was significantly affected by price. Per hectare gross margin for contracted bean, bitter gourd and okra production were Tk. 181548, Tk. 261395 and Tk.95057 while it was Tk. 88070, Tk. 92053, Tk. 18522 for non-contract cauliflower, bitter gourd and okra production, respectively. The study also identified the problems and constrained associated with supply and marketing chain management for production and export of high value vegetables.

Islam and Rahman (1991) conducted a study on " Estimation of Jute Hectareage Allocation Function from Farm-Level Data in Bangladesh" This study was undertaken to estimate jute hectareage allocation function using micro-level data in order to avoid the limitations of supply response functions estimated from micro-level time series data. Some, important conclusions can be drawn from the study. First, farm size, net return from jute and return from jute sticks were found to be the most significant explanatory variables. But returns from paddy and paddy byproduct were not significant variables in equations estimated for irrigated or non-irrigated areas. Second, return from by-product of jute was found to be the most significant variable in equations estimated for both irrigated and non-irrigated areas and its elasticity is much higher than that of the net return from jute.

Kumer and Shama (1991) conducted an experiment of two onion cultivars, designated N-53 and N-2-4-1, grown in the Kharif season. Result showed that bulb yield increased linearly as N application was increased up to 75 kg N/ha. The mean increase in the bulb/plant weight ratio was 1:2.22 with 25 kg N, compared with 1:1.95 for untreated controls; higher N rates reduced this ratio.

Miah (1992) studied intercropping of potato, onion, mustard and lentil with sugarcane at Joypurhat Sugar Mill Zone. He reported that farmers of all the mills zone areas preferred mustard as intercrop with sugarcane although the sugarcane with potato combination

produces the highest net return per hectare (Tk. 34985.81) followed by sugarcane with mustard (Tk. 19733.43), sugarcane with onion (Tk. 19935.96) and sugarcane with lentil (Tk. 18165.75).

Mahmood (1995) examined the relative profitability of selected spices, compared with their competing crops. Among all competing crops onion was the most profitable crop with net profit of Tk. 26673, which was followed by potato (Tk. 25875.30), lentil (Tk. 20652.1) and garlic (Tk. 16755.49) in respect of net return per hectare.

Pandey *et al.*, (1994) reported that onions growing in the field in 1981 - 1982 received nitrogen fertilizer at 50, 100, or 150 kg/ha and were sprayed with maleic hydrazide at 0,2000, 2500, 3000 and 3500 ppm at 7, 14, or 21 days before harvest. Onion were harvested and stored in ambient conditions in bamboo baskets for 5 months. As nitrogen application rate during production increased, post-harvest storage losses due to sprouting, rotting, rooting, moisture loss, and weight loss increased.

Pramanik (2008) carried out a research on Vegetables production strategy in Rajshahi region of Bangladesh. This study was conducted at six villages namely Tonapara, Mypara, Noapara, Shakepara, Bharuahra and Tarapur of Puthiaupazilla under Rajshahi district of Bangladesh during the period from January to June 2008 to find out the profitability of vegetables production, to examine the input use pattern in vegetables production, identify the problems lie in production of vegetables in Rajshahi Region.The gross return and margin was the highest in tomato (Tk. 510000/ha, Tk. 338630/ha) followed by brinjal (Tk.495000./ha; Tk.324080/ha) and cauliflower (Tk.440000/ha; Tk.274640/ha) and the lowest in white gourd (Tk.220000/ha; Tk.59638/ha) and sweet gourd (Tk.225000/ha;Tk. 63240/ha). The total cost was highest in potato (Tk.183760 /ha) followed by tomato (Tk.171370/ha) and brinjal (Tk.170920/ha) and red amaranth (Tk.38650/ha) and spinach (Tk. 89830/ha). Among the vegetables crop tomato gave higher benefit cost ratio (2.98) followed by brinjal (2.90) and cauliflower (2.66) and white gourd (1.37) and sweet gourd (1.39). Considering the yield cost and return the tomato, brinjal, cauliflower, cabbage and bottle gourd cultivation were more profitable in Rajshahi region of Bangladesh.

Quayum *et al.*, (2004) conducted a survey on the socio-economic aspects of rice-wheat production system research at Chuadanga district. They observed that the family size was 9 and literacy rate of family was 22 percent where the average farm size was 0.87 ha. The main source of income of the farmers was agriculture and the income increased when the increases of farm size. About 28.73% high land, 66.83% medium high land and 4.44% medium low land was found in the studied areas. The most important cropping pattern were Jute-T.Aman-Wheat in the high land, Fallow-T.Aman (MV)-Boro (MV) in the medium high and medium low land. About 12, 39 and 30% of the total cropped area was covered with wheat, T.Aman (MV) and Boro (MV) of the study area, respectively.

Rahman (1993) conducted a comparative study on HYV potato and wheat production in some selected areas of Jamalpur district. He observed that the farmers had to bear higher cost of production (Tk. 362752.87/ha) in producing potato than wheat (Tk. 9231.66/ha). The gross margin to potato was higher than that of wheat. He also observed that the gross margin of cardinal variety (Tk. 37049/ha) was higher than that of diamond variety of potato (Tk.26533/ha).

Rahman (1995) earned out an economic study with mustard and without mustard cropping pattern in Comilla district. He found that per hectare yield and net return were 1245.90 kg and Tk 5683.89 respectively. The study also revealed that per hectare net return of with mustard cropping pattern (Mustard-HYV Boro-T. Aman) was Tk 19792.16 which was higher than without mustard cropping pattern (HYV Boro-T. Aman-T. Aus) Tk 13965.28.

Rahman (1998) examined production costs and economic returns in producing onion to estimate the profitability of different farm size groups. The study revealed that total costs of production under small, medium and large farmers were Tk. 37485.35, Tk. 42229,91 and Tk. 44074.21 per hectare, respectively. Considering all farmers, it was Tk 41723.30/ha. Gross return for the small, medium, and large and all farmers were Tk. 118765.50, Tk. 157606.75, Tk. 155027.25 and Tk. 145360.50 respectively and their corresponding net returns were Tk. 81280.15, Tk. 115376.84, Tk 111553.04 and Tk. 103637.30, respectively. Per hectare yield of small, medium, large and all farmers were

9501.24, 12608.54, 12450.18 and 11628.84 kg respectively. Per hectare human labour use was 309.65 man-days constituting 40.82 percent of total cost for all farmers which was the highest of all cost items. Compared to other farms (small and large) resource use efficiency was higher in the medium size farms and the BCR for the group was 3.73. Variation in yield was greatly influenced by the number and magnitude of human labour used for ploughing, manuring, irrigating, sowing, planting and harvesting.

Rahman (1999) conducted an economic study on HYV potato in Rangpur district. In the study the author considered three varieties of potato namely, cardinal, Diamant and BARI TPS 1. Yield of Cardinal, Diamant and BARI TPS 1 per hectare were 27408.26, 27455.01 and 35148.10 kg and gross margin were estimated at Tk 48490.58, 43011.53 and 55306.07 and net return over full cost were calculated Tk 32959.10, 30908.45 and 41715.81 respectively.

Rahman (2004) studied effect of growth regulators on growth and yield of three varieties of onion grown from sets. Three varieties of onion viz., Taherpuri, Zhitka, Kalashnagar and four different growth regulators, namely IAA (200 ppm), GAj (100 ppm), NAA(200 ppm), CCC (500 ppm) and control were used. The Taherpuri produced the highest bulb yield (14.99 t/ha). Application of all the growth regulators increased plant highest, number of leaves per plant, bulb diameter, mean bulb weight, and bulb yield compared to control plants of onion.

Sabur and Mollah (1993) examined the trend, annual and seasonal variability and relative profitability ot spices in Bangladesh. The result showed that all spices except turmeric and ginger had negative growth rate in production since independence. Price fluctuation was directly related to the amount of onion produced in different years. The study revealed that onion requires less irrigation and can be easily grown in the fellow land of roadside and homestead area to ensure the maximum utilization of scarce land. Moreover, onion has the desirable characteristics of high yield and low cost, nutritious and palatable food. The study further revealed that per hectare net return from spices were much more profitable compared to their competing crops in Bangladesh and among the spices onion was the highest.

Saha (1996) earned out an economic study on Local, Diamant and Cardinal varieties of potato under improved management and farmer's management in some areas of Mymensingh, Kushtia, Dinajpur, Zhenidaha, Narsingdi, Narayangonj and Gazipur districts. He estimated that per hectare costs of local, Cardinal and Diamant varieties under improved management were Tk 35219.73, 58774.89 and 62288.54 whereas under farmer's management corresponding costs were Tk 41608 59, 57950.88 and 61719.44 respectively. Per hectare gross return for producing local, Cardinal and Diamant under improved management were Tk 55865.10 99004.68 and 113451.58 while under framer's management per hectare costs were Tk 51661.91, 85260.28 and 83793.64 respectively. It was revealed from this study that potato growers under improved management gained the highest net return while growers under farmers management achieved the lowest net return. He also observed that the major factors of yield variation were human labour, animal labour, cow dung, fertilizer and date of planting.

Shrivastava (1998) studied on economics of agro-forestry in Indo-Gangctic alliums of Uttar Pradesh in India. The study was managed under an agro-silvicultural system with Eucalyptus and a mixture ot agricultural crops e.g. mustard, gram, coriander, onion, garlic, and turmeric. Intercropping was to be carried out over the first 3 years. Detailed cost data were given, including initial expenditure, actual and projected working costs of Eucalyptus plantation for the first 6 years and costs of intercropping. Total profit from the first and second cycles was predicted as Rs. 28363125 and Rs.75548135, respectively with cost/benefit ratio of 4.0 and 7.2. The system generated 112960 man-days of employment in the first rotation.

Sarker *et al.*, (2003) conducted a study on allocation efficiency in irrigated boro rice production: the case of mymensingh farms. They observed that most of the rice farmers in the study area are predominantly inefficient in allocating their resources. Further efficient use of chemical fertilizer, land preparation and weeding for irrigated MV boro rice would enable farmers to achieve higher economic return.

Sarker *et al.*, (2004) conducted a study on resource exploitation for irrigated boro rice cultivation under favorable production environments. They observed that most of the rice farms under study are predominantly inefficient in allocating their resources. More

efficient application of chemical fertilizers and land preparation for irrigated HYV rice would enable farms to achieve productivity under similar production environments.

Yasmin (2009) studied "A Supply Response Growth Study of Jute in Bangladesh". The study estimated the growth rate of area, yield, production and real price of jute crop in Bangladesh. The time series data was used for this purpose. This study covered the time period of 1980/81 to 2005/06. Supply response was estimated for jute crop in terms of Nerlovian price expectations model. The long run price elasticity was 0.38. Growth rates of area, production, yield and real price of jute crop were estimated by fitting exponential trend function. Growth rates of area and production of jute had declined significantly at the rate of 2.26 and 0.95 percent, respectively over the whole period.

CHAPTER III

METHODOLOGY

Farm management research usually requires collection of primary data from individual farmers. The type of primary data to be collected essentially depends upon the nature of the study. For the present study, the farm survey method was used. Survey method has advantages over other methods. Because this method does not require trained personnel and sophisticated equipment's as synthetic method does. The method is less costly in terms of money and time. However, the major drawback of the survey method when used in Bangladesh is that the investigator has to rely upon the memory of the farmers. To overcome the difficulty, frequent visits in the area were made and the farmers were interviewed shortly after the events for which the information was sought. In a survey, the following steps are necessary.

3.1 Selection of the study area

Selection of the study area is an important step in a farm management study and it largely depends upon the objectives set for the study. Therefore, careful thought has to be given to select an area where a particular set of objectives can be fulfilled. Keeping in view the objectives, Three village namely Beramaloncha, Telia para and bahadurpur of Gobindogonj upazila and another Three village Saunia, Purondor and Khukshia of polashbari upazila of Gaibandha district were purposively selected. The upazila is the second lowest tier of administrative government in Bangladesh. The districts of Bangladesh are divided into sub-districts called Upazila (Sarker, 2010).

The main criteria behind the selection these villages were:

- Most of the winter crops such as mustard and potato are grown abundantly in these villages.
- Familiarity of the researcher with the language and other socioeconomic characteristics of the farmers in the selected villages and the high anticipated cooperation from the respondents to obtain reliable data.

- No study of this type was carried out previously in this area.

3.2 Selection of sample and sampling technique

In selecting samples for a study two factors need to be taken into consideration. The sample size should be as large as to allow for adequate degrees of freedom in the statistical analysis. On the other hand, administration of field research, processing and analysis of data should be manageable within the limitation imposed by physical, human and financial resources. However, because of diversity in the technical and human environment, it is necessary to sample several numbers of the population before any conclusion can be drawn. Therefore, the purpose of sampling is to select a sub-set of the population that is representative of the population.

It was not possible to include all the farmers in area studied due to limitation of time, money and personnel. A simple random sampling technique was followed in the present study for minimizing cost, time and to achieve the ultimate objectives of the study.

Table 3.1: The number of sample of potato and mustard growers

Vegetables produced	No. of farmers selected
Potato	60
Mustard	60
Total	120

At first three villages were selected from two upazila. Total number of population was 120. Among them 60 farmers for mustard and 60 farmers for potato, were randomly selected. Thus, the selected farmers were interviewed to achieve the ultimate objectives of the study.

3.3 Preparation of the survey schedule

In conformity with the objectives of the study, a draft survey schedule was prepared in such a way that all factors associated with the phonemic organization and performance of the farm business could be included. A set of interview schedule was prepared for

eliciting desired information from the farmers. The draft survey schedule was pretested by interviewing some farmers. In the pretest survey, attention was paid to inclusion of any new information which was not included in the draft schedule. Thus, the draft schedule was improved, rearranged and modified in the light of the actual and practical experiences. After making necessary adjustments, a final survey schedule was developed in logical sequences.

3.4 Study period and period of data collection

In the present study, necessary information was collected by the author himself through personal interviews. Data were collected during the period from January, 2018 to February, 2018.

3.5 Method of data collection

The relevant data were collected from the selected farmers through face to face interview. Before taking actual interviews the whole academic purpose of the study was clearly explained to the sample farmers. Initially, the farmers hesitate to answer the question but when they were assured that the study was purely an academic one and it would not affect them adversely then they cooperated with the research work. At the time of interview, questions were asked systematically and questions were explained whenever it was felt necessary. Farmers were requested to provide correct information as far as possible. After each interview was over, the interview schedule was cheeked so as to ensure that information to each of the items had properly been recorded. If there were such items, which were overlooked or contradictory, were corrected by another interview. In order to minimize the errors, data were collected in local unit, but later those were converted into standard international units.

3.6 Analytical technique

Data were analyzed with the purpose of achieving the objectives of the study. In order to arrive at a meaningful conclusion, tabular technique and statistical analysis were employed i.e. tabular technique; correlation or regression analysis etc. To explore the

relationship between production and inputs used, Cobb- Douglas production function was used.

3.7 Functional analysis

No single form of function can be used to characterize agricultural production under all environmental conditions. The algebraic form of the function and its magnitudes will vary with soil, climate, type and variety of crops, magnitude of other inputs in fixed quantity for the farm, etc. Hence a problem in each study is selection of an appropriate algebraic form of function, which is consistent with the phenomena under investigation.

Cobb-Douglas production function model was chosen to estimate the effects of key variables on production processes of potato and bean. The double log form of the Cobb-Douglas model proved to be a superior alternative on theoretical and econometric grounds. Thus Cobb-Douglas model was selected for this study.

In the study area, for producing (potato and mustard), the following inputs namely human labour, seed, fertilizer, irrigation and insecticides were employed which were considered as priority explanatory variables responsible for the variation of selected vegetables production. Multiple regression analysis was conducted to understand the possible relationship between the input and output. In order to determine the effect of variable inputs on the yield of selected vegetables, Cobb-Douglas production function was initially estimated.

The following Cobb-Douglas production function was used in the present study:

$$Y_i = \alpha X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} X_5^{\beta 5} X_6^{\beta 6} e^{ui}$$

By taking log in both sides the Cobb-Douglas production function was transformed into the following logarithmic form because it could be solved by the ordinary least squares (OLS) method.

$$In\ Y = ln\ \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + e^{Ui}$$

Where,

α = Constant or Intercept

Y = Gross return (Tk./ha)

X_1= Human labour cost (Tk./ha)

X_2 = Land preparation cost (Tk./ha)

X_3 = Seed cost (Tk./ha)

X_4 = Fertilizer and manure cost (Tk./ha)

X_5 = Irrigation cost (Tk./ha)

X_6 = Insecticides cost (Tk./ha)

$\beta_1, \beta_2, \ldots\ldots \beta_6$ = Coefficient of respective variables

In = Natural logarithm

e = Base of natural logarithm

Ui = Error term.

3.8 Procedure for computation of costs and returns

In this study variable cost, fixed cost and total cost had been described. Total variable cost included land preparation cost, human labour cost, seed cost, fertilizer cost, insecticides cost, irrigation cost and interest on operating capital. Fixed cost included rental value of land. Total cost included total variable cost and fixed cost.

3.8.1 Cost of human labour

One of the most important input used in the production process of winter vegetables was human labour. Human labour was classified into two: (i) family labour for which no cash payment was made by the farmers and ii) hired labour for which farmers had to pay in cash. To determine the cost of family labour the opportunity cost concept was used. In this study the opportunity cost of family labour was assumed to be the market wage rate i.e the wage rate which the farmers actually paid to the hired labour. In the study a man day was considered to be 8 hours of work by an adult man. For female and children, the working day assumed to be 6 and 4 hours of work of an adult man, respectively. The daily wage rate Tk 300 per man-day in the study area.

3.8.2 Land preparation cost

Power tiller was used by the farmer for land preparation for producing both potato and bean. The farmers paid the charge for power tiller use at a fixed rate prevailing in the study area.

3.8.3 Cost of seeds

In the study area, farmers used home supplied and purchased seeds and seedlings. The costs of purchased seeds were calculated on the basis of actual payment made by the farmers. The price, thus estimated was also used for determining the costs of farm supplied seeds.

3.8.4 Cost of fertilizer

The farmers used four kinds of fertilizers, namely, Urea, Triple super phosphate (TSP), Muriate of potash (MoP), and Gypsum. The costs of chemical fertilizers were charged on the basis of actual payment made by the farmers for their purchases.

3.8.5 Cost of insecticides

In the study area, most of the farmers used insecticides, such as nogos, dimecrone, diazinon, malathion and sumithion. The costs of insecticides were computed on the basis of the actual price paid by the farmers.

3.8.6 Cost of irrigation

Only shallow tubewell was used for producing winter crops in the study area. Irrigation costs consisted of fuel cost and payment for the use of shallow tubewell. Some of the irrigation water users had their own shallow tubewell; while hired shallow tubewell were used by others. Fuel cost was considered as cash expense which was estimated as prevailing market rate. The payment at the rate of Tk. 1500 per hectare for the use of hired shallow tubewell was considered as cash expense.

3.8.7 Cost of manures

For producing mustard and potato most of the farmers used manures, such as cow dung. The costs of purchased cow dung were calculated at the prevailing local market price. It was also charged for farm supplied manures.

3.8.8 Interest on operating capital (IOC)

The amount of money needed to meet the expenses on hired or purchased inputs was treated as operating capital. In the present study, interest on operating capital was charged at the rate of 10 percent per annum and was estimated for the period during which the operating capital was used. Since all expenses were not incurred at the beginning at the crop season; rather they were speeded over the whole production period, the interest on operating capital was therefore computed using the following formula:

$$IOC = \frac{\text{Operating capital} \times \text{Rate of interest} \times \text{Period of production}}{2}$$

The time considered for a crop production ranged from the period of land preparation to harvesting of the crop.

3.8.9 Land use cost

Land used cost was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of three months. So cash rental value of land has been used for cost of land use.

3.8.10 Returns

Per hectare returns from crop production were broadly classified into gross returns and net returns. The per hectare gross returns was determined by multiplying the crop production with their respective farm get prices. The value of the byproducts was also determined according to the farmer's assessment when the byproducts were not sold. The net returns were estimated by deducting total cost from the gross returns.

CHAPTER IV

SOCIO-ECONOMIC PROFILE OF POTATO AND MUSTARD FARMERS

The socioeconomic background of the sample farmers particularly the family size and composition, literacy level, occupation, land ownership pattern and its distribution etc. are discussed in this section. These characteristics of the farmers often affect their production decision.

4.1 Age

In this study potato and mustard farmers were classified into different age groups i.e. young age (16 to 30 years old), middle age (31-45 years old) and old age (above 45 years old).

Table 4.1 indicates that in the case of Potato producing household 8.33 percent member's belonged to young age group, 60.00 percent belonged to middle age groups and 31.67 percent belonged to the old age. Besides, in the case of mustard farmers, 6.67 percent belonged to young age group, 56.66 percent members belonged to middle age groups and 36.67 percent belonged to the old age group.

It is evident from the Table 4.1 that the age of 31-45 (Middle age group) was the highest which were involved in both potato and mustard production where near about same population were also involved in both potato and mustard production that were belongs to old age group. Old aged people are more experienced about potato and mustard cultivation. So that they can it make easily profitable than young and middle age group. But middle age group belongs to more working ability and also had experience and they can also make these cultivations easily profitable.

Table 4.1: Age distribution of the potato & mustard farmers

Age groups (years)	Potato farmers N = 60		Mustard farmers N = 60		All farmers N = 120
	Number	Percent (%)	Number	Percent (%)	
Young (16-30)	5	8.33	4	6.67	9
Middle (31 - 45)	36	60.00	34	56.66	70
Old (above 45)	19	31.67	22	36.67	41
Total	60	100 of	60	100	120

Source: Field survey, 2018

4.2 Education

Education was considered as the key factor for transforming technology. An educated farmer is inclined to take the new technology and motivated towards progress. It is because of the fact that education changes the psychology of the farmers. The present study has been categorized the respondent family into four categories on the basis of educational qualification.

Table 4.2: Educational status of the potato & mustard farmers

Level of literacy	Potato farmers n=60		Mustard farmers n=60	
	No.	% of family members	No.	% of family members
Illiterate	6	10.00	8	13.34
Primary (1-5)	29	48.33	31	51.67
Secondary Education (6-10)	20	33.34	17	28.33
Higher Secondary or above (>10)	5	8.33	4	6.66
Total	60	100	60	100

Source: Field survey, 2018

Table 4.2 showed that in the case of potato farmers 10 percent were illiterate. The rate of illiteracy was lower in potato producing farmers than those of mustard producing farmers. Primary education is higher in mustard producing farmers and secondary and higher education is higher in potato producing farmers. In case of, potato producing farmers, 48.33 percent had primary education, 33.34 percent had secondary education and 8.33 percent had above secondary level of education. On the other hand, in case of

mustard producing farmers, 51.67 percent had primary education, 28.33 percent had secondary education and 6.33 percent had above secondary level of education. The overall level of education was to be found relatively better for potato producing farmers.

4.3 Family size

The sample of 60 household in the study area comprised a total population of 286, among them 164 were male and 122 were female in case of potato farmers. On the other hand, in the case of mustard farmers the male and the female were 150 and 119, respectively. The average family size of potato and mustard producing farmer was 4.77 and 4.48, respectively shown in table 4.3.

Table 4.3: Family size and gender distribution of potato & mustard farmers

Farmers	Family type		Total family member		Total Family member (No)	Average family size
	Nuclear	Joint	Male	Female		
Potato farmers	21	39	164	122	286	4.77
Mustard farmers	40	20	150	119	269	4.48

Source: Field survey, 2018

4.4 Farm size

Farm size is measured by the entire land area operated by the operator. It is computed by adding the area of land owned and the rented in from others and subtracting the area rented to others. It includes both homestead area and the area used for woods, pasture and crops. In the present study, the size of farm has been defined as, **Cultivated land** = **(Own + Rented in + Mortgaged in - Rented out- Mortgaged out)** during the year of investigation.

Table 4.4: Farm size of the potato & mustard farmers

Categories of farmers	Potato farmers		Mustard farmers		All farmers	
	Number	Percent (%)	Number	Percent (%)	Number	Percent (%)
Small farmers (0.2-1.0 ha)	13	21.67	7	11.67	20	16.67
Medium farmers (1.01-2.0 ha)	43	71.66	50	83.33	93	77.50
Large farmers (above 2.0 ha)	4	6.67	3	5.00	7	5.83
All farmers	60	100	60	100	120	100.00

Source: Field survey, 2018

Table 4.4, shows the land use pattern of potato and mustard farmers. It shows that average farm size of potato and mustard farmers were 0.29 hectares and 0.56 hectares respectively. Table 8, also shows different categories of farmers according to their land size as small, medium and large farmers. Among the respondents, 21.67 percent potato farmers were in small category, 71.66 percent were in medium category and 6.67 percent were in large category. On the other hand, 16.67 percent mustard farmers were in small farmer's category, where 77.50 percent and 5.83 percent were in medium and large farmer category, respectively. From the Table 8, it was evident that most of farmers both in potato and mustard, medium sized farmers were highest and large farmers were the lowest in number and also found that farm size of mustard farmers were higher than potato farmers.

4.5 Farming experience

The sample farmers were found to be experienced in potato and mustard cultivation which was measured by year of experience. According to experience, farmers were categorized in three levels as low, medium and high.

Table 4.5: Farming experience of the potato & mustard farmers

Category	Potato farmers				Mustard farmers			
	Basis of categorization (Years)	Observed range	No	Percent (%)	Basis of categorization (Years)	Observed range	No.	Percent (%)
Low	<13	7-40	5	8.33	<13	10-38	3	5.00
Medium	14-26		28	46.67	14-26		30	50.00
High	>26		27	45.00	>26		27	45.00
Total			60	100.00			60	100

Source: Field Survey, 2018

Tables 4.5 showed that in case of potato producing farmers 46.67 percent (highest) were in medium experienced category and almost same farmers (45%) were in high experienced category and only 8.33% farmers were in low experienced category. In case of mustard producing farmers, 50 percent (highest) were in medium experienced category and 45% were in high experienced category and only 5% farmers were in low experienced category.

4.6 Occupation status

The sample farmers were found to be engaged in various types of occupations Agriculture was the main occupation for both potato and mustard producers.

Table 4.6: Occupation status of the potato & mustard farmers

Type of occupation	Potato farmer		Mustard farmer	
	Main occupation (No)	Percent (%)	Main occupation (No)	Percent (%)
Agriculture	37	61.67	33	55.00
Business	17	28.33	19	31.67
Service	6	10.00	8	13.33
Total	60	100	60	100

Source: Field survey, 2018

Table 4.6 showed that in case of potato producing farmers 61.67 percent were engaged in agriculture, 28.33 percent in business and 10 percent in service. Whereas 55 percent were engaged in agriculture, 31.67 percent in business and 13.33 percent in service of mustard producing farmers.

4.7 Sector wise annual income

The sample farmers were found to be engaged mainly in Agriculture as main income source and agriculture income is highest in both potato and mustard farmer.

Table 4.7: Sector wise average annual income of the potato & mustard farmers

Income source	Potato farmer		Mustard farmer	
	Tk.	Percent	Tk.	Percent
Agriculture	67547	40.21	56570	39.82
Business	28450	16.93	27033	19.03
Service	22100	13.15	19233	13.54
Day labour	6000	3.57	7500	5.28
Other family member	39583	23.56	28516	20.08
Other Source	4320	2.58	3200	2.25
Total	168000	100	142052	100

Source: Field survey, 2018

Table 4.7 showed that in case of potato producing farmer's 40.21 percent income from agriculture and 16.93 percent, 13.15 percent, 3.57 percent, 23.56 percent, 2.58 percent from business, service, day labour, other family member & other source respectively. In case of mustard producing farmer's 39.82 percent income from agriculture and 19.03 percent, 13.54 percent, 5.28 percent, 20.086 percent, 2.25 percent from business, service, day labour, other family member & other source respectively.

4.8 Annual farm income

Cash return from different sectors such as crops, livestock, fisheries, business etc. is considered as family income.

Table 4.8: Farm annual income of the potato & mustard farmers

Category	Potato farmers				Mustard farmers			
	Basis of categorization (Tk. 000')	Observed range (Tk. 000')	No.	Percent (%)	Basis of categorization (Tk. 000')	Observed range (Tk. 000')	No.	Percent (%)
Low	< 100	76.2-452	6	10.00	< 100	75-205.2	4	6.67
Medium	100 - 200		46	76.67	100 - 200		55	91.67
High	> 200		8	13.33	> 200		1	1.67
Total			60	100.00			60	100

Source: Field survey, 2018

According to table 4.8 the annual family income for both potato and mustard farmers were categorized into three groups as low, medium and high. In terms of potato farmers, the highest farmers (76.67%) were in medium income category where 10% farmers were in low income category. On the other hand, the highest number of mustard farmers (91.67%) was in medium income category, where 6.67% mustard farmers were in low income category.

4.9 Annual family expenditure

According to table 4.9 the annual family expenditure for both potato and mustard farmers were categorized into three groups as low medium and high. In terms of potato farmers, the highest farmers (51.67%) were in low income expenditure category where 46.67% farmers were in medium and 1.67 was in high expenditure category. On the other hand, the highest number of mustard farmers (56.67%) was in low income expenditure category, where 43.33% in medium and no farmer were in high expenditure category.

Table 4.9: Annual family expenditure of the potato & mustard farmers

Category	Respondents for potato farmers				Respondents for mustard farmers			
	Basis of categorization (Tk. 000')	Observed range (Tk.000')	No.	Percent (%)	Basis of categorization (Tk. 000')	Observed range (Tk.000')	No.	Percent (%)
Low	< 100	57.8-305.16	31	51.67	< 100	61.6-141.16	34	56.67
Medium	100 - 200		28	46.67	100 - 200		26	43.33
High	> 200		1	1.67	> 200		0	0.00
Total			60	100.00			60	100.00

Source: Field survey, 2018

CHAPTER V

PROFITABILITY OF POTATO AND MUSTARD PRODUCTION

Study on economic research depends on the profitability of enterprises. In this chapter costs, returns and profitability of potato and mustard production have been estimated. In calculating cost and return both full cost and cash cost were used. Attempt has been made to profitability of the two crops.

5.1 Variable cost

5.1.1 Cost of human labour

Human labour was one of the most important and largely used inputs in producing both mustard and potato. It may be noted that in the case of potato production a total of 163 man-days of human labour were required per hectare. The per hectare total cost of human labour was Tk. 48900 for potato production (Table 5.1). The study revealed that tuber planting, weeding and harvesting, carrying and storing consumed the largest amount of human labour in producing potato, which was about 75 percent of total labour cost. In the case of mustard production, total human labour requirement was 51 man-days per hectare. Per hectare total cost of human labour was Tk. 15300 for mustard production (Tables 5.2).

Table 5.1: Per hectare cost of human labor for potato production

Items of cost	Total labor (man-day)	Total cost (Tk.)	Percentage of total cost
Main land preparation	32	9600	19.64
Tuber planting	35	10500	21.47
Manure and fertilizer	9	2700	5.52
Weeding	14	4200	8.57
Irrigation	5	1500	3.07
Pest management	9	2700	5.52
Harvesting	42	12600	25.78
Carrying and storing	17	5100	10.43
Total	163	48,900	100.00

Source: Field survey, 2018

Table 5.2: Per hectare cost of human labor for mustard production

Items of cost	Total labor (man-day)	Total cost (Tk.)	Percentage of total
Main land preparation	11	3300	21.57
Seed sowing	2	600	3.92
Manure and fertilizer	7	2100	13.73
Irrigation	4	1200	7.84
Pest management	2	600	3.92
Harvesting	17	5100	33.33
Carrying and storing	8	2400	15.69
Total	51	15300	100

Source: Field survey, 2018

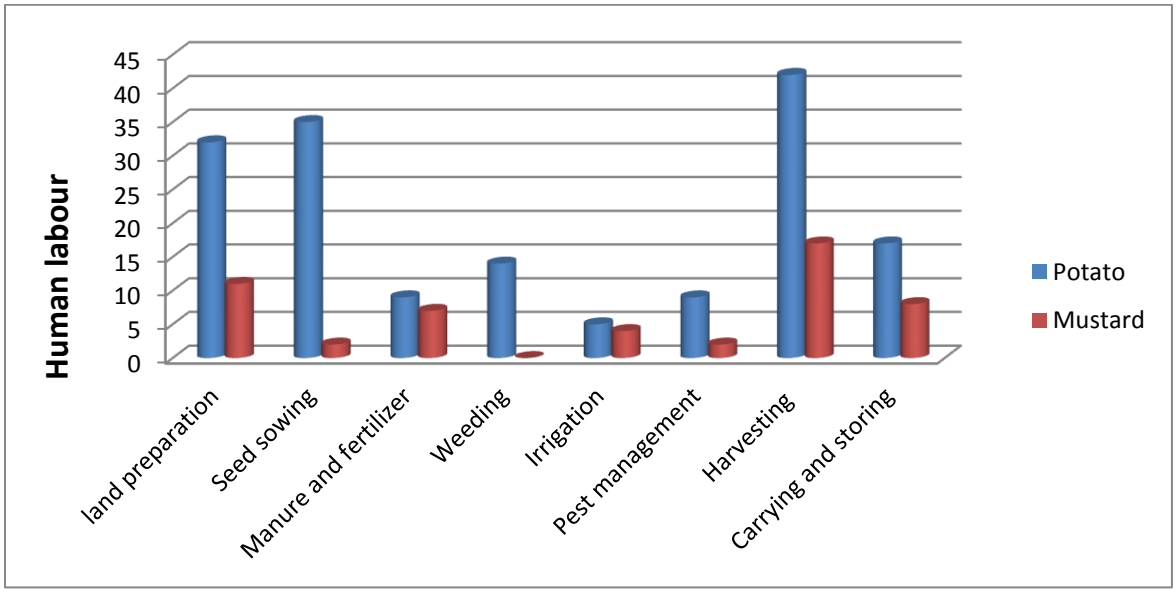

Figure 5.1: Distribution of per hector labour required for Potato & Mustard Production

5.1.2 Cost of land preparation

Power tiller was used by the farmer for land preparation for producing both potato and mustard. The farmers paid the charge for power tiller use at a fixed rate prevailing in the study area. The power tiller cost for potato and mustard was Tk. 3712 and Tk. 3723 per hectare which shared 2.71 and 7.03 percent of total cost, respectively (Table 5.3 and 5.4).

5.1.3 Cost of seeds

The cost of seed is the single most important cost item for potato and mustard production. In the study area, it was found that farmers used both home supplied and purchased seeds. The total amount of seed cost per hectare for producing potato was Tk.40595 which shared 29.67 percent of total cost (Table 5.3). In case of mustard cultivation, cost of seeds was Tk. 630, which shared 1.19 percent of total cost (Table 5.4).

5.1.4 Manure cost

The cost of manure is an important cost item for potato and mustard production. In the study area, it was found that farmers used both homemade and purchased organic manure. All the manures were purchased, estimated according as the cash price paid by farmers. Per hectare manure cost of potato production was Tk. 4578 which represent 3.35 percent of the total cost (Table 5.3). In case of mustard cultivation, the total amount of manure cost per hectare was Tk. 4575, which shared 8.64 percent of total cost (Table 5.4).

5.1.5 Fertilizer cost

Farmers used urea, TSP, MP and gypsum. All the fertilizers were purchased, cost of fertilizers were estimated according as the cash price paid by farmers. Per hectare fertilizer cost of potato production was Tk. 16347 which represent 11.94 percent of the total cost (Table 5.3). In case of mustard cultivation, the total amount of fertilizer cost per hectare was Tk. 14983, which shared 28.28 percent of total cost (Table 5.4).

5.1.6 Cost of irrigation

Irrigation water is an important input in winter vegetables cultivation. Per hectare cost of irrigation water was Tk. 7018 for potato and Tk. 1507 for mustard which represented 5.13 percent and 2.84 percent of their respective total cost (Table 5.3 and Table 5.4).

5.1.7 Cost of pesticides

The cost of insecticides was calculated on the basis of actual money paid. The cost of insecticides amounted to Tk. 2583 per hectare for potato and Tk. 1210 for mustard production, which occupied 1.89 and 2.28 percent of their respective total cost (Table 5.3 and Table 5.4).

5.1.8 Interest on operating capital (IOC)

Interest on operating capital (IOC) was considered at the rate of 10 percent consulting with the local bank managers. Three months were considered as the production period of mustard and potato and accordingly operating capital cost was estimated. Several studies also used the same percentage of bank rate. Interest on operating capital was charged on cash cost only. The IOC was calculated using the following formula.

$$\text{IOC} = \frac{\text{Operating capital} \times \text{Rate of interest} \times \text{Period of production}}{2}$$

On an average 3 months is required to cover the production period (from land preparation to harvesting) but to process the loan it takes some times like 1-1.5 months. So, in total 3 months was considered to calculate the IOC of each crop selected for this study.

Table 5.3: Per hectare costs of potato production

Items of cost	Total cost (Tk.)	Percent of total cost
Total labor cost	48900	35.74
Animal/mechanical power cost for land preparation	3712	2.71
Seed cost	40595	29.67
Manure cost	4578	3.35
Fertilizer cost	16347	11.94
Pesticide cost	2583	1.89
Irrigation cost	7018	5.13
IOC	3093	2.26
A. Total variable cost	126826	92.69
Land used cost	10000	7.31
B. Total fixed cost	10000	7.31
C. Total cost (A+B)	136826	100.00

Source: Field survey, 2018

Table 5.4: Per hectare costs of mustard production

Items of cost	Total cost (Tk.)	Percent of total cost
Total labor cost	15300	28.88
Animal/mechanical power cost for land preparation	3723	7.03
Seed cost	630	1.19
Manure cost	4575	8.64
Fertilizer cost	14983	28.28
Pesticide cost	1210	2.28
Irrigation cost	1507	2.84
IOC	1048	1.98
A. Total variable cost	42976	81.12
Land used cost	10000	18.88
B. Total fixed cost	10000	18.88
C. Total cost (A+B)	52976	100

Source: Field survey, 2018

5.1.9 Total variable cost

The summation of the costs of variable inputs gave the total variable costs which were Tk. 126826 and Tk. 42976 per hectare for potato and mustard production respectively. In percentage term total variable costs covered 92.69 percent and 81.12 percent of total costs for mustard and potato respectively (Table 5.3 and Table 5.4).

5.2 Fixed costs

Fixed costs are the amounts spent by the firm on fixed inputs in the short run. These costs remain unchanged even if the output of the firm is nil. Fixed cost remains fixed because the firm does not change its size and the amount of fixed factors employed.

5.2.1 Land use cost

Land use cost was calculated by using per hectare cash rental value of land. Land use cost was estimated for the cropping period of three months for potato and mustard production. The land use cost per hectare was Tk. 10000 for potato and Tk. 10000 for mustard production. Land use cost covered 7.31 and 18.88 percent of total cost of potato and mustard production respectively (Table 5.3 and Table 5.4).

5.3 Total cost

Tables 5.3 and Table 5.4 showed that per hectare gross cost for producing potato and mustard production were Tk. 136826 and Tk. 52976 respectively. Per hectare gross cost of mustard was lower than potato due to higher amount of seed cost incurred in producing potato.

5.4 Gross return from potato and mustard production

The average market price of potato and mustard was Tk.10 per kg and Tk. 42 per kg respectively. The per hectare average yield of potato was 21500 kg (Table 5.5) and the per hectare average yield of mustard was 1450 kg (Table 5.6). The average per hectare gross returns was Tk. 215000 and Tk. 63623 for potato and mustard production respectively.

Table 5.5: Per hectare costs and return of potato production

Items	Quantity (Kg)	Price per unit (Tk./kg)	(Tk.)
Yield	21500	10	215000
A. Gross return			215000
B. Total variable cost			126826
C. Total cost			136826
Gross margin (A-B)			88174
Net return (A-C)			78174
BCR (Undiscounted)			1.57

Source: Field survey, 2018

Table 5.6: Per hectare costs and return of mustard production

Items	Quantity (Kg)	Price per unit (Tk.)	(Tk.)
Yield	1450	42	60900
By product			2723
A. Gross return			63623
B. Total variable cost			42976
C. Total cost			52976
Gross margin (A-B)			20647
Net return (A-C)			10647
BCR (Undiscounted)			1.20

Source: Field survey, 2018

5.5 Net return

Net return was calculated by subtracting Total cost from its Gross return. Per hectare net return from potato production was Tk. 78174 and mustard production was Tk. 10647 (Table 5.5 and Table 5.6). So it can be concluded from this study that potato production is more profitable than mustard production.

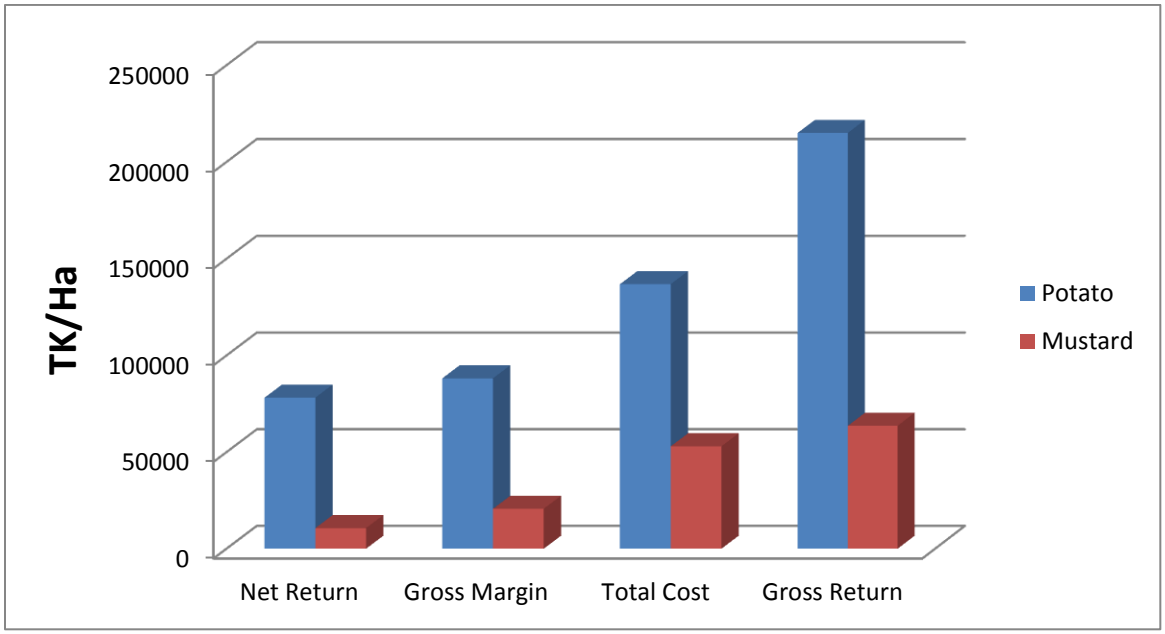

Figure 5.2: Net return, Gross margin, Total cost & Gross return of potato and mustard production.

5.6 Benefit-cost ratio (Undiscounted)

In this study, BCR (undiscounted) was found 1.57 and 1.20 for potato and mustard production respectively (Table 5.5 and Table 5.6). It implies that one taka investment in potato production generated Tk. 1.57 and one taka investment in mustard production generated Tk. 1.20. From the above calculation it was found that both productions are profitable but potato production is more profitable than mustard production.

5.7 Comparative profitability of potato and mustard cultivation

In determining the comparative profitability of mustard and potato it was found that per hectare yield, cost and net return of potato were higher than those of mustard. Total variable cost of potato production per hectare is Tk. 126826 (Table 5.3) which is higher than the variable cost of mustard production, Tk. 42976 (Table 5.4). Results show that between potato and mustard cost of production per hectare was higher in producing potato. The cost of production of potato per hectare was estimated at Tk. 136826 (Table 5.3) and the per hectare cost of production of mustard was amounted to Tk. 52976 (Table 5.4). Table 18 and Table 19 shows that per hectare gross return from potato and mustard were Tk. 215000 and Tk. 63623 respectively. The per hectare yield was highest for potato as well as the net return per hectare was also the highest for potato. The per hectare net return of potato and mustard were amounted to Tk. 78174 (Table 5.5) and Tk. 10647(Table 5.6) respectively. Benefit cost ratio (undiscounted) comprised 1.57 (Table 5.5) and 1.20 (Table 5.6) was for potato and mustard, respectively. The per hectare cost and return of producing potato was higher than the per hectare cost and return of producing mustard. Due to per hectare gross return of producing potato is higher than that of producing mustard, BCR (undiscounted) was higher in potato than mustard.

From the above discussion it was considered that potato cultivation is relatively profitable than mustard cultivation.

CHAPTER VI

FACTORS AFFECTING THE PRODUCTION OF POTATO AND MUSTARD

The focus of the present chapter is to make a functional analysis of different categories in the framework of production function analysis. Six variables were considered for the variation of the production of selected crops. Cobb- Douglas production function model was used to determine the effects of individual input used for selected crop production and economic returns.

6.1 Factors contributing to yield and economic return

In the study area for producing potato and mustard the following inputs namely human labour, seed, Land preparation cost, fertilizer, irrigation and insecticides were employed which were considered as priority explanatory variables responsible for the variation of selected crops production. Multiple regression analysis was conducted to understand the possible relationship between the input and output. In order to determine the effect of variable inputs on the yield of selected vegetables, Cobb-Douglas production function was initially estimated.

The following Cobb-Douglas production function was used in the present study:

$$Y_i = \alpha X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} X_5^{\beta 5} X_6^{\beta 6} e^{ui}$$

By taking log in both sides the Cobb-Douglas production function was transformed into the following logarithmic form because it could be solved by the ordinary least squares (OLS) method.

$$In\ Y = ln\ a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + e^{Ui}$$

Where,

α = Constant or intercept

Y = Gross return (Tk. /ha)

X_1= Human labour cost (Tk. /ha)

X_2 = Land preparation cost (Tk. /ha)

X_3 = Seed cost (Tk. /ha)

X_4 = Fertilizer and manure cost (Tk. /ha)

X_5 = Irrigation cost (Tk. /ha)

X_6 = Insecticides cost (Tk. /ha)

$\beta_1, \beta_2, \ldots\ldots \beta_6$ = Coefficient of respective variables:

In = Natural logarithm

e = Base of natural logarithm

Ui = Error term.

6.2 Estimated values of the production function analysis

The estimated values of the coefficients and related statistics of the Cobb-Douglas production functions for mustard and potato have been presented in Table 6.1. The major features of the model are:

- The significance level of individual coefficient was tested at one and five percent probabilities ;
- Total variation of the output was measured by coefficient of multiple determination(R^2); and
- Goodness of fit of the model was measured by F-statistics.

6.3 Interpretation of the results

Human labour (X_1)

The magnitude of the regression coefficient of human labour cost was found to be positive and significant at 1 percent level for both potato and mustard production (Table 6.1). Co-efficient of human labour cost (X_1) was 0.296 for potato and 0.263 for mustard production. It implies that tk.1 increase of human labour cost, keeping other factors constant, would lead to an increase in the gross return of mustard and potato by tk. 0.296 and tk. 0.263 respectively (Table 6.1).

Land preparation cost (X_2)

The regression coefficients of power tiller cost (X2) were positive but insignificant for both potato and mustard production. The regression coefficients of power tiller cost (X2) were 0.047 and 0.050 for potato and mustard production, respectively (Table 6.1).

Seed cost (X_3)

It can be seen from Table 20 that regression coefficient of seed cost (X_3) were 0.046 and 0.032 for potato and mustard production respectively, Which were positive but insignificant for both potato and mustard production (Table 6.1).

Fertilizer cost (X_4)

The regression coefficients of fertilizer cost were positive and significant at 1 percent level for potato and significant at 5 percent level for mustard production. Co-efficient of Fertilizer cost (X_4) were 0.343 for potato and 0.319 for mustard production. This indicates that an increase in tk. 1 of fertilizer cost, remaining other factors constant, would result in an increase the gross return of potato and mustard by tk. 0.343 and tk. 0.319 respectively (Table 6.1).

Pesticide cost (X_5)

It can be seen from Table 6.1 that regression coefficient of Pesticide Cost (X_5**)** were 0.178 (significant at 10 percent level) and 0.136 (significant at 10 percent level) for potato and mustard production, respectively, which implies that tk. 1 increase in amount of pesticide, keeping other factors constant, would result in an increase the gross return of potato and mustard by tk. 0.178 and tk. 0.136 respectively (Table 6.1).

Irrigation cost (X_6)

The regression coefficient of irrigation cost were positive and significant at 5 percent level for Potato production, which value is 0.161 but positive and insignificant for Mustard production, which value is 0.052. This indicates that an increase in tk. 1 of irrigation cost, remaining other factors constant, would result in an increase the gross return of Potato production by tk.0.161 (Table 6.1).

6.4 Factors affecting potato and mustard production

Table 6.1: Estimated values of the coefficients and related statistics of Cobb-Douglas production function of potato and mustard

Explanatory variables	Estimated coefficient & (t)value			
	Potato	t value	Mustard	t value
Intercept	9.362 (3.870)	2.42	3.470 (1.907)	1.82
Total labor cost (X_1)	0.296*** (0.059)	5.01	0.263*** (0.057)	4.61
Animal/mechanical power cost for land preparation (X_2)	0.047 (0.040)	1.17	0.050 (0.081)	0.62
Seed cost (X_3)	0.046 (.038)	1.21	0.032 (0.029)	1.10
Fertilizer cost (X_4)	0.343*** (0.062)	5.52	0.319** (0.061)	5.22
Pesticide cost (X_5)	0.178* (.083)	2.14	0.136* (0.071)	1.91
Irrigation cost (X_6)	0.161** (0.057)	2.82	0.052 (0.079)	0.65
Return to Scale	1.071		0.852	
R^2	0.67		0.62	
F-value	7.52***		6.67***	
Sample size	60		60	

Source: Field survey, 2018

*** Significant at 1 percent level
** Significant at 5 percent level
* Significant at 10 percent level

In table parenthesis indicate standard error

Performances of the mustard and potato production model

The $\mathbf{R^2}$ were found to be 0.67 and 0.62 for potato and mustard, respectively (Table 6.1). It indicated that about 67 percent of the total variations in yield of Potato and 62 percent of the total variations in yield of Mustard could be explained by the explanatory variables included in the model. Other 33 percent and 38 percent variation of total yield depend on the factors which were not included in the regression model of potato and mustard respectively. The **F-values** of potato and mustard production were 7.52 and 6.67 respectively (Table 6.1) and both were significant at 1 percent level, which implied good fit of the model. Highly significant F-value implied that the included variables collectively were important for explaining the variations in the yield of mustard and potato production.

Return to scale is the summation of all regression co-efficient of the estimated production function. For potato, the summation of the coefficient is 1.071 (Table 6.1) which implies that the production function exhibits a tendency to increasing return to scale. That is, the farmers were operating their potato farming in the first stage of production function. In this case, if all the inputs specified in the production function are increased by one percent, gross return will increase by 1.071 percent.

For mustard, return to scale is 0.852 (Table 6.1) which implies that production function exhibits diminishing return to scale. That is, the farmers were operating their mustard farming in the second stage of production function. That is, if all the inputs specified in the function are increased by one percent, gross return will increase by 0.852 percent.

CHAPTER VII

PROBLEMS AND CONSTRAINTS OF POTATO AND MUSTARD PRODUCTION

It is generally agreed that the small fanners in Bangladesh do not get access to the required quantity of seeds, fertilizer, insecticides, technical support and finally fair price of their products. They fail to achieve their target due to some technical, economic, marketing and social problems. Although the cultivation of mustard and potato is profitable at farm level, the farmers are facing various problems and constraint to its production. Therefore, an effort has been made to ascertain the extent of problems and constraints faced by the farmers in the production and marketing of mustard and potato.

7.1 Problems and constraints faced by the farmers

In the study area, it was observed that the problems and constraints faced by the farmers were not identical. These differed from farmer to farmer and enterprise to enterprise. These problems and constraints affected production as well as profitability to the farmer. However, farmers were asked about their acute problems and constraints in the production of mustard and potato are as follows. For the sake of analytical convenience, the problem and constraints were as follows-

I. Lack of capital or institutional credit

The production of selected vegetables needs proper doses of fertilizers, irrigation water, insecticides in order to special agronomic care and therefore, farmers should have sufficient money to buy the necessary inputs. But in the study area, about 55.00 and 53.33 percent of total potato and mustard growers respectively reported that they did not have adequate amount of operating capital (Table 7.1). Most of the growers did not get institutional credit and, therefore, they had to borrow money from relatives, neighbors and money lenders at exorbitant rate of interest.

II. Scarcity of quality seeds and high price

Seed is one of the most important inputs. Production of crop depends largely upon timely availability of good and healthy seeds. About 58.33 percent of potato and 55.00 percent of mustard (Table 7.1) growers mentioned that some inferior quality seeds were sold in the market and consequently the germination rate was very low.

III. Lack of knowledge

Low productivity of mustard and potato is a serious problem. In the study area most farmers are illiterate. About 53.33 percent of mustard and 50.00 percent of potato growers (Table 7.1) reported that the productivity of the selected winter vegetables was low due to lack of scientific knowledge about cultural practice.

IV. Storage capacity

Lack of proper storage facilities was the most important problem regarding potato and mustard marketing. 56.67 percent of potato growers and 56.67 percent of mustard growers complained about the storage problem (Table 7.1).Therefore, due to lack of proper storage facilities the farmer did not get fair prices of their potato and mustard.

V. High price of fertilizers and insecticides

Fertilizer and insecticides are vital inputs in the production of mustard and potato. During the cultivation period, the prices of fertilizer and insecticides went up due to profit making motive of both retailers and wholesalers. It was reported that mustard and potato plants were attacked by various types of pests and diseases. About 51.67 percent of mustard and 51.67 percent of potato growers had to face this problem and they reported that although there were timely supplies of fertilizers, the prices were higher. They complained that they had to purchase fertilizers and insecticides at higher price in the study area (Table 7.1).

VI. Low market price of product at harvesting period

Price of particular product works as an incentive for increasing the production of crops. It was reported that prices of output of the crops were not adequately attractive to the

farmers for growing mustard and potato in the study area. About 53.33 percent of potato and 48.33 percent of mustard farmers reported that the prices received from mustard and potato were low, particularly after harvest of the crops (Table 7.1).

VII. Pest & diseases infestation

Some incidences of pest and disease attack were noticed in the crops. About 50.00 percent of potato and 51.67 percent of mustard growers identified this as a major problem (table 7.1).

Table 7.1: Responses on major problems faced by the farmers in producing potato and mustard

Name of problems	Potato fanners (n=60)			Mustard farmers (n=60)		
	Farmer response (No.)	Percent (%)	Rank	Farmer response (No.)	Percent (%)	Rank
1. Lack of capital or Institutional credit	33	55.00	3	32	53.33	3
2. Scarcity of quality seed & high price	35	58.33	1	33	55.00	2
3. Lack of technical knowledge	30	50.00	6	32	53.33	3
4. Lack of storage capacity	34	56.67	2	34	56.67	1
5. High market price of fertilizer	31	51.67	5	31	51.67	4
6. Low market price of product	32	53.33	4	29	48.33	5
7. Pest & diseases infestation	30	50.00	6	31	51.67	4

Source: Field survey, 2018

CHAPTER VIII

SUMMARY AND CONCLUSION

8.1 Summary

The present study was undertaken with a view to determine and analyze the comparative profitability of potato and mustard production in an area of Gaibandha district and area selected for the study covered two upazila namely Gabindogonj and Polashbari in the district of Gaibandha. Gaibandha district had been purposively selected as study area, 120 samples were selected by simple random sampling technique. Among 120 farmers, 60 farmers were potato producer and the other 60 farmers were mustard producer.

Data were collected during the months from January to February 2019. All the collected data were summarized and scrutinized carefully to eliminate all possible errors. Data were presented mostly in the tabular form. Descriptive statistics like average, percentage, etc., were followed to analyze the data to achieve the objectives of the study. Cobb-Douglas production function was used to estimate the factors affecting the yield of potato and mustard.

In studying socioeconomic characteristics, age, educational status, farm size and land ownership, family size, annual family income and family expenditure of the sample farmers were considered. It was found that the age group of 31 to 45 years was the largest group in all the cases. The literacy rate of potato producers was high. The average farm size of potato and mustard were 0.29 hectare and 0.56 hectare respectively. The average farm size indicated that most of the sample fell in the small size category.

Actual price paid by farmer were used to estimate the cost of purchased inputs, prevailing market price was used for home supplied inputs. The bank interest rate of 10 percent per annum was used to determine the opportunity cost of operating capital. In the production process of selected vegetables, human labour 'was the most important factor. On an average per hectare human labour required for potato and mustard were 163 man-days and 51 man-days respectively. The per hectare costs of human labour for potato and

mustard were Tk. 48,900 and Tk. 15300, respectively. Farmers of the study area used home supplied and purchased seeds. The per hectare seed costs for potato and mustard were Tk. 40595 and Tk. 630 respectively. The cost of seed constituted 29.67 percent and 1.19 percent of total cost of potato and mustard respectively. Fertilizer is a major requirement of potato and mustard production. In the study area, farmers mainly used four types of fertilizer namely urea, TSP, MP and gypsum. The per hectare cost of these fertilizers were calculated at Tk. 16347, and Tk. 14983 for potato and mustard, respectively. The per hectare costs of irrigation was Tk. 7018 for potato and 5.13 percent the total costs of respective crop and the per hectare costs of irrigation was Tk. 1507 for mustard and 2.84 percent of total cost.

Gross returns of the production were calculated on the bass of the value of product and by-product. The per hectare total values of product for potato and mustard were Tk. 215000 and Tk. 63623 respectively. Net returns for potato were calculated at Tk. 78174 and for mustard production were Tk. 10647 per hectare respectively. Undiscounted BCR on total cost bases were 1.57 and 1.20 for potato and mustard production respectively.

In the present study, Cobb-Douglas production function model was applied on the basis of its superior properties and empirical fit. The explanatory variables were human labour, seed, fertilizer, insecticides and irrigation for potato production and human labour, seed, fertilizer, manure and insecticides for mustard production. The coefficient of multiple determinations $\mathbf{R^2}$ was **0.67** in case of potato production function & **0.62** in case of mustard production function. Explanatory variables like human labour, fertilizer, land preparation cost had significant impact on both potato and mustard production. The **F-values** of potato and mustard production were **7.52** and **6.67** respectively; both were significant at 1 percent level, which implied good fit of the model.

The present study identified some of the problems and constraints associated with potato and mustard production. The main problems faced by the farmers were: lack of capital, high price of fertilizer and insecticides, low price of the product, lack of scientific knowledge and method and scarcity of quality seeds.

8.2 Conclusion

In determining the comparative profitability of potato and mustard it was found that per hectare yield and gross return of potato were higher than that of mustard. The study revealed that potato production was relatively more profitable than mustard. Through potato production more profitable compared to mustard, due to huge cost involvement it was difficult to cultivate potato for the resource poor farmer. Seed cost was the most important factor for potato production. Due to lack of adequate storage facilities the potato farmers had to sell their product at a lower price during harvesting period and they had to buy seed at higher cost. Human labour cost was another important factor for both potato and mustard production. It may be mentioned that due to some limitations, it is difficult to achieve absolute conclusion for this study.

Policy recommendations

The study revealed that the cultivations of potato and mustard were profitable in the study area. Potato and Mustard can contribute more than the present situation if proper management is practiced. There was a great opportunity to increase the productivity of potato and mustard due to their highly nutritious value and demand in the country. With a view to improving production system, to remove hindrance in producing potato and mustard and to enhancing farmer's income the following recommendations are highlighted below:

- Scarcity of quality seeds was a serious problem both for potato and mustard production. So variety development programme may be undertaken by the relevant research institutes.
- Seeds of good quality, disease resistance and high yielding varieties could be provided directly to the farmers just before the growing season.
- Linkage between researcher and extension may be helpful to disseminate the modern technological knowledge.
- Capital shortage was one of the severe problems faced by the farmers. It is therefore, necessary that credit on easy terms should be provided to the farmers for the entire area under potato and mustard production.
- Regular supply of fertilizer should be ensured and fertilizer adulteration should be

controlled strictly.

- Farmers generally do not use balanced dose of fertilizer. They have to follow the recommended dose for different agro-ecological zones.
- Irrigation facilities should be made available to the producers.
- To mitigate storage problem cold storage facilities may be increased with lower preservation cost.
- Modern technology should be disseminated by the extension workers for improving the efficiency in producing these crops.
- To control the price fluctuation and ensure proper price to the producer, it is necessary to have government intervention potato and mustard marketing.

Shortcomings of the study

The present study provides some useful information for farmers, researchers and decision makers regarding the economics of potato and mustard production. Almost all the research studies have some common limitations in terms of time, fund and personnel. The present study is not an exception to that. Some of the specific limitations however are as follows:

- The farmers in Bangladesh do not generally keep records of their farm business transactions. As a result, the accuracy of data fully depends upon their memories and sincerity. Consequently, the possibility of data errors could not be ruled out.
- Exact quantification of family labour was a difficult task because the farmers could not estimate distinctly the number of family labour used in different farm activities.
- The study was conducted in a limited area of upazila taking small number of sample producer. Therefore, the findings of the study should be taken with a note of caution.

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