COMPARATIVE PROFITABILITY AND RESOURCE USE EFFICIENCY ANALYSIS BETWEEN LOCAL AND HIGH YIELDING VARIETY OF POTATO IN MUNSHIGANJ DISTRICT OF BANGLADESH

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CERTIFICATE

This is to certify that the thesis entitled "**COMPARATIVE PROFITABILITY AND RESOURCE USE EFFICIENCY ANALYSIS BETWEEN LOCAL AND HIGH YIELDING VARIETY OF POTATOIN MUNSHIGANJ DISTRICT OF BANGLADESH**" submitted to the Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Dhaka-1207, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (MS) in AGRICULTURAL ECONOMICS**, embodies the result of a piece of bona fide research work carried out by **PROTIC BISWAS**, Registration No. **15-06813** 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.

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Dedicated To
My Parents

ABSTRACT

Potato is a vital crop in Bangladesh, with the country being the fourth-largest producer in Asia. It is contributing significantly to the country's economy and food security. The sample frame for this research was purposively chosen to include areas with extensive potato farming. A sample size of 80 farmers who cultivated potato in Munshiganj district was chosen. This research aimed to investigate the socio-demographic profile of potato farmers, assess the comparative profitability and resource use efficiency of hybrid and local varieties of potatoes, and identify the problems faced by farmers during potato cultivation. The research found that high yielding variety potato cultivation was more profitable than local variety potato cultivation, with an undiscounted benefit cost ratio of 1.20 compared to 1.02 for local variety potato cultivation. The study also found that all the inputs were overutilized. The constrains in potato production and marketing include high rotting rate during storage, low price of output, high cost of storage facilities, scarcity of quality seed, problems of middlemen in the market, lack of modern cultivation knowledge, and unavailability of credit and extension services. The government has implemented policies such as providing fertilizer and seed subsidies and creating potato storage facilities to help potato growers.

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ABBREVIATIONS AND ACRONYMS

BARI	: Bangladesh Agricultural Research Institute
BBS	: Bangladesh Bureau of Statistic
BCR	: Benefit Cost Ratio
BDT	: Bangladeshi Taka
BER	: Bangladesh Economic Review
DAE	: Department of Agricultural Extension
et al.	: and others (at elli)
HIES	: Household Income and Expenditure Survey
HYV	: High Yielding Variety
IOC	: Interest on Operating Capital
kg	: Kilogram
NGO	: Non-Government Organization
$	: Dollar

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Bangladesh is an agricultural nation, where agriculture is the main industry and source of employment. This industry directly generates 11.50% of the overall GDP (BBS, 2022). In tropical and subtropical nations, potatoes are a significant food crop. In Bangladesh, it is the fourth-most significant crop. It is a significant and well-liked crop due to its rapid financial return and variety of uses. With a leading position among Bangladeshi vegetable farmers in terms of both acreage and output, it offers a wider scope and promise for ensuring food security and reducing poverty. Every day of the year, almost every family in Bangladesh eats potatoes as a vegetable. Though not frequently, it is used as an inexpensive source of carbs to augment diet rice. As a substitute crop and multipurpose food crop, potatoes might be crucial for Bangladesh. It possesses the ideal qualities of being very productive, nourishing or excellent food, and pleasant in taste. Over about 464011 hectares of land, Bangladesh grows potatoes, with an average production of 21.863 metric tons per hectare. (BBS, 2022)

In Bangladesh, potatoes are a major and dominant food crop. In Bangladesh, it is the third most significant food crop after rice and wheat in terms of human consumption, and it ranks as the world's seventh-largest producer of potatoes (FAOSTAT, 2020). Like rice, which is cultivated in more than 100 countries, potatoes are not just a cash crop for farmers; they are also used as a staple meal in many nations, where they are consumed by one billion people. The potato is an excellent supply of high-quality protein, a significant source of vitamin C, and it is rich in essential minerals but it is not a very effective source of energy (Sing and Rajgond, 2014). Potatoes are equivalent to rice and wheat in terms of nutrients. It is simple to digest. The greatest substitute for rice that offers the same nutrients is the potato, which is why consumption of potatoes is rising in developing nations. Although being a temperate crop, potatoes may be produced throughout the majority of the nation in the winter. Potato plantations should be planted in well-fertilized soil that is sufficiently moistened in warm, sunny weather. The ideal temperature range for growth and development is between 15^0 and 20^0 C (Struik, 2007). Since 1960, Bangladesh has been cultivating it using rare, specifically imported cultivars from the Netherlands. The demand for potatoes has caused the

production area to grow quickly and surpass all other food crops in emerging nations. Nowadays, a large amount of the world's potato production is supplied by developing nations in South America, Africa, and Asia to ensure the food security of millions of people (CIP, 2019).

Instead of growing rice, Bangladeshi farmers have been growing potatoes, which are a key food crop and a source of income. But, in recent years, potato output has severely decreased due to unfavorable weather conditions brought on by climate change. Over recent years, the major item on the dinner table has shifted from being a vegetable to being a potato. Farmers have previously experienced price fluctuations during harvest season and got low prices during years of strong produce (BBS, 2022).

1.2 Production of Potato

As a cash crop, potatoes are produced across Bangladesh during the winter (mid-November to mid-February). The potato has a rather short growth season (around 90 days). Low temperatures following planting, during early development stages, and high temperatures throughout the tuber bulking stage severely limit potato growth and yield since Bangladesh's winter season (End-November to End-January) is so brief. The northern region experiences longer winters and benefits more from potato production. To get a larger tuber production from potatoes in these kinds of conditions, effective management practices to promote strong early development are crucial.

One of the most crucial aspects of potato production is the optimal plant density since it affects seed cost, plant development, yield, and crop quality (Bussan et al., 2007). In actuality, the quantity and size of seed tubers sown affect plant density in potato crops (Allen and Wurr, 1992). As a result, several research have been carried out to determine the ideal seed size and planting spacing for a particular area (Hoque, 2001, Bussan et al. 2007). In general, total yields rose as plant density grew, but the yield per plant fell (Hoque, 2001). Nevertheless, the ideal planting density varies according on the cultivars and environmental factors.

In Bangladesh, potatoes ranked 2nd among major crops. All around the country, potato is growing. Rangpur, Dinajpur, Bogura, Rajshahi, Munshigonj, and Joypurhat are among the districts that are known for being more forward-thinking and seeing rapid increases in potato production. Rangpur Division produces the most potatoes, with Rajshahi Division coming in second.

Table 1.1: Variety wise potato cultivated area and production area (FY 2020-21 to FY 2021-22)

Variety	2020-21			2021-22		
	Area (Hectares)	Production (M.T.)	Average Yield (M.T./Ha.)	Area (Hectares)	Production (M.T.)	Average Yield (M.T./Ha.)
Local	69338	796832	11.492	67529	798788	11.829
Hybrid	399342	9090810	22.764	396482	9346047	23.572
Total	468680	9887242	21.096	464011	10144835	21.863

Source: BBS, 2022.

Table 1.2: Division wise area and production of local variety of Potato in Bangladesh

Division	2020-21			2021-22		
	Area (Ha.)	Production (M.T.)	Average Yield (M.T./Ha.)	Area (Ha.)	Production (M.T.)	Average Yield (M.T./Ha.)
Barishal	-	-	-	-	-	-
Chattagram	5242	53888	10.279	5066	67588	13.341
Dhaka	3302	30374	9.199	3095	28408	3.714
Khulna	-	-	-	-	-	-
Mymenshingh	5685	53862	9.474	5721	56014	9.791
Rajshahi	34790	436914	12.559	33441	402439	12.034
Rangpur	17754	196146	11.048	17420	214128	12.292
Sylhet	2564	25247	9.847	2786	30210	10.843
Bangladesh	69338	796432	11.492	67529	798788	11.829

Source: BBS, 2022

The average production of high yielding variety of potato in Bangladesh was 22.764 MT/Ha. and 23.578 MT/Ha. in FY 2020-21 and FY 2021-22, respectively (Table 1.1). The average production of local variety of potato in Bangladesh was 11.492 MT/Ha.

and 11.829 MT/Ha. in FY 2020-21 and FY 2021-22, respectively (Table 1.1). So, the average production of high yielding variety of potato was higher than local variety. The average production of local variety was 12.559 Mt/Ha., 11.048 MT/Ha., 10.279 MT/Ha., 9.847 MT/Ha., 9.474 MT/Ha., and 9.199 MT/Ha. in Rajshahi, Rangpur, Chattagram, Sylhet, Mymenshingh and Dhaka division, respectively. So, the highest average production of local variety of potato in Rajshahi division (Table 1.2).

The average production of local variety was 28.538 MT/Ha., 24.239 MT/Ha., 21.030 MT/Ha., 21.028 MT/Ha., 20.147 MT/Ha., 18.601 MT/Ha., 18.145 MT/Ha., and 16.338 MT/Ha. in Dhaka, Rajshahi, Rangpur, Khulna, Barishal, Chattagram, Mymenshingh, and Sylhet division, respectively. So, the highest average production of local variety of potato in Dhaka division (Table 1.3).

Table 1.3: Division wise area and production of high yielding variety of Potato in Bangladesh

Division	2020-21			2021-22		
	Area (Ha.)	Production (M.T.)	Average Yield (M.T./Ha.)	Area (Ha.)	Production (M.T.)	Average Yield (M.T./Ha.)
Barishal	8739	176065	20.147	8733	184850	21.166
Chattagram	23755	441860	18.601	21724	387354	17.831
Dhaka	52595	1500985	28.538	50135	1441080	28.744
Khulna	13292	279520	21.028	11754	251546	21.401
Mymenshingh	10082	182943	18.145	10619	207789	19.568
Rajshahi	127465	3089653	24.239	129138	3146288	24.364
Rangpur	159849	3361550	21.030	160548	3658658	22.789
Sylhet	3564	58234	16.338	3832	68481	17.872
Bangladesh	399342	9090810	22.764	396482	9346047	23.572

Source: BBS, 2022

Munshiganj supplies one-third of Bangladesh's needs for potatoes. Asterix, Diamond, Granola, Cardinal, Lady Rossetta, and several others are among the roughly ten potato varieties grown here (Dhaka Tribune, 2021).

1.3 Justification of the study

Potato production is an essential sector in the agricultural economy of Bangladesh, providing employment and income for millions of farmers and contributing significantly to the national economy. The study aims to analyze the profitability and efficiency of local and hybrid potato varieties in Munshiganj District, which will provide valuable insights into the performance of different varieties and their impact on the farmers' income and the economy.

There is a lack of research on the profitability and efficiency of local and hybrid potato varieties in Munshiganj District specifically. Although several studies have been conducted on potato production in Bangladesh, most of them are limited to specific regions or varieties. The study will fill this research gap and provide a comprehensive analysis of the local and hybrid potato varieties in Munshiganj District.

The study is crucial for informing policy decisions and interventions aimed at improving the profitability and sustainability of potato production in Bangladesh. The analysis of the factors influencing profitability and efficiency will help policymakers and stakeholders identify key areas for improvement and develop strategies to enhance the sector's performance.

This study is important for promoting sustainable potato production in Bangladesh. The findings will provide valuable insights into the most efficient and profitable practices for potato production in Munshiganj District, which can be adopted by farmers to improve their income and reduce the environmental impact of potato production.

1.4 Objectives of the study

To provide the research the right orientation in regard to this problem, the following specific objectives were developed:

i. To investigate the socio-demographic profile of potato farmers in the study area;
ii. To assess comparative profitability between high yielding variety and local varieties of potato in the study area;

iii. To analyze resource use efficiency of high yielding variety and local varieties of potato in the study area; and

iv. To identify the constrains in potato production and marketing in the study area.

CHAPTER 2
REVIEW OF LITERATURE

In this chapter, an attempt has been made to review of pertinent literature keeping in view the problem entitled, "Comparative Profitability and Resource Use Efficiency Analysis between Local Variety and High Yielding Variety of Potato on Munshiganj District of Bangladesh". Again, some of these studies may not entirely relevant to the present study, but their findings, methodology of analysis and suggestions have a great influence on the present study. Review of some research works relevant to the present studies, which have been conducted in the recent past, are discussed below.

Hossain et al. (2008) investigated the technical efficiency of potato growers in several regions of Bangladesh. They discovered that, in terms of variable costs, the cost of seeds was the greatest, followed by the cost of human labor for potato production. The cost of seed tubers accounted for around 40% of the entire production cost in potato farming. Additionally, the study revealed that the expenditure on seeds accounted for 50-60% of the overall variable costs associated with potato production. Due to the labor-intensive nature of tasks such as seed cutting, planting, mulching, fertilizer application, crop management, and harvesting, potato cultivation accounts for approximately 21% of the overall variable cost. Phosphorus had a greater expense compared to potassium among the various inorganic fertilizers. The gross return, gross margin, and benefit-cost ratio (BCR) were achieved at Tk. 298,800 per hectare, Tk. 174,319 per hectare, and 2.40, respectively. The mean technical efficiency is 75%, indicating that the mean inefficiency is 25%. Consequently, providing farmers with proper training in potato production and assuring the use of high-quality seed may significantly reduce technical inefficiency.

Begum et al. (2010) conducted a translog stochastic frontier analysis study on the productivity and efficiency of potato production in two specific areas of Bangladesh, farmers in Aditmari Upazila produced more potatoes per hectare (21208.47 kg) than those in Lalmonirhat Sadar Upazila (19897.28 kg). Potato production costs are positively correlated with the prices of manure, fertilizer, land rent, and irrigation on a per hectare basis on the translog stochastic cost frontier. Translog stochastic cost frontier analysis yielded an estimated mean economic efficiency of 96%. According to

this, farms might save 4% on their production costs while maintaining a consistent output. There was no substantial effect at the aggregate level in the inefficiency effect model. However, the education coefficient is adversely significant in Aditmari Upazila, but the farm size coefficient is favorably significant, indicating that inefficiency rises with farm size. As a result, educated farmers are thought to be more economically efficient than uneducated or less educated farmers. This suggests that economic inefficiency declines with increasing education. Regarding the production of potatoes in Aditmari Upazila, the variance ratio parameter γ linked to the variance in the stochastic frontier is much higher. According to this, potato production in Aditmari Upazila has considerable negative consequences on economic inefficiencies.

Shahriar (2011) examined the profitability and resource use efficiency of potato production in two specific areas of Bangladesh. The results showed that the benefit cost ratio (BCR) for Munshigonj and Rangpur was 1.60 and 1.54 respectively, indicating that potato cultivation was more profitable in Rangpur than in Munshigonj. When farm group types were taken into account, small farmers had the highest BCR (1.61), followed by medium farmers (1.54) and big farmers (1.52). There was a 13 percent and 15 percent inefficiency in potato output in Munshigonj and Rangpur, respectively, based on the average technical efficiency of potato growers, which was 0.87 and 0.85 in those two locations. Potato production's technological inefficiency was significantly impacted by operated land and extension connectivity. Technical efficiency rises as extension links grow and falls as the amount of land under operation grows. Regular, structured instruction on potato production technologies provided by the concerned institution might help increase farmer productivity. Another element restricting potato yield is high-quality seed. During the planting season, appropriate measures should be taken to guarantee the availability of high-quality seeds.

Mukul et al. (2013) investigated the profitability of potato cultivation for farmers in Rangpur district, Bangladesh. The researchers discovered that the farmers displayed individual variations in their socio-economic attributes, with the majority falling into the young age group (20-35 years), having a medium family size, being illiterate, having a medium farm size (0.34-1.0 acre), and having 1-10 years of farming experience. The majority of those surveyed utilized potato seeds from the Cardinal variety and sold their produce locally. Compared to other farmers, those who sold

potatoes at the market made more money. According to the survey, big farmers had the highest profitability when compared to other farms. The main issues that potato growers dealt with were reduced potato prices during harvest season, price volatility, capital scarcity, high cold storage costs, poor seed quality, potato perishability, inadequate storage facilities, increased input costs, and a lack of marketing resources, among other issues. The research reveals that net profit per acre (TK. 12731). According to this study, large farmers have the largest net profit margin whereas medium farmers cultivate more area. because potatoes are sold on the market by the majority of large farmers. Consequently, it may be claimed that marketing has a major influence on net profit. Compared to selling potatoes at home, farmers receive a greater price in the market.

In a research conducted by Saha (2014), the profitability analysis of potato cultivation was examined in Debiganj thana, located in the Panchagarh district. The findings revealed that potato production was really lucrative. The cost per hectare for potatoes amounted to 193779.34 TK, while the gross return was 299500.00 TK. The net return for potato production is 105720.66 TK per hectare. The findings of the Cobb-Douglas production function revealed that the gross yield of potato production was significantly impacted by factors such as human labor, seedlings, irrigation, manure, fertilizer, pesticide, and other inputs. The current study reveals limitations in potato production. The issues were a lack of financial resources, expensive inputs, poor output prices, insufficient supply of quality seeds, and inadequate extension services. The data revealed that inadequate oversight of potato farming might result in financial deficits. In order to achieve the maximum profitability in potato production, it is imperative to have adequate cold storage facilities for efficient potato management.

Chowdhury and Chowdhury (2015) conducted an observation on the issues and future prospects of potato cultivation in Bangladesh and discovered that although production costs are rising, harvesting time potato prices are falling. Farmers so become less strict. A startling scenario has arisen for the majority of potato growers, who have not even recovered thirty percent of their investment in the current season. Even though the cost of cold storage is quite high—Tk. 4.2–4.5 per kg nationwide—nearly 420 cold storage facilities can hold 3.6 million tons of potatoes, or 44% of the nation's entire crop. To ensure that farmers receive a fair price for their potatoes, there should be a greater

dissemination of market information. Potato producers faced several challenges, including reduced prices during harvest season, price volatility, financial constraints, high cold storage costs, poor quality seed, perishable potatoes, inadequate storage facilities, increased input costs, and a lack of marketing resources.

According to Sujan et al. (2017), potato farming in Bangladesh's Munshiganj district was profitable and efficient in using resources. The average gross return, gross margin, and net return were determined to be Tk. 3,47,200, Tk. 1,47,125, and Tk. 1,17,300, respectively. On a full cost basis, the benefit-cost ratio was 1.51; on a variable cost basis, it was 1.74. The gross return on potatoes was significantly impacted by the major production elements, which included labor from humans, land preparation, fertilizer, seed, insecticides, and irrigation. An investigation of resource usage efficiency in potato farming showed that farmers were not using resources efficiently. Increased utilization of underutilized resources including irrigation, pesticide, human labor, and land preparation might increase profitability. Since fertilizer and seed made up the majority of production costs, using those resources to their fullest potential might increase potato cultivation's profitability and efficiency in Munshiganj district.

Dolon (2018) conducted research in the Thakurgaon district on the impact of potato cultivation on revenue creation and discovered that potato farming is beneficial for farmers and makes a substantial contribution to their income.

Islam (2018) conducted an observation on the profitability and post-harvest issues related to potato production in Bangladesh's Rangpur area. The average gross return, gross margin, and net return were determined to be Tk. 392,012, Tk. 197,866, and Tk. 127,835, in that order. 1.48 was obtained for the benefit-cost ratio. Potato production was mostly dependent on the following factors: prepared land, labor from humans, seed, fertilizer, pesticides, irrigation, and harvesting costs. The analysis pinpointed a number of significant post-harvest issues, including poor seed supply, storage and holding capacity issues, decreased market prices, transportation issues, a dearth of public procurement, and load shedding. The potato farmers believed that if high-quality, reasonably priced seeds, processing, storage, and marketing facilities were guaranteed, as well as reasonably priced fertilizer or pesticides, potato cultivation would be economically feasible.

In Nilphamari district, Nahar (2018) compared the profitability of potato production as perceived by vermicompost users and non-users. The study revealed that vermicompost users incurred a greater total variable cost compared to non-users. The researchers determined that the total cost per hectare for vermicompost users was Tk. 189807, while the cost for non-users was Tk. 180819. Gross return per hectare was determined to be Tk 366600 for vermicompost users and Tk 313625 for non-users. The gross return of vermicompost users was greater than that of non-users. Gross margin per hectare for vermicompost users was determined to be Tk. 210078, whereas it was Tk. 168541 for non-users. The gross margin of vermicompost users was greater than that of non-users. An estimated Tk. 176793 and Tk. 132806, respectively, in net return per hectare, was obtained from vermicompost users and non-users. The benefit-to-cost ratio (BCR) for vermicompost users was 1.93, while that for non-users was 1.73. As indicated by the study, vermicompost consumers generated a greater profit than those who did not utilize vermicompost. The respondents indicated that the primary obstacle for vermicompost non-users in the study areas was the unavailability of seedlings. Conversely, the lack of credit facilities was identified as the most critical issue for vermicompost users.

In his study, Rahat (2018) investigated the profitability and resource use efficacy of potato cultivation in a specific region of the Panchagarh district in Bangladesh. Based on his findings, potato production incurred a total variable cost of Tk 193827.00 and a fixed cost of Tk 1938.27 per hectare. The potato production generated a gross return of 279400.00. 83634.73 Tk was the net return, and the cost-benefit ratio was 1.42. Insecticide, fertilizer, and irrigation usage for potato cultivation in the study area was inadequate, while labor and seed usage were excessive. Irrigation, insecticide, and seed all exhibited statistical significance. dearth of capital, high prices for fertilizers and insecticides, scarcity of high-quality seeds, pest and disease infestation, inadequate storage and marketing infrastructure, and a dearth of market information were all challenges faced by potato cultivars.

According to a comparative financial analysis conducted by Rahman (2018) in specific regions of the Gaibandha district, the costs of producing potatoes and mustard per hectare were Tk. 136826 and Tk. 52976, respectively. The corresponding gross incomes were Tk. 215,000 and Tk. 63623. Potato cultivation generated an estimated net profit of Tk 78,174, while mustard cultivation generated Tk 10,647. The findings suggest that in comparison to mustard producers, potato growers obtained a greater gross return and

net return. An examination of function demonstrated that human labor, fertilizers, pesticides, and irrigation significantly impacted yield variation. The yield variation can be attributed either directly or jointly to these factors. Insufficient storage and transportation infrastructure, unavailability of high-quality seeds, inadequate market value of products during harvest season, inadequate storage facilities, and a scarcity of human labor were among the challenges identified by the study as well as inadequate irrigation facilities and transportation infrastructure.

Tasnim (2018) found that potato farming is lucrative after seeing and analyzing the technical efficiency and profitability of the crop in a few chosen regions of the Naogaon district. The total production cost per hectare of potato field was Tk. 173221.86. The net yields per acre were Tk. 1,00092, while the gross returns were Tk. 273314. The benefit-cost ratio, or BCR, was determined to be 1.58, meaning that a taka investment in potato production produced Tk. 1.58. This research measured the technical efficiency of potato producers using the Cobb-Douglas stochastic frontier production function. In contrast to the considerable and positive coefficient of fertilizer and seed costs, the parameter pertaining to human labor costs was shown to have a negative coefficient. The technical inefficiency effect model shows that the technical inefficiency of potato farmers may be reduced by experience, farm size, loan service, and extension service, all of which have negative coefficients. After large-scale commercial potato production was introduced, the study found that there was a significant improvement in the socioeconomic conditions and family income of the potato producers in the study region. The potato producers encountered several significant issues, such as the exorbitant cost of fertilizers and insecticides, scarcity of high-quality seed, and low prices during the late harvesting phase. It's possible that utilizing new, contemporary potato varieties might boost potato yield.

Afrina (2020) looked into the profitability analysis of potato agriculture. She conducted a research on a few chosen regions of the Munshiganj district and found that producing potatoes was profitable. The gross return per hectare was BDT 332500.00, whereas the total cost of farming potatoes was BDT 144650.24. Potato output had a net return of BDT 187849.76 per hectare. The value of the undiscounted benefit cost ratio (BCR) was 1.29. The Cobb-Douglas production function's result demonstrated growing returns to scale while also demonstrating how heavily human labor, irrigation, manure, fertilizer, pesticide, and other inputs dominated potato farming. With the exception of

human labor, MOP, TSP, and pesticide, efficiency research revealed that the majority of farmers used inputs inefficiently. A few restrictions related to potato farming were also disclosed by the study. These were divided into three categories: technical and economic, marketing, and storage issues. Once more, the constraints include a lack of funding, high input and low output costs, poor seed quality, high labor costs, a dearth of extension services, etc.

Juthy (2020) conducted a technical efficiency analysis and profitability study on potato production in a few chosen areas in Bangladesh's Bogura district. The study found that the average gross return, gross margin, and net return were Tk 237236, Tk 77438, and Tk 55944, respectively. 1.31 was the benefit-cost ratio discovered. There, we calculated that the standard deviation is 0.135 and the log probability is 41.3964. The main components of potato production were the preparation of the land, labor from humans, seeds, fertilizer, pesticides, irrigation, and harvesting expenses. A number of significant post-harvest issues were noted by the research, including poor seed supply, storage issues, holding capacity issues, decreased market prices, transportation issues, a dearth of public procurement, and load shedding. According to potato growers, potato farming would be profitable if appropriate prices were set for fertilizer or pesticides, processing, storage, and marketing facilities, as well as high-quality seeds at an accessible price.

Rahman (2020) investigated the economic viability and technological efficiency of potato cultivation in a few chosen regions in Bangladesh's Munshiganj district and discovered that it is lucrative. The figures for average gross return, gross margin, and net return were Tk. 2,23,202.71, Tk. 1,40,324.91, and Tk. 89,045.35, in that order. A benefit-to-cost ratio of 1.66 was discovered. The gross return on potato production was significantly impacted by the major production elements, which included labor-intensive farming practices, seed, fertilizer, pesticides, irrigation, and prepared soil. Experience, farm size, training, and credit service have anticipated (negative) coefficients in the technical inefficiency impact model. Large farm families are supposedly more efficient than small farm households, according to the negative coefficient of farm size. According to the theory behind the negative coefficient of credit service, farmers who borrow money to grow potatoes are theoretically more productive than others. According to the training coefficient, farmers who receive training are theoretically more productive than those who do not. Since these factors have no effect on the technical inefficiency, the extension service's positive coefficient

of extension is positive. In other words, these factors have no effect on the technological inefficiency of potato production. Potato producers faced several challenges, including reduced prices during harvest season, price volatility, financial constraints, high cold storage costs, poor quality seed, perishable potatoes, inadequate storage facilities, increased input costs, and a lack of marketing resources.

According to a study conducted by Rana (2021), potato farming proved successful in a few chosen regions of the Joypurhat district. In the research regions, the potato production yielded total costs of Tk. 173222.52, gross returns of Tk. 273691, and net returns of Tk. 100468.48 per hectare. With a Benefit Cost Ratio (BCR) of 1.58, one taka spent in potato cultivation produced a yield of Tk. 1.58. A variety of issues plagued potato producers, such as excessive costs for fertilizer and insecticides, a scarcity of good-quality seed, and poor pricing for the crop during the later stages of harvest. The use of a fresh, contemporary variety might boost the output of potatoes.

The literature review suggests that there is a significant research gap in the profitability and resource use efficiency analysis of local and hybrid varieties of potato production in the study area. Although potato production is an important sector of the economy in Bangladesh, there is limited research conducted on this specific geographical area. While some studies have investigated the profitability and resource use efficiency of potato production in other regions of the country, the unique characteristics of study area, such as the soil quality, climate, and availability of resources, may impact the profitability and efficiency of local and hybrid varieties of potato production differently. Moreover, the existing studies have focused on the adoption of improved potato varieties, with limited analysis of the profitability and efficiency of local and hybrid varieties of potato production.

Therefore, there is a need for more research on the profitability and resource use efficiency of local and hybrid varieties of potato production in the study area. Such research can help farmers in the region make informed decisions about which variety of potato to grow and identify opportunities to improve their profitability and resource use efficiency in potato production. Additionally, this research can contribute to the broader knowledge base on potato production in Bangladesh and inform policy and development initiatives aimed at improving the sector's profitability and sustainability.

CHAPTER 3
METHODOLOGY

3.1. Introduction

The credibility of agricultural management research is intricately tied to the chosen research methodology. Employing an appropriate technique is essential for conducting robust and reliable research. The configuration of each survey is primarily influenced by the study's inherent characteristics, objectives, and aims. Moreover, it is contingent upon the accessibility of necessary resources, materials, and time. Various data collection methods are at the disposal of researchers engaged in farm management studies.

In farm business research, the process often involves the acquisition of data from individual farmers. The selection of data collection techniques within the confines defined by the available resources for the assignment requires careful consideration and judgment (Dillon and Hardaker 1993). In the present study, the "survey approach" predominated for two specific reasons:

i. Surveys facilitate rapid examination of a large number of cases;

ii. The findings obtained through surveys possess broader applicability.

The main limitation associated with this approach is the reliance on farmers' memory. To mitigate this challenge, regular visits to the research area were undertaken to collect data. In cases of any omissions or discrepancies, farmers were contacted to obtain the missing and/or accurate information. The survey for this study was structured using the following stages.

3.2. Selection of the Study Area

The process of selecting the study area is a pivotal step in the execution of farm management research. The choice of region was aligned with the study's specific objectives and the feasibility of collaboration with local farmers. While potato cultivation is widespread throughout Bangladesh, the Munshiganj district stands out as a significant hub for potato production. Consequently, the selection of three upazilas—Munshiganj Sadar, Tongibari, and Gazaria—within the Munshiganj district was deliberate, driven by their notable concentration of potato output.

The rationale behind choosing the study area can be summarized as follows:

a) The study area boasted a substantial population of potato growers;

b) These villages exhibited similar physical attributes, including topography, soil composition, and climate, fostering conducive conditions for potato cultivation;

c) The selected villages were easily reachable and equipped with ample communication facilities; and

d) There was an expectation of robust cooperation from respondents to facilitate data collection.

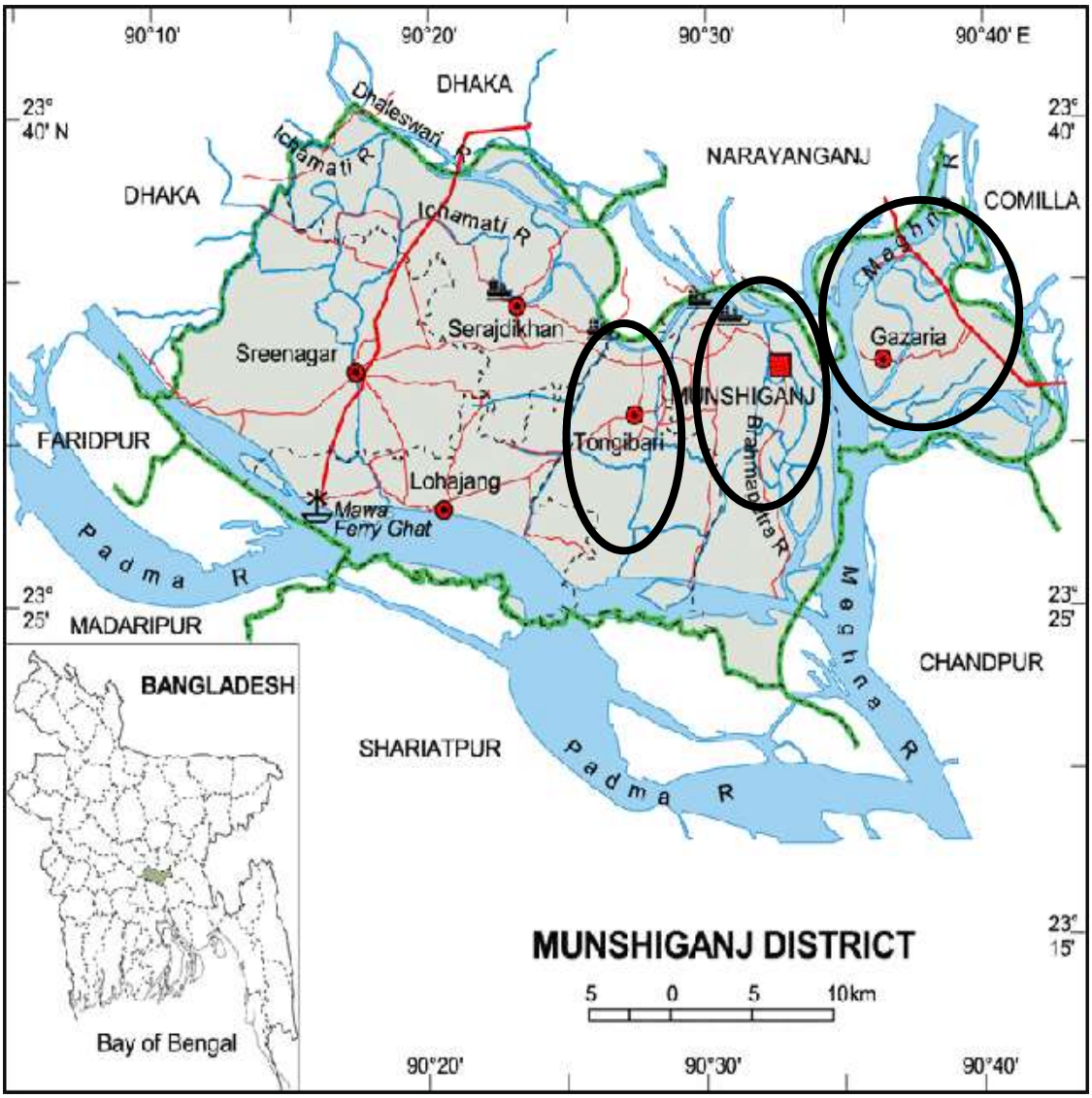


Figure 3.1: A map of Munshiganj district showing the study area

3.3. Sampling Technique and Sample Size

When selecting samples for research, two key considerations come into play. Firstly, the sample size should be maximized to the extent possible while still allowing for sufficient degrees of freedom for statistical analysis. Conversely, the administration of field research, data processing, and analysis must remain feasible within the constraints of physical, human, and financial resources. Given the diverse technological and human landscapes, it becomes imperative to obtain a representative sample of the population before drawing any conclusions. The objective of the sample is to select a subset that faithfully mirrors the characteristics of the entire population (Kabir, 2016).

However, due to limitations in time, finances, and manpower, it was impractical to include all farmers in the study area. Consequently, a total of 80 farmers were randomly chosen—40 from local variety potato cultivars and 40 from high-yielding variety potato cultivars. The current research employed purposive sampling as a cost-effective and time-saving measure, aligning with the ultimate objectives of the study.

3.4. Preparation of the Survey Schedule

To collect data from the sample farms, a preliminary questionnaire was created. Keeping the study's objectives in focus, the questionnaire underwent a pre-testing phase, involving interviews with numerous potato-growing farmers. Necessary adjustments, additions, or alterations were implemented based on the feedback received, ensuring refinement before the finalization of the questionnaire.

The final questionnaire encompassed three distinct sets of information. The first category aimed to gather data on the socioeconomic conditions of the farmers. The second group focused on collecting information regarding expenses and returns. The last category of information delved into the constraints and challenges faced by farmers in the process of potato cultivation.

3.5. Period of the Study

The collection of data occurred between January 10 and February 9, 2022. Over this timeframe, periodic visits to the research region were conducted to gather information on both inputs and outputs.

3.6. Data Collection Methods

The present study acquired data from farmers engaged in potato cultivation through a field survey. The researcher directly obtained the necessary information from the selected potato farmers. Before conducting interviews, the chosen farmers were contacted to schedule convenient interview times. During the interviews, the researcher posed structured questions and discussed the study's goals and objectives as required. The farmers were briefed that the investigation was solely for academic purposes, and they were informed about the study's relevance to their agricultural business environment. After each interview, the interview schedule was carefully reviewed to ensure accurate documentation of all relevant information for each item. Any omissions or discrepancies were addressed during subsequent visits. Additionally, alongside surveys, the researcher collected data through observation.

3.7. Processing, Tabulation and Analysis of Data

The collected data underwent manual editing and coding before being carefully compiled and analyzed. Furthermore, electronic data input was carried out, and analyses were executed using the suitable tools, specifically Microsoft Excel and STATA. It's important to note that the information was initially gathered in local units and subsequently converted to international standard units after necessary checks were conducted.

3.8. Analytical Techniques

The data were assessed to fulfill the objectives of the study, employing various analytical techniques. A substantial portion of the data analysis relied on the tabular technique, widely favored for its natural ability to present a clear depiction of agricultural economics in a straightforward manner. Basic statistical methods, such as percentage and arithmetic mean or average, were employed to evaluate data and delineate the socioeconomic characteristics of potato producers, including input consumption, expenses, returns on potato production, and the undiscounted benefit-cost ratio (BCR).

In estimating the level of technological efficiency in alignment with production function theory, this study will employ a stochastic frontier production function of the Cobb-Douglas type.

3.8.1. Economic Profitability Analysis

The net economic returns from potato cultivation were calculated based on a set of financial prices. These financial prices encompassed the market prices received by farmers for their outputs and the prices paid for purchased inputs during the study period. The cost items considered for the study included the following –

- Land preparation
- Human labour
- Seed
- Urea
- TSP
- MoP
- Gypsum
- Pesticide
- Irrigation
- Interest on operating capital
- Land use

Cost of Land Preparation

Land preparation stands out as a crucial element in the production process, particularly in potato cultivation. This stage involves various activities such as ploughing, ridge preparation, earthing up, and other tasks essential to render the soil suitable for planting seedlings. It was observed that the frequency of ploughings varied across farms and locations.

Cost of Human Labor

Human labor cost emerged as a significant component within the production process, necessitated for various operations including land preparation, sowing and transplanting, weeding, fertilizer and insecticides application, irrigation, harvesting and carrying, threshing, cleaning, drying, storing, etc. The computation of human labor cost involved multiplying the recorded man-days per hectare by the wage per man-day corresponding to a specific operation.

Cost of Seed

The cost of seed exhibited significant variation based on its quality and availability. To calculate the cost of seed, market prices for reputable potato seeds were utilized. The total quantity of seed required per hectare was multiplied by the market price of seed, providing the cost of seeds for the study areas.

Cost of Urea

Urea played a crucial role as a fertilizer in the cultivation of potatoes. The computation of urea costs was based on prevailing market prices. To determine the cost of urea, the recorded unit of urea per hectare was multiplied by the market price of urea.

Cost of TSP

The calculation of the cost of TSP was determined using market prices. To ascertain the cost of TSP, the recorded unit of TSP per hectare was multiplied by the prevailing market price of TSP.

Cost of MoP

Among the primary fertilizers employed in potato production, MoP was one of them. The computation of the MoP cost per hectare involved multiplying the market price of MoP by the per-unit cost of that input per hectare for a specific operation.

Cost of Gypsum

The computation of the Gypsum cost was conducted utilizing market prices. To determine the cost of Gypsum, the recorded unit of Gypsum per hectare was multiplied by the prevailing market price of Gypsum.

Cost of Manure

The cost of manure was determined using market prices as the basis for analysis. To determine the cost of manure, the researchers multiplied the price of manure by the per total input per hectare in the study.

Cost of Pesticides

Farmers employed various types of pesticides approximately 5-7 times to protect their crops from pests and diseases. The cost of insecticides was determined by considering the market price of the insecticides utilized in the study areas per hectare.

Cost of Irrigation

Effective water management contributes to the enhancement of potato production. The expense associated with irrigation varies among farmers and was computed based on the frequency of irrigation required per hectare and its associated cost.

Interest on Operating Capital

Interest on operating capital was calculated following the opportunity cost principle. The operating capital, reflecting the average operating cost over the entire period, was determined as costs were incurred continuously throughout the production duration, rather than all at the beginning or a specific point in time. For potatoes, interest on operating capital at a rate of 9% per annum was computed for a four-month period. The calculation was performed using the following formula:

IOC= AIit

Where,

IOC= Interest on operating capital

i = Rate of interest

AI= Total investment /2

t = Total time period of a cycle

Land Use Costs

The cost of land use was determined by considering the opportunity cost associated with the utilization of land per hectare during the four-month cropping period. Therefore, the cash rental value of the land was utilized as the cost for land use.

Calculation of Returns

Gross Return

The per-hectare gross return was computed by multiplying the total quantity of the main product and by-products by their respective per-unit prices.

Gross Return= Quantity of the product * Average price of the product

Gross Margin

Gross margin is characterized as the variance between gross return and variable costs. Typically, farmers aim for the highest return over variable production costs. The rationale for employing gross margin analysis is rooted in farmers' desire to ascertain

returns over variable costs. Gross margin was computed on a Total Variable Cost (TVC) basis. The per-hectare gross margin was derived by deducting variable costs from gross return, expressed as follows:

Gross margin = Gross return – Total Variable cost

Net Return

Net return or profit was determined by subtracting the total production cost from the total return or gross return, expressed as follows:

Net return = Total return – Total cost

Undiscounted Benefit Cost Ratio (BCR)

Evaluating the average return for every taka invested in production serves as a crucial metric for assessing profitability. The Undiscounted Benefit-Cost Ratio (BCR) was calculated by determining the ratio of the total return to the total cost per hectare.

BCR = Total return/ Total cost

3.8.2 Resource Use Efficiency Analysis of Local and High Yielding Variety Potato Production

The assessment of resource use efficiency was conducted using the Cobb-Douglas production function, employing the methodologies outlined by Rahman and Lawal (2003).

$$Y_i = \alpha X_{1i}^{\beta 1}\, X_{2i}^{\beta 2}\, X_{3i}^{\beta 3}\, X_{4i}^{\beta 4}\, X_{5i}^{\beta 5}\, X_{6i}^{\beta 6}\, X_{7i}^{\beta 7}\; e^{ui}$$

Here, Y represents the frontier output, X denotes the physical input, b signifies the elasticity of Y concerning X, a is the intercept, and Ɛ = V-U is a composite error term, as previously defined. For simplicity, we have omitted the subscript.

3.8.2.1 Specification of Production Model

The Cobb-Douglas Production Function has been designated to gauge resource use efficiency. The functional expression for the production function is outlined below:

$$\text{In } Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_s \ln X_5 + b_6 \ln X_6 + U_i$$

The above function is linearized double-log form:

Y = Return per hectare (Tk/ha);

In a = Intercept of the function;

X_1 = Cost of human labor (Tk/ha)

X_2 = Cost of seed (Tk/ha)

X_3 = Cost of manure (Tk/ha)

X_4 = Cost of fertilizer (Tk/ha);

X_5 = Cost of pesticide (Tk/ha);

X_6 = Cost of irrigation (Tk/ha);

b_1, b_2 ..... b_7= Coefficients of the respective input to be estimated; and

U_i = Error term.

The calculation of resource use efficiency level was determined using the following formula:

$$r = \frac{MVP}{MFC}$$

Where:

r = Efficiency ratio

MVP = Marginal Value Product, representing the value of an incremental unit of output resulting from an additional unit of inputs.

MFC = Marginal Factor Cost, equal to one since both dependent and explanatory variables are converted to monetary value. It is defined as the increase in the cost of inputs due to the purchase of an additional unit of inputs.

The most dependable, and arguably the most practical estimate of MVP is obtained by considering all input resources (Xi) and gross return (Y) at their geometric means (Dhawan and Bansal, 1977). All variables in the fitted model were computed in monetary value. Consequently, the slope coefficients of the independent variables in the model represent the MVPs. These were estimated by multiplying the production coefficients of the given resources with the ratio of the geometric mean (GM) of gross return to the geometric mean (GM) of the given resources, as follows:

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

Where,

b_i = Estimated regression coefficient of input X_i

$\bar{Y}_i$ = Geometric mean value of output

$\bar{X}_i$ = Geometric mean value of i^{th} resources used

In this approach, the decision guidelines are as follows:

- When r > 1, the level of resource use is below the optimum level, indicating under-utilization of resources. Enhancing the rate of that resource's utilization will contribute to increased productivity.

- When r < 1, the level of resource use is above the optimum level, signifying overutilization of resources. Decreasing the rate of that resource's utilization will aid in improving productivity.

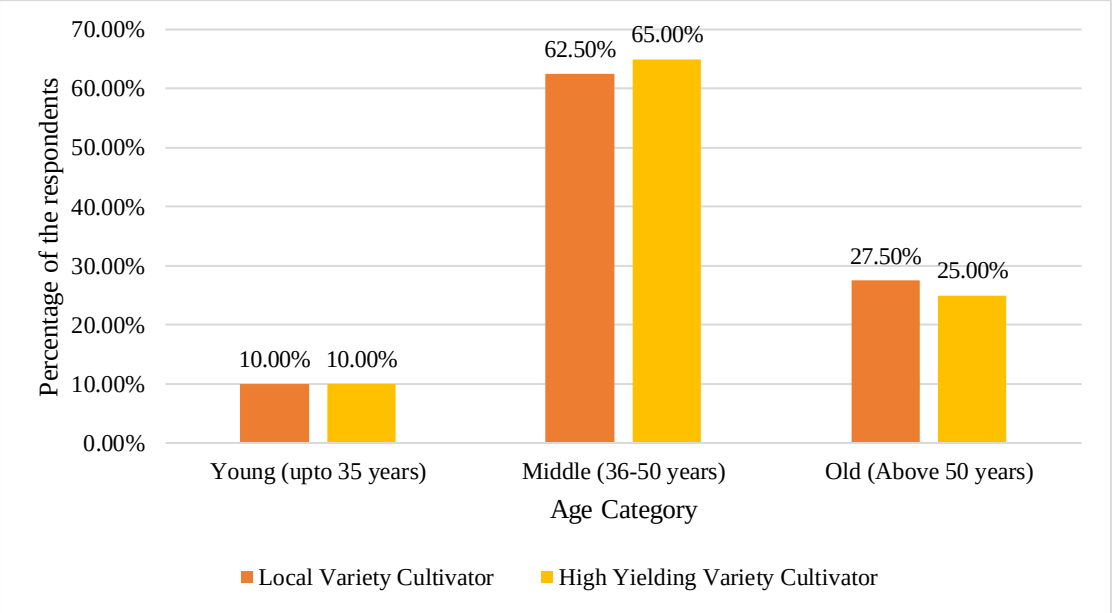
- When r = 1, the level of resource use is at the optimum, implying efficient resource utilization.

CHAPTER 4
SOCIO-ECONOMIC CHARACTERISTICS OF THE POTATO FARMERS

The socioeconomic attributes of farmers play a pivotal role in shaping production planning. Individuals exhibit variations in various aspects, and their behavior is largely influenced by their qualities. An individual's behavior and personality development are strongly influenced by a range of interconnected and component traits. In this study, farmers were selected from the three upazillas of Munshiganj district, and the socioeconomic factors of the sampled households were examined. These factors included age distribution, educational attainment, family size, experience, annual household income, and more. A brief overview of these characteristics is presented below.

4.1 Age

In the current study, all types of farmers in the study region were divided into various age groups as given in Figure 4.1. The potato farmers were categorized into three age groups: young age (up to 35 years), middle age (36-50 years) and old age (over 50 years) classified by MoYS (2012).



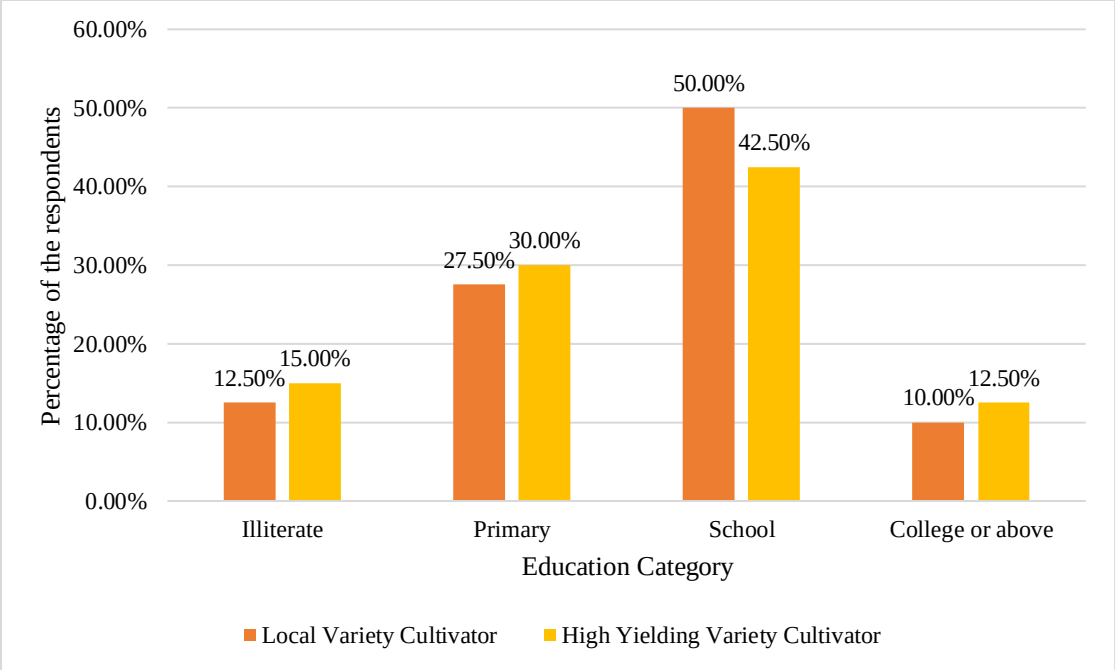
Source: Field Survey, 2022

Figure 4.1: Distribution of the sample farmers according to the Age

Out of the sample farmers 10% belonged to the age range of up to 35 years, 62.50% belonged to the age group of 36-50 years and 27.50% fell into the age category of over 50 years in the local variety cultivator category. On the other hand, 10% belonged to the age range of up to 35 years, 65% belonged to the age group of 36-50 years and 25% fell into the age category of over 50 years in the high yielding variety cultivator category. This data show that majority of the sample farmers were in the most active age group was middle aged in both local and high yielding variety cultivators.

4.2 Education Level

In the current study, all types of farmers in the study region were divided into various education level category as given in Figure 4.2. The potato farmers were categorized into four groups: illiterate, primary level, school level and college level or above.



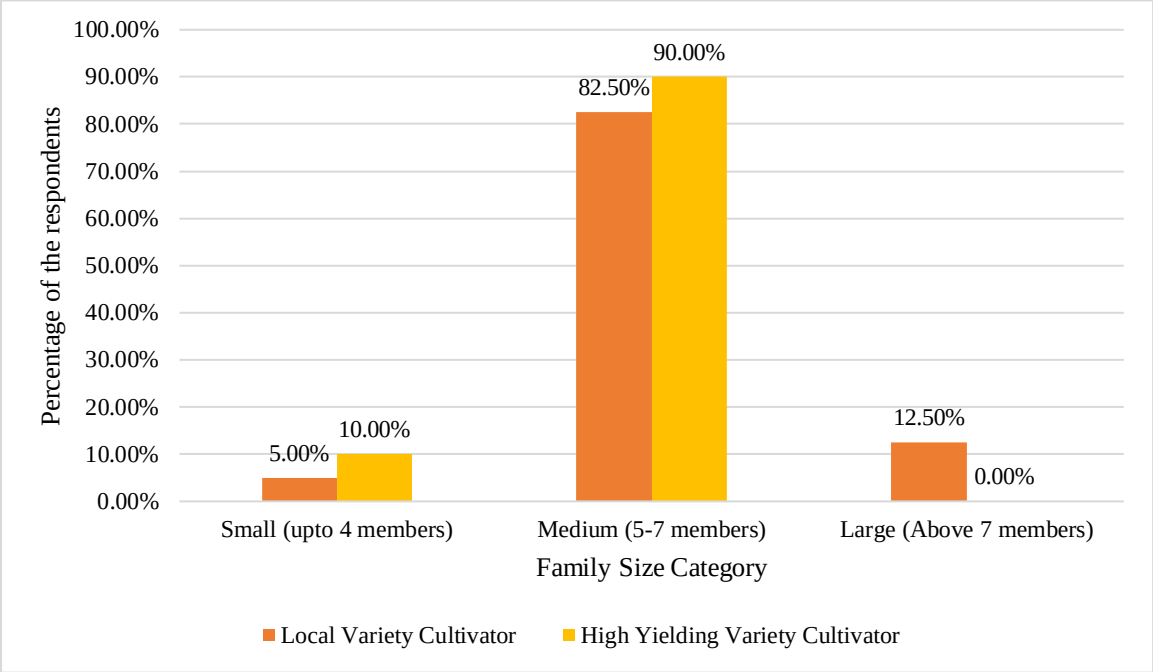
Source: Field Survey, 2022

Figure 4.2: Distribution of the sample farmers according to the education level

Out of the sample farmers 12.50% were illiterate, 27.50% had primary level education, 50% had school level education and 10% had college level or above education level in the local variety cultivator category. On the other hand, 15% were illiterate, 30% had primary level education, 42.50% had school level education and 12.50% had college level or above education level in the high yielding variety cultivator category. This data show that majority of the sample farmers had school level education in both local and high yielding variety cultivators.

4.3 Family Size

In the current study, all types of farmers in the study region were divided into various family size category as given in Figure 4.3. The potato farmers were categorized into three groups: small (up to 4 members), medium (5-7 members) and large (above 7 members) (Santo, 2021).



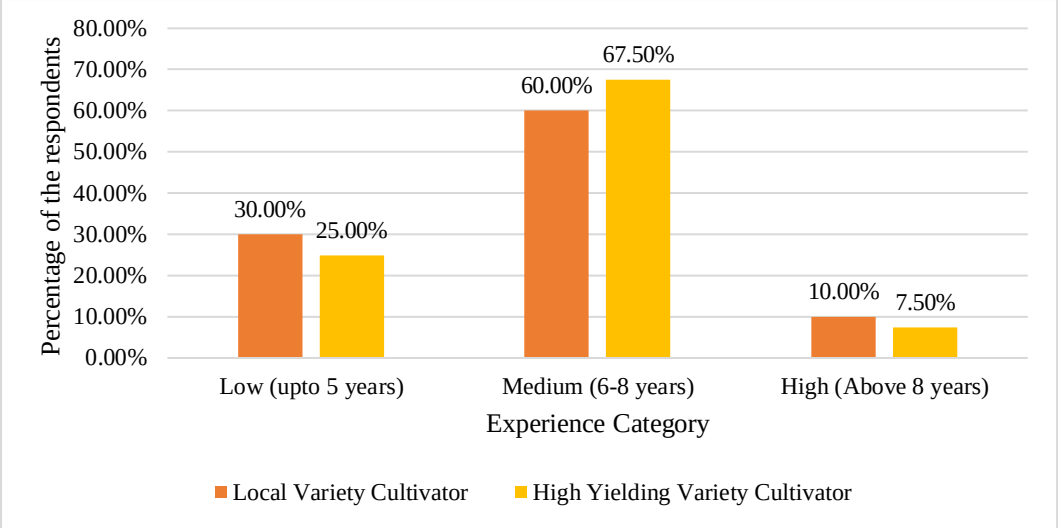
Source: Field Survey, 2022

Figure 4.3: Distribution of the sample farmers according to the family size

Out of the sample farmers 5% were belongs to small family size, 82.50% were medium family size and 12.50% were large family size in the local variety cultivator category. On the other hand, 10% were belongs to small family size, 90% were medium family size and there was no large family size in the high yielding variety cultivator category. The average family size was 6.05 and 5.72 in local variety cultivator and high yielding variety cultivator, respectively.

4.4 Experience

In the current study, all types of farmers in the study region were divided into various experienced category as given in Figure 4.4. The potato farmers were categorized into three groups: low (up to 5 years), medium (6-8 years) and high (above 8 years) (Santo, 2021).



Source: Field Survey, 2022

Figure 4.4: Distribution of the sample farmers according to the experience

Out of the sample farmers 30% had low experience, 60% had medium experience, and 10% had high experience in the local variety cultivator category. On the other hand, 25% had low experience, 67.50% had medium experience, and 7.50% had high experience in the high yielding variety cultivator category. This data show that majority of the sample farmers had medium experience in both local and high yielding variety cultivators.

4.5 Annual Household Income

On the basis of annual income, the respondents were classified into three categories, viz. low, medium and high annual household income. The distribution of the farmers according to annual household income are presented in Table 4.1.

Table 4.1: Distribution of the sample farmers according to the Annual Household Income

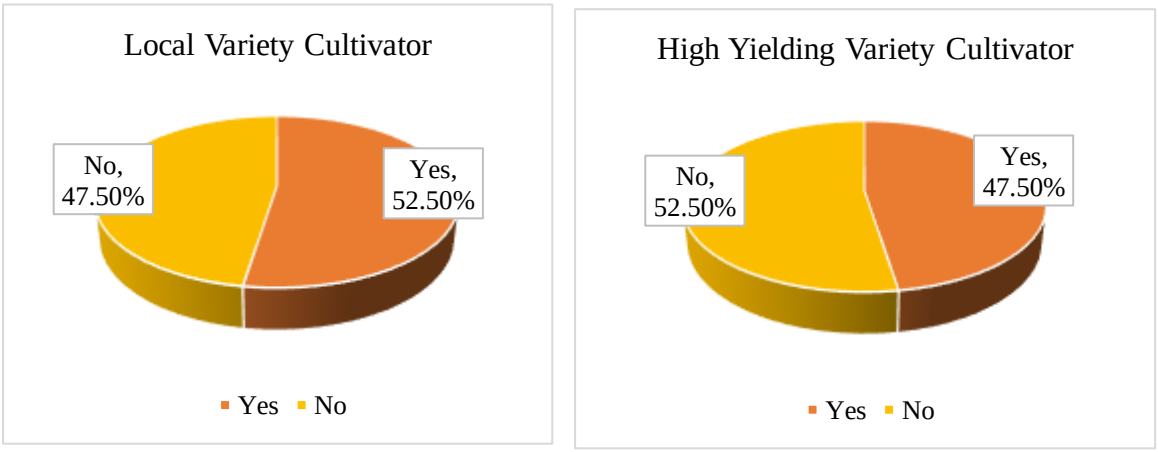
Income Category	**Local Variety Cultivator**		**High Yielding variety Cultivator**	
	Number	Percentage	Number	Percentage
Low (up to 2 lakh taka)	25	62.50	16	40.00
Medium (2.1 – 4 lakh taka)	15	37.50	18	45.00
High (Above 4 lakh taka)	-	-	6	15.00
Total	40	100.00	40	100.00

Source: Field Survey, 2022

Data in Table 4.1 revealed that the potato farmers having low annual household constitute the highest proportion (62.50%), followed by medium income 37.50% and there was no farmer who had high income in local variety cultivator. On the other hand, the potato farmers having medium annual household constitute the highest proportion (45%), followed by low income was 40% and high income was 15% in high yielding variety cultivator. The findings from Table 4.3 indicated that average annual household income from of the study area was 1.89 lakh Tk. and 2.74 lakh Tk in local variety cultivator and high yielding variety cultivator, respectively.

4.6 Agricultural Training

Agricultural training received by the farmers was shown in Figure 4.5. On the basis of training scores, the respondents were classified into two categories namely, no training and training received.



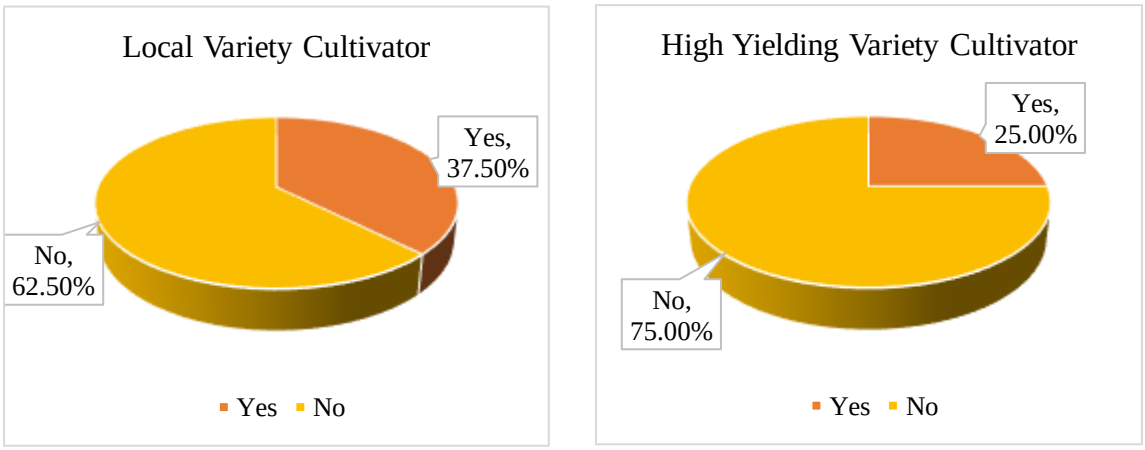
Source: Field Survey, 2022

Figure 4.5: Distribution of the sample farmers according to the agricultural training received

Data of Figure 4.5 revealed that the majority (52.50%) of the respondents received training, whereas 47.50% of the respondents didn't receive any agricultural training among local variety cultivator. On the other hand., majority (52.50%) of the respondents didn't receive any agricultural training, whereas 47.50% of the respondents received training among high yielding variety cultivators.

4.7 Training on Potato Cultivation

Training on potato cultivation received by the farmers was shown in Figure 4.6. On the basis of training scores, the respondents were classified into two categories namely, no training and training received.



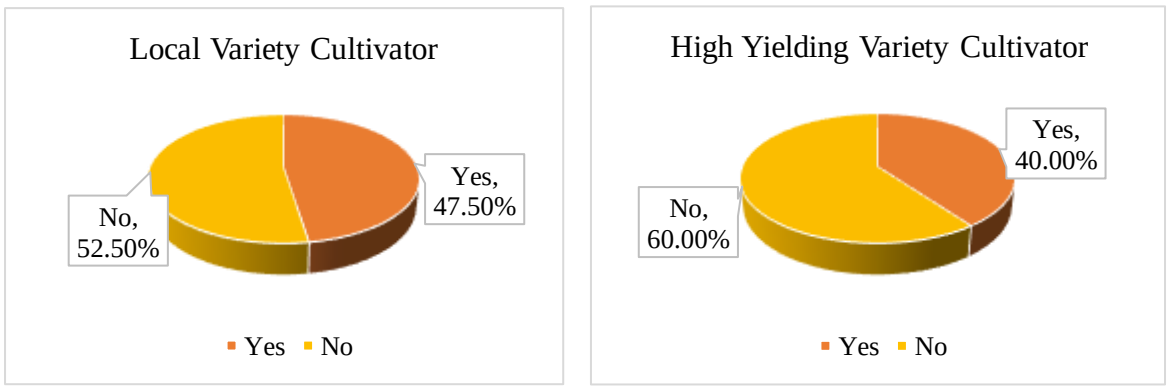
Source: Field Survey, 2022

Figure 4.6: Distribution of the sample farmers according to the training on potato cultivation received

Data of Figure 4.6 revealed that the majority (62.50%) of the respondents didn't receive training on potato cultivation, whereas 37.50% of the respondents received training on potato cultivation among local variety cultivator. On the other hand., majority (75%) of the respondents didn't receive any training on potato cultivation, whereas 25% of the respondents received training on potato cultivation among high yielding variety cultivators.

4.8 Extension Contact

Extension contact was shown in Figure 4.7. On the basis of extension contact scores, the respondents were classified into two categories namely, yes and no.



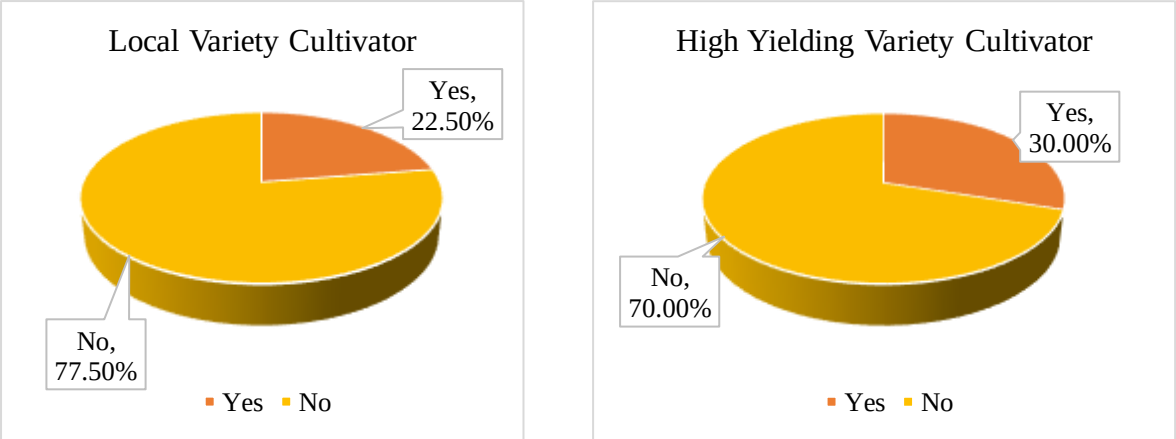
Source: Field Survey, 2022

Figure 4.7: Distribution of the sample farmers according to the extension contact

Data of Figure 4.6 revealed that the majority (52.50%) of the respondents didn't have any extension contact, whereas 47.50% of the respondents had extension contact among local variety cultivator. This might be due to a lack of available resources, such as trained personnel or money. Furthermore, many farmers may be uninformed of the gains that might be made by extension contact. If these advantages are to be fully realized, then greater efforts must be taken to promote and offer extension contact in potato farming and this will increase the overall potato production. On the other hand., majority (60%) of the respondents didn't have any extension contact, whereas 40% of the respondents had extension contact among high yielding variety cultivators.

4.9 Access to Credit

Farmers access to credit was shown in Figure 4.8. On the basis of training scores, the respondents were classified into two categories namely, yes and no.



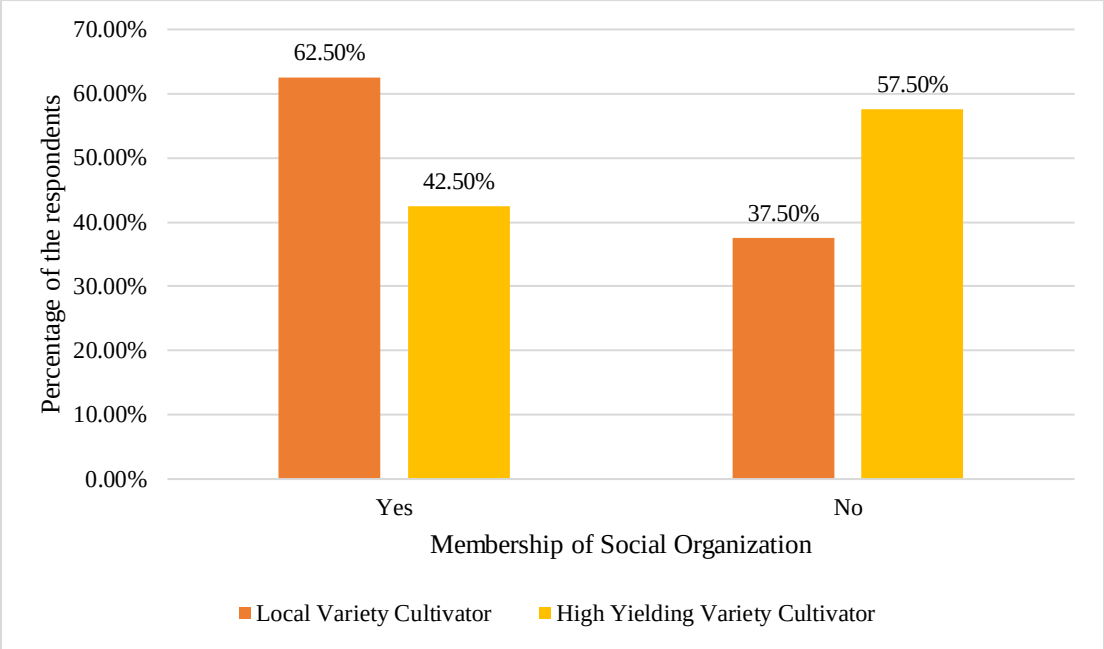
Source: Field Survey, 2022

Figure 4.8: Distribution of the sample farmers according to the access to credit

Data of Figure 4.7 revealed that the majority (77.50%) of the respondents didn't have access to credit, whereas 22.50% of the respondents had access to credit among local variety cultivator. On the other hand., majority (70%) of the respondents didn't have access to credit, whereas 30% of the respondents had access to credit among high yielding variety cultivators

4.10 Membership of Social Organization

Farmers membership of social organization was shown in Figure 4.9. On the basis of training scores, the respondents were classified into two categories namely, yes and no.



Source: Field Survey, 2022

Figure 4.9: Distribution of the sample farmers according to membership of social organization

Data of Figure 4.9 revealed that the majority (62.50%) of the respondents had membership of social organization, whereas 37.50% of the respondents had no membership of social organization among local variety cultivator. On the other hand., majority (57.50%) of the respondents had no membership of social organization, whereas 42.50% of the respondents had membership of social organization among high yielding variety cultivators

4.11 Distance to Local Market from House

On the basis of distance to local market from house, the respondents were classified into three categories, viz. short, medium and long distance. The distribution of the farmers according to the distance to local market from house are presented in Table 4.2.

Table 4.2: Distribution of the sample farmers according to the to distance to local market from house

Distance Category	**Local Variety Cultivator**		**High yielding variety Cultivator**	
	Number	Percentage	Number	Percentage
Short (up to 1 km)	24	60.00	9	22.50
Medium (1.1 – 2 km)	15	37.50	17	42.50
Long (Above 2 km)	1	2.50	14	35.00
Total	40	100.00	40	100.00

Source: Field Survey, 2022

Data in Table 4.2 revealed that the potato farmers having short distance constitute the highest proportion (60%), followed by medium distance 37.50% and long distance 2.50% in local variety cultivator. On the other hand, the potato farmers having medium distance constitute the highest proportion (42.50%), followed by long distance was 35% and short distance was 22.50% in high yielding variety cultivator.

CHAPTER 5

PROFITABILITY ANALYSIS OF LOCAL AND HIGH YIELDING VARIETY POTATO CULTIVATION

Profitability stands as a crucial determinant for deciding whether to cultivate a particular crop at the farm level. It can be assessed through metrics such as net return, gross margin, and return on total cost. The comprehensive manufacturing cost was calculated by summing the expenses associated with all products. Crop returns were estimated by considering the values of both primary products and by-products.

5.1 Profitability of Potato Production

5.1.1 Variable Costs

Cost of Land Preparation

Land preparation is a vital component of the production process, encompassing activities such as ploughing, ridge preparation, earthing up, and other tasks essential for rendering the soil suitable for potato cultivation. The average cost of land preparation for potato production was determined to be Tk. 8,845.00 and Tk. 7,550.00 per hectare, constituting 2.40% and 1.91% of the total cost for local variety and high-yielding variety potato cultivation, respectively (refer to Table 5.1 and 5.2).

Cost of Hired Human Labor

Human labor cost constitutes a significant component in the production process, serving as a crucial input for potato cultivation. It plays a vital role in various operations, including land preparation, sowing, weeding, application of fertilizers and pesticides, irrigation, harvesting, carrying, threshing, cleaning, drying, and storing. The average usage of hired human labor was determined to be 120 and 114 man-days per hectare in local variety and high-yielding variety potato cultivation, respectively, with an average labor price of Tk. 500 per man-day. Consequently, the total cost of hired human labor amounted to Tk. 60,000.00 and Tk. 57,000.00, representing 15.95% and 15.03% of the total cost for local variety and high-yielding variety potato cultivation, respectively (refer to Table 5.1 and 5.2).

Table 5.1: Per hectare cost analysis of local variety potato cultivation

Cost Items	Quantity	Price per unit	Total	Percentage of total cost
A. Variable Cost				
Hired Labor (Man-days)	120	500	60000.00	15.95
Land Preparation			8845.00	2.35
Seed (Kg)	2389.63	30	71688.90	19.06
Manure (kg)	258.73	15	3880.95	1.03
Urea (Kg)	375.25	22	8255.5	2.19
TSP (Kg)	295.13	22	6492.86	1.73
MoP (Kg)	249.61	15	3744.15	0.99
Gypsum (Kg)	97.22	35	3402.70	0.90
Pesticide			10126.02	2.69
Irrigation			19711.16	5.23
Total Variable Cost			**196147.20**	52.14
B. Fixed Cost				
Family Labor (Man-days)	60	500	30000.00	17.97
Interest on Operating Capital (@9%)			35306.50	9.38
Rental Value of Land			114714.70	30.50
Total Fixed Cost			**180021.20**	47.85
Total Cost			**376168.40**	100.00

Source: Field Survey, 2022

Cost of Seed

Cost of seed varied widely depending on its quality and availability. Per hectare farmers used 2389.63 Kg and 2552.88 Kg, in local variety and high yielding variety potato cultivation, respectively where recommended rate for seed per hectare was 1815 kg. So, the total cost of seed was estimated to be Tk. 71688.90, and Tk. 76586.40, which constituted 19.06% and 20.19% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1 and 5.2).

Cost of Manure

In the study area, farmers used different types of manure like cow dung, poultry waste, etc. On an average, farmers used manure 258.73 Kg and 257.36 Kg per hectare in local variety and high yielding variety potato cultivation, respectively. Per hectare cost of manure was Tk. 3880.95, and Tk. 3860.40, which represents 1.03% and 1.02% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1 and 5.2).

Cost of Urea

In the study area, farmers used different types of fertilizers. On an average, farmers used urea 375.25 Kg and 461.31 Kg per hectare in local variety and high yielding variety potato cultivation, respectively where recommended dose for urea per hectare was 250 kg. Per hectare cost of urea was Tk. 8255.5 and Tk. 10148.82, which represents 2.19% and 2.67% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1 and 5.2).

Cost of TSP

Among the different kinds of fertilizers used, the rate of application of TSP per hectare was 295.61 Kg and 293.04 Kg in local variety and high yielding variety potato cultivation, respectively where recommended dose for TSP per hectare was 150 kg. The average cost of TSP was Tk. 6492.86 and Tk. 6446.88 per hectare which representing 1.73% and 1.70% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1 and 5.2).

Cost of MoP

The application of MoP per hectare was 249.61 Kg and 260.92 Kg in local variety and high yielding variety potato cultivation, respectively where recommended dose for MoP per hectare was 250 kg. So, per hectare total cost of MoP was found Tk. 3744.15 and Tk. 3913.80, which represents 0.99% and 1.03% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1, and 5.2).

Cost of Gypsum

The application of gypsum per hectare was 97.72 Kg and 74.69 Kg in local variety and high yielding variety potato cultivation, respectively where recommended dose for

gypsum per hectare was 120 kg. So, per hectare total cost of gypsum was found Tk. 3402.70 and Tk. 2614.15, which represents 0.90% and 0.69% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1, and 5.2).

Table 5.2: Per hectare cost analysis of high yielding variety potato cultivation

Cost Items	Quantity	Price per unit	Total	Percentage of total cost
A. Variable Cost				
Hired Labor (Man-days)	114	500	57000.00	15.03
Land Preparation			7550.00	1.99
Seed (Kg)	2552.88	30	76586.40	20.19
Manure (Kg)	257.36	15	3860.40	1.02
Urea (Kg)	461.31	22	10148.82	2.67
TSP (Kg)	293.04	22	6446.88	1.70
MoP (Kg)	260.92	15	3913.80	1.03
Gypsum (Kg)	74.69	35	2614.15	0.69
Pesticide			10483.95	2.69
Irrigation			10204.56	2.76
Total Variable Cost			**188808.96**	49.78
B. Fixed Cost				
Family Labor (Man-days)	72	500	36000.00	9.49
Interest on Operating Capital (@9%)			33985.61	8.96
Rental Value of Land			120495.20	31.77
Total Fixed Cost			**190480.81**	50.22
Total Cost			**379289.77**	100.00

Source: Field Survey, 2022

Cost of Pesticides

Farmers used different kinds of pesticides to keep their crop free from pests and diseases. The average cost of pesticides was found to be Tk. 10126.02 and Tk. 10483.95

which was 2.69% and 2.69% of total cost local variety and high yielding variety potato cultivation, respectively (Table 5.1, and 5.2).

Cost of Irrigation

The expense associated with irrigation is a crucial factor in potato production, as the crop's growth and yield significantly depend on proper irrigation. Adequate application of irrigation water contributes to enhancing bulb diameter, the number of cloves, leaves, and plant height, ultimately resulting in an increased yield per hectare. The average cost of irrigation was determined to be Tk. 19,711.16 and Tk. 10,204.56 per hectare, constituting 5.23% and 2.76% of the total cost for local variety and high-yielding variety potato cultivation, respectively (refer to Table 5.1 and 5.2).

Total Variable Cost

Therefore, from the above different cost items it was clear that the total variable cost was Tk. 196147.20 and Tk.188808.96 per hectare, which was 52.14% and 49.78% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1, and 5.2).

5.1.2 Fixed Cost

Cost of Family Labor

Family labor cost constitutes a significant component in the production process, serving as a crucial input for potato cultivation. It plays a vital role in various operations, including land preparation, sowing, weeding, application of fertilizers and pesticides, irrigation, harvesting, carrying, threshing, cleaning, drying, and storing. The average utilization of family-supplied labor (without hired labor) was approximately 60 and 72 man-days per hectare in local variety and high-yielding variety potato cultivation, respectively. The average price of family labor was Tk. 500 per man-day. If we were to remunerate these laborers, the cost would be Tk. 30,000.00 and Tk. 36,000.00, representing 7.97% and 9.49% of the total cost for local variety and high-yielding variety potato cultivation, respectively (refer to Table 5.1 and 5.2).

Interest on Operating Capital

It may be noted that the interest on operating capital was calculated by taking in to account all the operating costs incurred during the production period of potato. Interest on operating capital for potato production was estimated @ 9% as bank rate and

calculated Tk. 35306.50 and Tk. 33985.61 per hectare, which represents 9.38% and 8.96% of the total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1 and 5.2).

Rental Value of Land

Rental value of land was calculated on the basis of opportunity cost of the use of land per hectare for the cropping period of four months. Cash rental value of land has been used as cost of land use. On the basis of the data collected from the potato farmers the land use cost was found to be Tk. 114714.70 and Tk. 120495.00 per hectare, and it was 30.50% and 31.77% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1 and 5.2).

Total Fixed Cost

Therefore, from the above different cost items it was clear that the total fixed cost was Tk. 180021.20 and Tk. 190480.81 per hectare, which was 47.85% and 50.22% of total cost of local variety and high yielding variety potato cultivation, respectively (Table 5.1, and 5.2).

5.1.3 Total Cost (TC) of Potato Production

Total cost was calculated by adding all the cost of variable and fixed inputs. In the present study per hectare total cost of local variety and high yielding variety potato cultivation was found to be Tk. 376168.40 and Tk. 379289.77, respectively (Table 5.1 and 5.2)

5.1.4 Return of Potato Production

Gross Return

Return per hectare of local variety and high yielding variety potato cultivation were shown in table 5.3 and 5.4. Per hectare gross return was calculated by multiplying the total amount of product with respective per unit price. It is evident from table that the average yield per hectare was 19090.78 Kg and 22712.50 Kg of local variety and high yielding variety potato cultivation, respectively and the average selling price of potato was Tk. 20. Therefore, the gross return was found to be Tk. 381816.60 and Tk. 454692.60 per hectare of local variety and high yielding variety potato cultivation, respectively (Table 5.3).

Table 5.3: Per hectare return from local and high yielding variety potato cultivation

Product	Quantity (Kg)	Price per unit	Total
Potato (Local Variety)	19090.78	20	381816.60
Potato (High yielding variety)	22734.63	20	454692.60

Source: Field Survey, 2022

Gross Margin

Gross margin, defined as the difference between gross return and total variable cost, was determined by subtracting the total variable cost from the gross return. Based on the provided data, the gross margin was found to be Tk. 185,669.40 and Tk. 265,883.64 per hectare for local variety and high-yielding variety potato cultivation, respectively (refer to Table 5.4).

Net Return

Net Return, representing the profit, was calculated by deducting the total cost from the gross return. According to the data, the net return was estimated as Tk. 5,648.20 and Tk. 75,402.83 per hectare for local variety and high-yielding variety potato cultivation, respectively (refer to Table 5.4).

Table 5.4: Calculation of gross margin, net return and BCR

Items	Local Variety	High yielding variety
A. Gross Return	381816.60	454692.60
B. Total Variable Cost	196147.20	188808.96
C. Total Fixed Cost	180021.20	190480.81
D. Total Cost	376168.40	379289.77
E. Gross Margin (A-B)	185669.40	265883.64
F. Net Return (A-D)	5648.20	75402.83
G. Undiscounted BCR (A/D)	1.02	1.20

Source: Field Survey, 2022

5.2 Benefit Cost Ratio (Undiscounted)

Benefit Cost Ratio (BCR) is a relative measure, which is used to compare benefit per unit of cost. Undiscounted Benefit Cost Ratio (BCR) was found to be 1.02 and 1.20 of local variety and high yielding variety potato cultivation, respectively which implies that one taka investment will be generated Tk. 1.02 and Tk. 1.20 (Table 5.4). From the above calculation it was found that high yielding variety potato cultivation is profitable than local variety potato cultivation in Bangladesh.

CHAPTER 6

RESEOURCE USE EFFICIENCY ANALYSIS OF LOCAL AND HIGH YIELDING VARIETY OF POTATO CULTIVATION

To assess the efficiency of resource utilization, a ratio equal to unity was deemed indicative of optimal resource use, a ratio exceeding unity suggested the potential for increased yield by employing more resources. A value less than unity signified an unprofitable level of resource utilization, necessitating reduction to minimize losses due to excessive use by farmers. A negative MVP value indicated indiscriminate and inefficient resource use.

6.1 Factors Affecting Gross Return of Local Variety Potato

Human labor cost

The co-efficient of human labor cost was -0.012 which was negatively significant at 1% for local variety potato production. The wage rate of the hired human labor was high that affects the gross return in the study area. This indicates that 1% increase in human labor cost keeping other factors constant, would decrease the gross returns by 0.012% (Table 6.1).

Seed cost

The co-efficient of seed cost was 0.003 which was positive but insignificant for local variety potato production. This indicates that seed cost had no impact on the gross return (Table 6.1).

Manure cost

The co-efficient of manure cost was 0.001 which was positive but insignificant for local variety potato production. This indicates that manure cost had no impact on the gross return (Table 6.1).

Fertilizer cost

The co-efficient of fertilizer cost was -0.009 which was negatively significant at 5% for local variety potato production. This indicates that 1% increase in fertilizer cost keeping other factors constant, would decrease the gross returns by 0.009% (Table 6.1).

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

Variables	Coefficient	Standard Error	t-value
Constant	12.998***	0.121	107.16
Human labor cost (X_1)	-0.012***	0.004	-3.31
Seed cost (X_2)	0.003	0.008	0.36
Manure cost (X_3)	0.001	0.005	0.32
Fertilizer cost (X_4)	-0.009**	0.004	-2.16
Pesticide cost (X_5)	0.001	0.004	0.23
Irrigation cost (X_6)	0.003**	0.001	2.54
R^2	0.613		
Adjusted R^2	0.542		
F-value	8.70***		

Source: Field Survey, 2022 *** *p<.01*, ** *p<.05*, * *p<.1*

Pesticide cost

The co-efficient of pesticide cost was 0.001 which was positive but insignificant for local variety potato production. This indicates that pesticide cost had no impact on the gross return (Table 6.1).

Irrigation cost

The co-efficient of irrigation cost was 0.003 which was positively significant at 5% for local variety potato production. This indicates that 1% increase in irrigation cost keeping other factors constant, would increase the gross returns by 0.003% (Table 6.1).

Value of R^2

The co-efficient of multiple determinations, R^2 was 0.613 which indicates that about 61.3% of the total variation in return of local variety potato production is explained by the variables included in the model (Table 6.1).

F-Value:

The F-value of the equation was significant at 1% and it implies that the included variables are important for explaining the variation in returns of local variety potato production (Table 6.1).

6.2 Resource use efficiency of local variety potato production

The ratio of MVP and MFC of human labor cost (-0.05) for local variety potato cultivation was negative and less than one, which indicated that in the study areas use of human labor for local variety potato cultivation was overutilized (Table 6.2). So, farmers should decrease the use of human labor to attain efficiency considerably.

The ratio of MVP and MFC of seed cost (0.02) for local variety potato cultivation was positive and less than one, which indicated that in the study areas use of seed for local variety potato cultivation was overutilized (Table 6.2). So, farmers should decrease the use of seed to attain efficiency considerably.

The ratio of MVP and MFC of manure cost (0.12) for local variety potato cultivation was positive and less than one, which indicated that in the study areas manure cost for local variety potato cultivation was overutilized (Table 6.2). So, farmers should decrease the use of manure to attain efficiency considerably.

Table 6.2: Estimated resource use efficiency of local variety potato production

Variables	Geometric Mean	$\bar{Y}_i$ (GM)/ $\bar{X}_i$ (GM)	Co-efficient	MVP	r = MVP/ MFC	Decision
Yield (Y)	381815.2					
Human labor cost (X_1)	97213.11	3.93	-0.012	-0.05	-0.05	Overutilization
Seed cost (X_2)	62052.27	6.15	0.003	0.02	0.02	Overutilization
Manure cost (X_3)	3235.39	118.01	0.001	0.12	0.12	Overutilization
Fertilizer cost (X_4)	17110.3	22.31	-0.009	-0.2	-0.2	Overutilization
Pesticide cost (X_5)	9493.23	40.22	0.001	0.04	0.04	Overutilization
Irrigation cost (X_6)	11507.91	33.18	0.003	0.1	0.1	Overutilization

Source: Field Survey, 2022

The ratio of MVP and MFC of fertilizer cost (-0.2) for local variety potato cultivation was negative and less than one, which indicated that in the study areas use of fertilizer for local variety potato cultivation was overutilized (Table 6.2). So, farmers should decrease the use of fertilizer to attain efficiency considerably.

The ratio of MVP and MFC of pesticide cost (0.04) for local variety potato cultivation was positive and less than one, which indicated that in the study areas use of pesticide

for local variety potato cultivation was overutilized (Table 6.2). So, farmers should decrease the use of pesticide to attain efficiency considerably.

The ratio of MVP and MFC of irrigation cost (0.01) for local variety potato cultivation was positive and less than one, which indicated that in the study areas irrigation application for local variety potato cultivation was overutilized (Table 6.2). So, farmers should decrease the irrigation application to attain efficiency considerably.

6.3 Factors Affecting Gross Return of High Yielding Variety Potato

Human labor cost

The co-efficient of human labor cost was 0.188 which was positively significant at 1% for high yielding variety potato production. This indicates that 1% increase in human labor cost keeping other factors constant, would increase the gross returns by 0.188% (Table 6.3).

Seed cost

The co-efficient of seed cost was 0.048 which was positive but insignificant for high yielding variety potato production. This indicates that seed cost had no impact on the gross return (Table 6.3).

Manure cost

The co-efficient of manure cost was -0.163 which was negatively significant at 5% for high yielding variety potato production. This indicates that 1% increase in manure cost keeping other factors constant, would decrease the gross returns by 0.163% (Table 6.3).

Fertilizer cost

The co-efficient of fertilizer cost was -0.043 which was negatively significant at 1% for high yielding variety potato production. This indicates that 1% increase in fertilizer cost keeping other factors constant, would decrease the gross returns by 0.163% (Table 6.3).

Pesticide cost

The co-efficient of pesticide cost was -0.019 which was negative but insignificant for high yielding variety potato production. This indicates that pesticide cost had no impact on the gross return (Table 6.3).

Irrigation cost

The co-efficient of irrigation cost was 0.0004 which was positive but insignificant for high yielding variety potato production. This indicates that irrigation cost had no impact on the gross return (Table 6.3).

Table 6.3: Estimated values of coefficients and related statistics of Cobb- Douglas production function

Variables	Coefficient	Standard Error	t-value
Constant	17.274***	1.092	11.24
Human labor cost (X_1)	0.188***	0.038	4.89
Seed cost (X_2)	0.048	0.085	0.57
Manure cost (X_3)	-0.163**	0.065	-2.50
Fertilizer cost (X_4)	-0.043***	0.014	-2.98
Pesticide cost (X_5)	-0.019	0.031	-0.60
Irrigation cost (X_6)	0.0004	0.026	0.02
R^2	0.698		
Adjusted R^2	0.643		
F-value	3.82***		

Source: Field Survey, 2022 **** p<.01, ** p<.05, * p<.1*

Value of R^2

The co-efficient of multiple determinations, R^2 was 0.698 which indicates that about 69.8% of the total variation in return of high yielding variety potato production is explained by the variables included in the model (Table 6.3).

F-Value:

The F-value of the equation was highly significant at 1% and it implies that the included variables are important for explaining the variation in returns of high yielding variety potato production (Table 6.3).

6.4 Resource Use Efficiency of High Yielding Variety Potato Production

The ratio of MVP and MFC of human labor cost (0.095) for high yielding variety potato cultivation was positive and less than one, which indicated that in the study areas use of family labor for high yielding variety potato cultivation was overutilized (Table 6.4). So, farmers should decrease the use of human labor to attain efficiency considerably.

The ratio of MVP and MFC of seed cost (0.36) for high yielding variety potato cultivation was positive and less than one, which indicated that in the study areas use of seed for high yielding variety potato cultivation was overutilized (Table 6.4). So, farmers should decrease the use of seed to attain efficiency considerably.

The ratio of MVP and MFC of manure cost (-19.75) for high yielding variety potato cultivation was negative and less than one, which indicated that in the study areas manure cost for high yielding variety potato cultivation was overutilized (Table 6.4). So, farmers should decrease the use of manure to attain efficiency considerably

Table 6.4: Estimated resource use efficiency of high yielding variety potato production

Variables	Geometric Mean	$\bar{Y}_i$ (GM)/ $\bar{X}_i$ (GM)	Co-efficient	MVP	r = MVP/ MFC	Decision
Yield (Y)	454678.3					
Human labor cost (X_1)	89743.84	5.07	0.188	0.95	0.95	Overutilization
Seed cost (X_2)	61107.84	7.44	0.048	0.36	0.36	Overutilization
Manure cost (X_3)	3752.19	121.18	-0.163	-19.75	-19.75	Overutilization
Fertilizer cost (X_4)	16187.83	28.09	-0.043	-1.21	-1.21	Overutilization
Pesticide cost (X_5)	10478.93	43.39	-0.019	-0.82	-0.82	Overutilization
Irrigation cost (X_6)	10285.31	44.21	0.0004	0.02	0.02	Overutilization

Source: Field Survey, 2022

The ratio of MVP and MFC of fertilizer cost (-1.21) for high yielding variety potato cultivation was negative and less than one, which indicated that in the study areas use of urea for high yielding variety potato cultivation was overutilized (Table 6.4). So, farmers should decrease the use of fertilizer to attain efficiency considerably.

The ratio of MVP and MFC of pesticide cost (-0.82) for high yielding variety potato cultivation was negative and less than one, which indicated that in the study areas use of pesticide for high yielding variety potato cultivation was overutilized (Table 6.4). So, farmers should decrease the use of pesticide to attain efficiency considerably.

The ratio of MVP and MFC of irrigation cost (0.02) for high yielding variety potato cultivation was positive and less than one, which indicated that in the study areas irrigation application for high yielding variety potato cultivation was overutilized (Table 6.4). So, farmers should decrease the irrigation application to attain efficiency considerably.

CHAPTER 7

CONSTRAINTS IN POTATO PRODUCTION AND MARKETING

Cultivating potatoes posed various challenges for farmers. This section will delve into the issues and constraints related to potato cultivation. Initially, these challenges were identified by assessing the responses from participants. Subsequently, the counts were converted into percentages. Following this, the problem with the highest percentage was assigned the top rank (number 1). Subsequent problems were then ranked based on the increasing percentage of respondents encountering these challenges and constraints.

7.1 Scarcity of Quality Seed

Quality seed provides a high yield and disease-resistant crops, which is crucial for profitable potato farming. The lack of suitable infrastructure and minimal investment in seed production, along with the increasing demand for quality seed, makes it impossible to supply the need. About 70% of potato rated this as a serious concern (Table 7.1).

7.2 High Price of Potato Tuber

The high price of potato tubers is a key topic of concern in potato farming. It has an impact on farmer profitability as well as consumer affordability. About 43% of potato rated this as a serious concern (Table 7.1).

7.3 Unavailability of Labor During Cultivation

Labor scarcity is a key issue in potato farming, particularly during peak seasons such as planting and harvesting. A lack of competent and experienced labor can cause planting and harvesting delays, resulting in lower yields and financial losses. About 59% of potato rated this as a serious concern (Table 7.1).

7.4 High Wage Rate of Labor

The high labor wage rate is a major problem in potato farming, particularly in labor-scarce areas. Farmers' production expenses rise as a result, affecting profitability. About 50% of potato rated this as a serious concern (Table 7.1).

Table 7.1: Constrains in potato production and marketing

Problems	Frequency	Percentage	Ranked
High rotting rate during storage	73	91.25	1st
Low price of output	66	82.50	2nd
High cost of storage facilities	63	78.75	3rd
Scarcity of quality seed	56	70.00	4th
Problems of middlemen in the market	53	66.25	5th
Lack of modern cultivation knowledge	51	63.75	6th
Unavailability of labor during cultivation	47	58.75	7th
Shortage of storage facilities	42	52.50	8th
High wage rate of labor	40	50.00	9th
High price of potato tuber	34	42.50	10th

7.5 Lack of Modern Cultivation Knowledge

The lack of modern cultivation knowledge in potato cultivation can result in low yields, poor quality crops, and increased susceptibility to pests and diseases. The absence of modern knowledge and techniques also limits the ability to adapt to changing environmental conditions and emerging challenges. About 64% of potato rated this as a serious concern (Table 7.1).

7.6 Shortage of Storage Facilities

A shortage of storage facilities in potato cultivation can lead to significant post-harvest losses, reducing the overall profitability of potato farming. This shortage can be particularly challenging in regions with high potato production where storage facilities may be limited or outdated. Lack of proper storage can also lead to price fluctuations in the market, as farmers are forced to sell their crop quickly to avoid spoilage. About 53% of potato rated this as a serious concern (Table 7.1).

7.7 High Cost of Storage Facilities

The high cost of storage facilities in potato cultivation can be a significant barrier to small-scale farmers. Building or maintaining storage facilities requires significant capital investment and ongoing maintenance costs. About 79% of potato rated this as a serious concern (Table 7.1).

7.8 High Rotting Rate During Storage

High rotting rate during storage is a significant challenge faced by potato farmers worldwide. The rotting of potatoes can be caused by a variety of factors, including moisture, temperature, and the presence of pests and diseases. About 91% of potato rated this as a serious concern (Table 7.1).

7.9 Problems of Middlemen in the Market

Middlemen play a significant role in the potato market, but they can pose problems for farmers. Middlemen often act as intermediaries between farmers and buyers, but they may exploit their market power to charge high commissions, leaving farmers with little profit. About 66% of potato rated this as a serious concern (Table 7.1).

7.10 Low Price of Output

Potato farmers face the challenge of low prices for their output due to oversupply or lack of market access. The price of potatoes can fluctuate significantly depending on factors such as seasonal variations, consumer demand, and competition from imported produce. About 83% of potato rated this as a serious concern (Table 7.1).

CHAPTER 8

SUMMARY, CONCLUSION AND RECOMMENDATION

8.1 Summary

Potatoes are one of Bangladesh's most important agricultural crops, contributing significantly to the country's economy and food security. Bangladesh is Asia's 4th largest producer of potatoes. Potatoes are grown in nearly every area of the nation, with the majority of output centered in the northwest and central regions. In Bangladesh, potatoes are a basic meal that is utilized in a variety of recipes. Many farmers utilize them as a source of income, as the crop is farmed both commercially and by small-scale subsistence farmers. Bangladesh's government has undertaken a variety of policies and measures to assist potato growers, such as giving fertilizer and seed subsidies and creating potato storage facilities to avoid post-harvest losses.

This research intentionally selected a sample frame focused on regions with extensive potato farming. Given the substantial concentration of potato production in Munshiganj district, three upazillas were specifically chosen: Munshiganj Sadar, Tongibari, and Gazaria. A sample size of 80 was deemed the minimum for a larger population to ensure a level of confidence suitable for decision-making. In this context, individuals cultivating various types of potatoes in the designated areas were selected as samples. Data collection for this research took place from January 10 to February 9, 2022. Primary data was gathered directly from the primary producers through personal interviews, utilizing a pre-tested interview schedule with selected respondents. To ensure consistency and completeness, the collected data underwent examination and validation. Before being input into the computer, the data were edited and coded. Subsequently, all acquired information was thoroughly summarized and analyzed to identify and eliminate potential inaccuracies. The data were then entered into a computer and analyzed using appropriate software, namely Microsoft Excel and STATA.

Majority of the sample farmers were in the most active age group was middle aged, had school level education and had medium experience in both local and high yielding variety cultivators. The average family size was 6.05 and 5.72 in local variety cultivator and high yielding variety cultivator, respectively. The average annual household

income from of the study area was 1.89 lakh Tk. and 2.74 lakh Tk in local variety cultivator and high yielding variety cultivator, respectively.

Majority (52.50%) of the respondents received training among local variety cultivator. On the other hand., majority (52.50%) of the respondents didn't receive any agricultural training among high yielding variety cultivators. Majority (62.50%) of the respondents didn't receive training on potato cultivation among local variety cultivator. On the other hand., majority (75%) of the respondents didn't receive any training on potato cultivation among high yielding variety cultivators. Majority (62.50%) of the respondents had membership of social organization among local variety cultivator. On the other hand., majority (57.50%) of the respondents had no membership of social organization among high yielding variety cultivators.

Majority of the respondents didn't have any extension contact in both local variety cultivator and high yielding variety cultivators. Majority of the respondents didn't have access to credit in both local variety cultivator and high yielding variety cultivators.

The total variable cost of local and high yielding variety potato cultivation was Tk. 196147.20 and Tk. 188808.96 per hectare, respectively. And the total fixed cost of local and high yielding variety potato cultivation was Tk. 180021.20 and Tk. 190480.81 per hectare, respectively. The total cost of local and high yielding variety potato cultivation was calculated by adding the cost of variable and fixed inputs and was found to be Tk. 376168.40 and Tk. 379289.77 per hectare, respectively.

The average yield per hectare for local and high yielding variety potato cultivation was 19090.78 Kg and 22734.63 Kg, respectively, with an average selling price of Tk. 20, resulting in a gross return of Tk. 381816.60 and Tk. 454692.60 per hectare for each variety.

The Undiscounted Benefit Cost Ratio (BCR) for local and high yielding variety potato cultivation in Bangladesh was found to be 1.02 and 1.20, respectively, indicating that every taka invested would generate Tk. 1.02 and Tk. 1.20 in return. So, it was concluded that high yielding variety potato cultivation is more profitable than local variety potato cultivation in the country.

Cobb-Douglas production function analysis was carried out for examining the effect of input use and resource use efficiency. The explanatory variables like human labor cost,

fertilizer cost and irrigation cost were found to have significant effect on local variety potato production and variable like seed cost, manure cost, and pesticide cost had no impact on local variety potato production.

Again, explanatory variables like human labor cost, manure cost, and fertilizer cost were found to have significant effect on high yielding variety potato production and variable like seed cost, pesticide cost, and irrigation cost had no impact on high yielding variety potato production.

The study discovered that efficiency of different inputs in local and high yielding variety potato cultivation in a specific area. The study compared the MVP and MFC ratios for different inputs, including family labor, hired labor, seed, manure, urea, TSP, MoP, gypsum, pesticide, and irrigation. The ratios indicate whether the input was over or underutilized to attain efficiency. For both local and high yielding variety potato cultivation, the study found that all the inputs were over-utilized in the study area.

Farmers faced a lot of problems in potato cultivation and marketing. The problems were high rotting rate during storage, low price of output, high cost of storage facilities, scarcity of quality seed, problems of middlemen in the market, lack of modern cultivation knowledge, unavailability of labor during cultivation, shortage of storage facilities, high wage rate of labor, high price of potato tuber.

8.2 Conclusion

Potato is a crucial crop for Bangladesh's economy and food security, with the country being the fourth-largest producer in Asia. Potato farming is conducted by both commercial and small-scale subsistence farmers, and the government has implemented several policies to support growers. The research conducted in Munshiganj district showed that the majority of the sample farmers were middle-aged, had a school-level education, and had moderate experience in both local and high yielding variety cultivators. They faced several challenges in potato cultivation, including high rotting rates during storage, low prices of output, high costs of storage facilities, scarcity of quality seed, problems of middlemen in the market, lack of modern cultivation knowledge, unavailability of labor during cultivation, shortage of storage facilities, high wage rates of labor, and high prices of potato tuber. The study also found that high yielding variety potato cultivation is more profitable than local variety potato cultivation in Bangladesh. The analysis using Cobb-Douglas production function

showed that human labor cost, fertilizer cost, and irrigation cost had significant effects on local variety potato production, while human labor cost, manure cost, and fertilizer cost had significant effects on high yielding variety potato production. The study also revealed the efficiency of different inputs in local and high yielding variety potato cultivation in a specific area, and found that all inputs were overutilized. Therefore, policymakers and stakeholders should focus on addressing the challenges faced by potato growers, improving access to quality seed, providing training and extension services, and promoting high yielding variety potato cultivation to enhance the profitability and sustainability of potato farming in the country.

8.3 Recommendation

Based on the information provided, here are some recommendations for improving potato farming:

a) **Increase access to agricultural training:** The majority of respondents did not receive training on potato cultivation, particularly for hybrid varieties. Providing more training on modern cultivation techniques can help farmers improve their yields and profitability.

b) **Improve access to credit:** The majority of respondents did not have access to credit, which can limit their ability to invest in their farms. Improving access to credit can help farmers purchase inputs, such as high-quality seed, and improve their productivity.

c) **Address storage and market-related challenges:** Farmers faced challenges related to high rotting rates during storage, low prices for their output, and problems with middlemen in the market. Improving storage facilities and providing training on post-harvest handling can help reduce post-harvest losses. Additionally, creating better market linkages and improving market infrastructure can help farmers obtain better prices for their produce.

d) **Encourage social organization membership:** The majority of local variety cultivators had membership of social organizations, which could be beneficial in providing them with access to resources and knowledge. Therefore, it is recommended to encourage more farmers to join such organizations.

e) **Optimize the use of inputs:** The study found that all inputs were over-utilized. Farmers should use recommended dose of inputs provided by the officials to achieve greater efficiency.

f) **Improve availability of quality seed:** Scarcity of quality seed was identified as a problem. Thus, steps should be taken to improve the availability of quality seed for potato cultivators.

g) **Promote the adoption of hybrid varieties:** The study found that high yielding variety potato cultivation is more profitable than local variety potato cultivation. Promoting the adoption of hybrid varieties and providing training on their cultivation can help farmers improve their profitability.

h) **Provide modern cultivation knowledge:** Lack of modern cultivation knowledge was identified as a problem. Therefore, efforts should be made to provide farmers with access to modern cultivation knowledge.

8.4 Limitation of the study

The study has certain limitations, as outlined below:

a) The predominant source of data was interviews with farmers, and their cooperation with the interviewer was not consistently high.

b) The information was primarily derived from farmers' recollections, which may not always be entirely accurate.

c) Comprehensive and in-depth examination was somewhat restricted due to limitations in budget and time constraints.

REFERENCES

Afrina, T. (2020). Profitability analysis of Potato cultivation: a study on some selected areas of Munshiganj district. MBA thesis, Department of Management and Finance, Shere-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Allen, E.J., and Wurr, D. C. E. (1992). Plant density, In P.M. Harris (ed.) The potato crop: The scientific basis for improvement. *Chapman and Hall*, London. pp. 292–333.

BBS, (2022). Statistical Year book of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the peoples Republic of Bangladesh, Dhaka.

Begum, A., Imam, M. F. and Alam, M. A. (2010). Measurement Of Productivity And Efficiency of Potato Production In Two Selected Areas Of Bangladesh: A Translog Stochastic Frontier Analysis. *Progress. Agric.* 21(1 & 2): 233–245.

Bussan, A. J., Mitchell, P. D., Copas, M. E. and Drilias. M. J. (2007). Evaluation of the effect of density on potato yield and tuber size distribution. *Crop science*, 47: 2462-2472.

Chowdhury, M. D. and Chowdhury A. H. (2015). Problems and Prospects of Potato Cultivation in Bangladesh. *Asian Business Review*, 5(10): 28-32.

CIP (2019) International Potato Center, CIP Headquarters Avenida La Molina 1895, *La Molina Apartado* 1558, Lima 12, Peru.

Dhawan, K.C. and Bansal, P.K. (1977). Rationality of the Use of Various Factors of Production on Different Sizes of Farm in the Punjab. *Indian J. Agric. Econ*. 32(3):121-130

Dhaka Tribune (2021). Bumper potato yield likely in Munshiganj. *Dhaka Tribune*, 23-Mar-2021. [Online]. Available: https://www.dhakatribune.com/bangladesh/nation/241982/bumper-potato-yield-likely-in-munshiganj.

Dillon, J. L. and Hardaker, J.B. (1993), Farm Management Research for Small Farmer Development, *Food and Agricultural Organization*, Rome, 6: 313.

Dolon, M. I. K. (2018). Potato cultivation and its effect on income generation: a study in Thakurgaon district. MS thesis, Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

FAOSTAT (2020). New food balance sheet for Bangladesh, 2020. Food and Agriculture Organization of the United Nations.

Hoque, M. A. (2001). Effect of cut seed size and spacing on the yield and profitability of potato. *Annual Report on Post Flood Rehabilitation and Adaptive Research Support Project,* BARI, Munshiganj. pp. 13-17.

Hossain, M., Hasan, M., and Naher, Q. (2008). Assessment of Technical Efficiency of Potato Producers in Some Selected Areas of Bangladesh. *Journal of Agriculture & Amp; Rural Development,* 6(1): 113–118.

Islam, M. M. (2018). Profitability and post-harvest problems of potato cultivation in Rangpur district of Bangladesh. MS thesis, Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Juthy, N. F. (2020). Profitability and technical efficiency analysis of Potato production in some selected areas of Bogura district in Bangladesh. MS thesis, Department of Agricultural Statistics, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Kabir, S. M. S. (2016). Basic Guidelines for Research: An Introductory Approach for All Disciplines. Book Zone Publication, ISBN: 978-984-33-9565-8, Chittagong-4203, Bangladesh. pp. 201-275.

MoYS. (2012). The Population Category in Bangladesh. Ministry of Youth and Sports, Government of the People's Republic of Bangladesh. Retrieved from: http://www.moysports.gov.bd/.

Mukul, A. Z. A., Rayhan, S. J. and Hassan, M. M. (2013). Farmer's profitability of potato cultivation at Rangpur district: the socio-economic context of Bangladesh. *International Journal of Economics, Finance and Management Sciences,* 1(3): 136-144.

Nahar, A. (2018). Profitability of potato production: case of vermicompost users and non-users in Nilphamari district. MS thesis, Department of Agricultural

Economics, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Rahat, S. J. (2018). Profitability and resource use efficiency of Potato cultivation in some selected area of Panchagarh district in Bangladesh. MS thesis, Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Rahman, S. A. and Lawal, A. B. (2003). Economic analysis of maize based cropping systems in Giwi local Government area of Kaduna state, Nigeria. *An international Journal of Agriculture. Science, Environment and Technology*, 3(2):139 148.

Rahman, M. (2020). Profitability and technical efficiency of Potato production in some selected areas of Munshiganj district in Bangladesh. MS thesis, Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Rahman, M. M. (2018). Comparative financial study between Potato and Mustard production in selected areas of Gaibandha district. MS thesis, Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Rana, M. M. (2021). Profitability of potato production in some selected areas of Joypurhat district. MS thesis, Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Saha, S. K. (2014). Profitability analysis of potato cultivation: a study at Debiganj thana under Panchagarh district. MS thesis, Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Santo, M. A. B. (2021). Profitability Analysis of Pond Fish (Tilapia) Culture in Some Selected Areas of Chandpur District. MS thesis, Department of Development and Poverty Studies, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

Shahriar, S. M. (2011). Resource Use Efficiency and Profitability of Potato Production in Two Selected Areas of Bangladesh. An unpublished M.S. thesis, Department of Agricultural Economics, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Salna, Gazipur.

Singh, D. K. and Raigond, P. (2014) Potatoes: A Complete Food. Agropedia, ICAR, NAIP. http://agropedia.iitk.ac.in/content/potatoes-complete-food

Struik, Paul C. (2007). Responses of the Potato Plant to Temperature. *Potato Biology and Biotechnology*, pp., 367–393.

Sujan, H. K., Islam, F., Kazal, M. H. and Mondal, R. K. (2017). Profitability and Resource Use seed Efficiency of Potato Cultivation in Munshiganj District of Bangladesh. *SAARC J. Agri.*, 15(2): 193-206.

Tasnim, N. (2018). Profitability and technical efficiency analysis of Potato production in some selected areas of Naogaon district. MS thesis, Department of Agricultural Economics, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka.

APPENDIX A

Interview Schedule **Sample ID** L / H

Sher-e-Bangla Agricultural University, Dhaka

Comparative Profitability and Resource Use Efficiency Analysis Between Local and High Yielding Variety of Potato in Munshiganj District of Bangladesh

Dear Respondent,

All of your information will be used for the development works of our country. Your accurate information will help us to conduct our research accurately. So your accurate information will be highly appreciable. We will maintain your information with strictly confidential manner.

Thank You.

Module 1: Household Identity

a. Location of the Household	Name	Code	b. Identification of Household Head	
Division			Name of Household Head(HH)	
District			Father/ Husband's name	
Thana			Name of the Respondent	
Union/Block/Mouza			If the respondent is other than HH, state the relationship with HH [use code of relationship]	
Village			Type of Family [Nuclear=1, Joint=2, Extended=3]	
HH No.			Religion [Muslim=1, Hindu=2, Buddhist=3, Christan=4]	
c. Interviewer's Visit			Signature	Date
Name of the Interviewer				
Name of the Scrutinizer				
Name of the Data Entry Operator				

Socio Demographic status

Potato Cultivation Related Information

Particulars	Area(Unit area=…….. decimal)
Local variety	
High yielding variety	

Source of income

a) Agricultural Income (Yearly)

Type	**Taka**
Crop	
Livestock	
Poultry	
Fish	
Orchard	

b) Non-Agricultural Income (Yearly)

Type	**Taka**
Service	
Business	
Day Labor	
Rickshaw Puller	
Remittance	
Other	

Module 2: Detailed Information of Household Members

Sl. No.	Name of the Household member	Relation with HH (Code)	Sex (M=1, F=2)	Age in complete Years	Marital Status (Code)	Occupation (Code)		Education (5 yrs.+) (Year of schooling)	Whether any member include in a NGO? Code)	Date of joining
						Main	Subsidiary			
1	2	3	4	5	6	7	8	9	10	11
1										
2										
3										
4										
5										
6										
7										
8										

9										
10										

3. Relationship		6. Marital Status	7 & 8. Occupation		9.Education		10.NGO Membership
1=HH Head	7=Brother	1=Unmarried	01=Agriculture(Self)	08=Fishing	01=Passed class I	95=Can read and write	1=None
2=Wife/Husband	8=Sister	2=Married	02=Service	09=Student	02=Passed class II	96=Can write name only	2=Ex-member
3=Son	9=Daughter in Law	3=Widowed	03=Business	10=Others	….	97=Can read only	3=BRAC member
4=Daughter	10=Maid	4=Separated	04=Day laborer(agriculture)	Specify	10=Passed S.S.C	98=Illiterate	4=Grameen Bank
5=Father	11=Grand Child	5=Divorced	05=Day laborer(non-agril)		12=Passed H.S.C		5=ASA
6=Mother	12=Others	6=Left	06=Rural transportation		……		6=Proshika
			07=Domestic Work				7=Other NGO specify

Production Related Timetable

Particulars	Land Preparation	Seed Sowing	Harvesting
Local			
Hybrid			

Module 3: Land ownership and farm category (in decimal)

Category of land	Tenure Status							Total land size	Farm category
	Own land	Rented in	Mortgaged in	Leased in	Rented Out	Mortgaged out	Leased Out		
	1	2	3	4	5	6	7	8=(1+2+3+4-5-6-7)	9
1.Crop land									
2.Orchard									
3.Homestead									
4.Ponds									
5.Others									
6.Total									

If total land size is 50 to 100 decimal=marginal farm, 101 to 250 decimal= small farm and 251 to above = medium and large farm

9. Farm category code- Marginal farm=1. Small farm= 2 and Medium and large farm= 3

Module 4: Input use in Potato

Please identify land area in local units as follows: A: Decimal, B: Bigha of……. decimal, C: Katha of …….decimal, D: Pakhi of …… decimal, E: Other ……. Of …… decimal.

4A. Human labor Use

Variety				
Area (in decimal)				
Activities		Gender	Man-days/ Unit area	Wage rate (Tk/day)
			1	2
1.Land Preparation	a. Family	M		
		F		
	b. Hired	M		
		F		
2.Seedlind/ Transplantation	a. Family	M		
		F		
	b. Hired	M		

		F		
3.Weeding	a. Family	M		
		F		
	b. Hired	M		
		F		
4.Applying fertilizer	a. Family	M		
		F		
	b. Hired	M		
		F		
5.Applying irrigation water	a. Family	M		
		F		
	b. Hired	M		
		F		
6.Applying insecticides/ Others(specify)	a. Family	M		
		F		
	b. Hired	M		
		F		
7. Harvesting & Carrying	a. Family	M		
		F		
	b. Hired	M		
		F		
8. Sorting, Grading and Packaging	a. Family	M		
		F		
	b. Hired	M		
		F		

4B. Draft power Use

Variety			
Area (in decimal)			
Activities		Pairs days/ unit area	Rate
1.Land Preparation	a. Family		
	b. Hired		
2.Carrying	a. Family		
	b. Hired		
3.Threshing	a. Family		
	b. Hired		
4.Others (specify)	a. Family		
	b. Hired		

4C. Machinery Inputs

Variety			
Area (in decimal)			
Purpose of machinery use		Unit	Cost/Unit
		1	2
1.Land Preparation	a. Owned		

(Power Tiller/ Tractor)	b. Hired		
2.Harvesting (Harvester)	a. Owned		
	b. Hired		
3.Carrying (Tractor / Power Tiller / Van / Shallow irrigation pump)	a. Owned		
	b. Hired		
4.Threshing (Thresher)	a. Owned		
	b. Hired		
5.Others (specify)	a. Owned		
	b. Hired		

4D. Material Inputs:

Variety			
Area (in decimal)			
Inputs		Quantity/ Unit	Cost/ Unit
		1	2
Seed/ Seedling (KG)	a.Owned		
	b. Purchased		
Manure (KG)	a.Owned		
	b. Purchased		
Urea (KG)			
T.S.P (KG)			
M.P (KG)			
DAP (KG)			
Gypsum (KG)			
Insecticide (Gram)			
Irrigation (unit=)	Cash		
	Crop share		
Others (Specify)			
Rental value of land	TK. / Unit area		

4E. Storage:

Variety			
Area (in decimal)			
Output (s)		Unit	Cost/Unit
		1	2
Product (KG)			

4F. Output:

Variety			
Area (in decimal)			
Output (s)		Unit	Price/Unit
		1	2

Product (KG)			
By-product			

Module 5:

1. Do you have any training on agriculture? Yes / No
2. Do you have any training on potato cultivation? Yes / No
3. Potato Farming Experience: .....Years
4. Do you have livestock? Yes / No
5. Are you engaged in fish culture? Yes / No
6. Do you have orchard? Yes / No
7. Do you have access to extension service?.....Yes / No
8. Do you have any agricultural credit? Yes / No

   If yes: Source of Credit? Bank / NGO / Relatives / Others

9. Have you received any remittance last year? Yes / No

   If yes: Have you spend any portion of the remittance in farming? Yes/ No

10. What is the distance from farm to local market: ..... Km

Module 6: Constraints in potato production and marketing (Put tik marks)

Sl. No	Constrains	Put tik marks
1.	Problems of getting quality seed	
2.	Price of Potato tuber	
3.	Unavailability of labor during cultivation	
4.	Wages of labor	
5.	Problems of getting proper information about modern cultivation practices	
6.	Unavailability of irrigation facilities	
7.	Problems of getting enough land for potato cultivation	
8.	Shortage of storage facilities	
9.	Cost of storage	
10.	High rotting rate during storage	
11.	Problems of middlemen in the market	
12.	Problems of selling potato in the local market	
13.	Problems of getting enough cash for potato cultivation	