PROFITABILITY ANALYSIS OF BRINJAL PRODUCTION IN JAMALPUR DISTRICT

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*This is to certify that thesis entitled, "**PROFITABILITY ANALYSIS OF BRINJAL PRODUCTION IN JAMALPUR DISTRICT**" submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE (M.S.) in DEVELOPMENT & POVERTY STUDIES**, embodies the result of a piece of bona-fide research work carried out by **ZOBAYER**, Registration no. **14-06174** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

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Abstract

The objectives of this research study are to recognize and measure the profitability analysis on brinjal production, its profit and socio-economic condition of farmers. Primary data collection was carried out at three villages of Jamalpur Sadar upzilla under Jamalpur district. The study was based on primary data, collected from 70 farmers, selected using a purposively simple random sampling technique. Cobb-Douglas production function was applied to determine the effects of inputs on brinjal production. Land preparation cost, seedling cost, fertilizer cost and insecticides have significant impact on brinjal production. The average yield per hectare of brinjal was 121440 kilograms. The average purveyed price was BDT 20 per kilogram. Per hectare of gross return, gross margin, and net return/profit of brinjal production were BDT 242880; BDT 1133970 and BDT 993970 respectively **(**Table 4.13**)**. Per hectare benefit cost ratio was estimated at 1.70. Thus, Brinjal is a highly profitable enterprise. Increase of only managerial skills result in a substantial increase of output for Brinjal. Farmers faced a lot of problems in producing Brinjal. The problems were social and cultural, financial and technical. Lack of quality seed was one of the most important limitations of producing Brinjal in the study area. Lack of operating capital, high price of quality seed, high cost of irrigation water, shortage of human labor, lack of storage facilities, marketing problems and lack of quality preparation were the major problems faced by farmers. These are the major constraints for the producers of Brinjal in the study area.

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CHAPTER I

INTRODUCTION

1.1. General Background

Bangladesh is a mostly agricultural nation in South Asia. Agriculture is the primary segment of the Bangladesh economy, and the country's prosperity and stability are reliant in great part on agriculture's stable development (crops, livestock, fisheries, and related others). Around 84 percent of the entire population is dependent on agriculture, and the country's improvement is heavily conditional on agricultural productivity (BBS 2019). Around 77 percent of the people live in villages, and agriculture is their primary source of earnings (BBS 2020). Approximately 52 percent of the entire dynamic workforce is still involved in agriculture, either directly or indirectly. Bangladesh's economy is mostly based on agriculture.

Agriculture plays a significant role in Bangladesh's economic growth. Extensive irrigation, high-yielding crop varieties, more efficient markets, and mechanization, enabled by policy reforms and investments in agriculture research, human capital, and roads have driven the agriculture sector's growth. Bangladesh is well known for its improvement in human development. Over 87 percent of rural people derive at least some income from agriculture (BBS 2018). However, two-thirds of rural households rely on both farm and non-farm incomes Pro-poor agriculture growth has stimulated the non-farm economy in Bangladesh: a 10 percent rise in farm incomes generates a 6 percent rise in non-farm incomes (BBS 2018).

The country's future economic growth will be determined by the improvement made and objectives reached in the agriculture sector during the next decade. Thus, agriculture is critical for food security, job creation, poverty reduction, a higher quality of life, and increased earnings. Within agriculture, fisheries, crops, and livestock all play an important role in the socio-cultural and economic life of the Bangladeshi people.

Table 1.1 Contribution Agriculture in GDP

Sectorial Shares of gross domestic product (GDP) of Bangladesh	**2015-16**	**2016-17**	**2017-18**	**2018-19**
A) Agriculture	**14.77**	**14.17**	**13.82**	**13.32**
Agriculture and forestry	11.55	10.98	10.68	10.25
Crops & horticulture	8.15	7.69	7.48	7.12
Animal Farming	2.01	1.93	1.86	1.79
Forest and related services	1.39	1.37	1.34	1.35
Fishing	3.22	3.19	3.14	3.07

Source BBS, 2020

Above the Table (1.1) we can say that a large portion of GDP came from agriculture sector. we also say that dependency of agriculture sector is reducing because of huge growth of industry and service sector. This does not mean that agriculture production is declining but other industrial and service sector is increasing where agriculture production remains constant that's it means growth rate is decreasing in agriculture sector.

In the crops sector, we can get some horticulture products which is also added some production. Horticulture products can play a significant role in reducing the poverty of the rustic people of Bangladesh. It can raise food production, supply raw materials, deliver balance food, supply firewood, create employment, proliferation earnings, and preserve ecological stability. Agriculture is an important component in the GDP of Bangladesh, and it contributed 13.32 of GDP in the year 2018-2019 (BBS 2020). Vegetables and crops sub-sector also contribute an important share to the agricultural GDP which is near about 9.71 % (BER, 2018). Vegetable contributes an important share of the total agricultural export in Bangladesh. Moreover, this country is still shortage of per capita vegetable consumption against per capita vegetable requirement. Per

capita vegetable consumption is 166.1 grams per day whereas per capita consumption of fruits is 44.8 grams (FAO, 2014). WHO/FAO minimum recommended level of vegetables and fruits is 400 grams per day So, it is necessary to increase the production of vegetables and fruits to reach the recommended level of consumption. Farmers produce vegetables for their own consumption and sell. Vegetables are important for the economic and nutritional point of view.

The restrictions of the horticulture crop production can be solved in priority areas and showing the effectiveness of the crops. Brinjal is one the main horticulture crops which the most popular and high is yielding vegetable in our country.

Brinjal, or eggplant (*Solanum melongena L.*), is the second most important vegetable grown in Bangladesh. Brinjal accounted for 4.7 and 9.6%, respectively, of all winter and summer vegetable production in 2018 (BBS 2018). Brinjal is grown in almost all acro-climatic zones with over 100 different varieties under cultivation, offering brinjal fruits of different color, size, shape, and taste. In Bangladesh, brinjal is grown throughout the year.

During the hot humid rainy season, it is one of the few vegetables available to urban and rural market at reasonable prices. Bangladesh is one among the main horticultural countries in South Asia. Agriculture, including horticulture, is that the largest single sector of the economy, accounting for about 13 percent of the country's agricultural GDP (BER, 2006). Brinjal is a crucial vegetable for its commercial value within the world also as in Bangladesh. In Bangladesh brinjal is assessed into two categories in respect of production period. These are Rabi- brinjal and Kharif- brinjal. Though it's available throughout the year, its peak supply comes during December to April. Brinjal grown in Bangladesh are of various varieties.

1.2. Origin of Brinjal

The name brinjal is widespread in Indian subcontinents and is derived from Arabic and Sanskrit whereas the name eggplant has been derived from the shape of the fruit of some varieties, which are white and look like in shape to chicken eggs. It is also called auberges (French word) in Europe. The brinjal is of much importance in the sincere extents of Far East, being grown extensively in India, Bangladesh, Pakistan, China and Philippines. Egypt, France, Italy, and the United States are among the countries where it is popular. It is one of the most common, popular, and important vegetable crops

grown in Bangladesh, except for higher altitudes. It is a versatile crop that can be grown all year and is adapted to various agro-climatic regions. Although it is a perennial, it is commercially grown as an annual crop. S. Melongena L. varieties have a wide range of fruit shapes and colors, ranging from oval or egg-shaped to long club-shaped, and from white to purple to almost black in skin color. Many commercially important varieties have been selected from long-established tropical India and China types. Brinjal comes in a variety of shapes, colors, and sizes throughout Southeast Asia, indicating that this region is a hotbed of variation. The region of Bangladesh and Myanmar is thought to be a diversity hotspot (Former India-Burma border). Isshiki et al., 1994 provided evidence for this by observing isoenzyme and morphological variation in a large germplasm collection from Japan.

1.3. Brinjal Different Varieties

In a thickly populated region, the development and creation of brinjal is fundamental for the area and is an essential kind of revenue for helpless ranchers. Given its significance, researchers and ranchers have collaborated to track down both financially maintainable and harmless to the ecosystem ways of handling crop misfortunes and increment ranchers' salaries. Establishing time is October-November; prepared for collect in 90-100 days; yield goes from 40-45 m ton/ha relying upon the variety. Islampuri, Khat Khatia, Dohazari, Volanath and Singnath are some of the popular local varieties of brinjal.Recently the Bangladesh Agricultural Research Institute developed some varieties ie, Uttara, Shuktara (hybrid), Tarapuri (hybrid), Nayantara and Kazla.And Bt brinjal one of the most popular developed and modified variety. The variety grown in Jamalpur and Mymensingh area is famous for its size and taste.

1.4. Climate and Soil Factor

Brinjal is a warm-season vegetable that can be damaged by frost. During the cool season, climatic conditions, particularly low temperatures, cause abnormal ovary development (splitting) in flower buds, which then differentiate and develop into deformed fruits. The ideal temperature for fruit set and growth is 20-30°C. The high night and day temperatures of 22-24°C to 33-35°C, however, significantly reduce fruit set and yield (Kalloo et al, 1990). Many of the round varieties set fruit at a slightly lower temperature, but they are extremely frost prone. When the temperature drops below 17°C, the crop's growth is severely hampered. It can be grown successfully in

both the rainy and summer seasons. Brinjal can be grown in a wide range of soil types, from light sandy to heavy clay. Light soils are ideal for an early crop, while clay loam and silt-loam are ideal for high yielding crops. In general, silt-loam and clay-loam soils are best for growing brinjal. Deep, fertile, and well-drained soil is ideal. For optimal growth and development, the soil ph should be between 5.5 and 6.0 (Mohanty and Prusty 2000). It can tolerate acidic soil to a degree. Several cultivars can be grown successfully at high ph levels when farmyard manure or green manuring is applied liberally before transplanting. Brinjal is usually transplanted rather than seeded directly in the field because it is the most effective way to establish a uniform and complete stand. Brinjal seeds take one to two weeks to germinate after sowing.

1.5. Overall Brinjal Production

Bangladesh is devastatingly an agrarian country. In Bangladesh, brinjal is grown by about 150,000 resource-poor farmers on 50,955 hectares with a total production of 507,000 metric tons in 2018. (BBS 2018)

Because of its extremely ripe land and great climate, assortments of yield fill richly in this country. Horticulture area contributes around 14.23 percent to the nation's Gross Domestic Product (GDP) and employs around 40.60 percent of absolute work for Bangladesh is overwhelmingly an agrarian country. Because of its exceptionally rich land and good climate, assortments of harvest fill bounteously in this country.

In Bangladesh is one most the vegetable grower’s country in world. Bangladesh holds the third position after China and India in terms of producing vegetables, according to the United Nations World Food and Agriculture Organization (FAO). Many experts describe this success as a silent revolution in vegetable production over the last decade

Table 1.2 Vegetable Production

Year	Area '000, Acres	Production '000, M. tons	Per acre Yield (kg)
2018-2019	813	3189	90461
2017-2018	1008	4047	4041
2017--2016	1025	1744	1701

Source: DAE, 2019

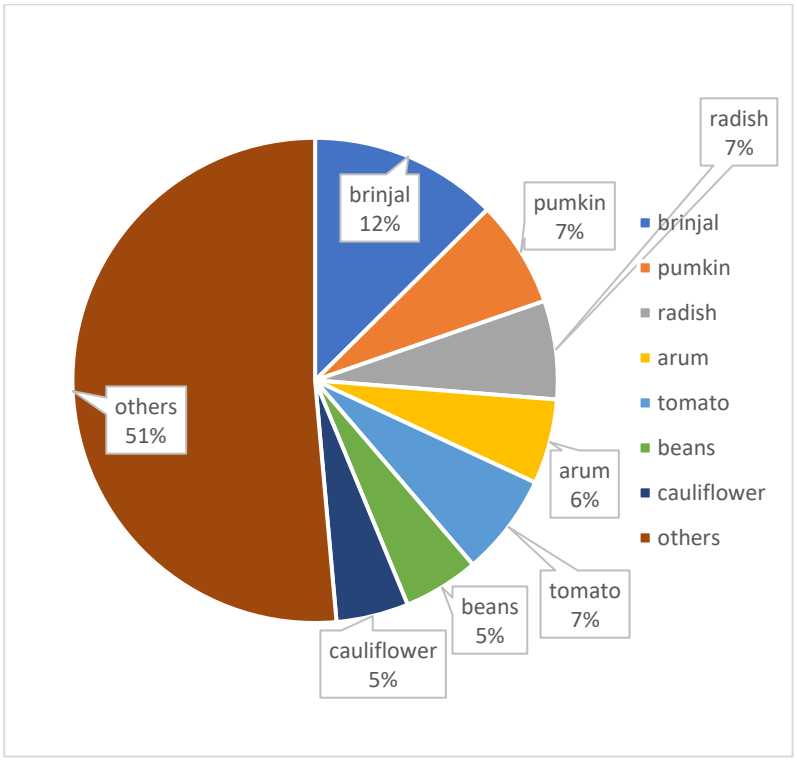

Figure 1.1 Area Under Vegetable (Winter & Summer) In Bangladesh, 2015-2016

Source: BBS, 2016

From **Table 1.2** we can see that production rate of vegetable is growing day by day. In last 2018-2019 years production is 3189000 metric tons where cultivate able land was 813000 acres with 90461 kg per acres.

. At present, the country is producing about 60 different kinds of vegetables out of more than 500 varieties that are produced in the world. “The success does not come overnight, it almost took a decade to reach this position,” a high official of the Department of Agriculture Extension (DAE) told this correspondent. Above the Figure (1.1) we can see that several vegetables grow with major quantity like brinjal 12%, pumpkin 7%, radish 7%, arum 6%, tomato 7%, beans 5%, cauliflower 5% and other vegetable 51% in 2015-2016 years.

According to agriculture ministry information, from 2008-09 to 2017-18 fiscal, the ministry has taken 204 projects to develop and increase vegetable output. Of them, 153 projects have been completed, while 51 projects are now continuing. Ministry officials said, even the arable land of the country is decreasing, but with the latest innovation, such production is boosting. Science technology and biotechnology are now appropriately used in food production

Table1.1 Brinjal Production in Bangladesh

Kharif	**2016-2017**		**2017-2018**		**2018-2019**	
	Area (acres)	Production (MT)	Area (acres)	Production (MT)	Area (acres)	Production (MT)
	45665	**159891**	**45760**	**160145**	**47213**	**170189**
Rabi	2016-2017		2017-2018		2018-2019	
	Area (acres)	Production (MT)	Area (acres)	Production (MT)	Area (acres)	Production (MT)
	80195	**347541**	**80618**	**355862**	**82206**	**360421**

Source: BBS, 2019

Table1.2 Brinjal Production in Mymensingh Division

Area	**Year & amount**					
Jamalpur	2016-2017		2017-2018		2018-2019	
	Area (acres)	Production (MT)	Area (acres)	Production (MT)	Area (acres)	Production (MT)
Kharif	**792**	**2178**	**822**	**2276**	**878**	**2396**
Rabi	**7035**	**25549**	**7579**	**27021**	**8015**	**28371**
Mymensingh	2016-2017		2017-2018		2018-2019	
	Area (acres)	Production (MT)	Area (acres)	Production (MT)	Area (acres)	Production (MT)
Kharif	**1547**	**4793**	**1542**	**4875**	**1742**	**4900**
Rabi	**3075**	**26181**	**3075**	**25011**	**3048**	**27440**
Sherpur	20162017		2017-2018		2018-2019	
	Area (acres)	Production (MT)	Area (acres)	Production (MT)	Area (acres)	Production (MT)
Kharif	**754**	**2246**	**774**	**2247**	**789**	**2294**
Rabi	**1363**	**7460**	**1387**	**7692**	**1429**	**8067**
Netrokona	2016-2017		2017-2018		2018-2019	
	Area (acres)	Production (MT)	Area (acres)	Production (MT)	Area (acres)	Production (MT)
Kharif	**154**	**357**	**150**	**357**	**202**	**410**
Rabi	**614**	**1670**	**652**	**1722**	**666**	**1544**

Source: BBS,2019

1.6. Economic Status of Brinjal

"Begoon" (Brinjal or Eggplant) is an exceptionally normal and most loved vegetable in Bangladesh which has a connection with the social, social and financial existences of provincial individuals. Brinjal is second most significant vegetable in Bangladesh as far as both, creation region and yield, just outperformed by potatoes. In Bangladesh, north of 1, 15,424 hectare of complete cultivable land is given to brinjal development (BBS, 2011).

From Table 1.3 we can see that production rate of brinjal production is growing day by day. In last 2018-2019 years production is 170189 metric tons in kharif season and in rabi season we got 360421 metric tons brinjal which huge amount than kharif seasons. It is developed in the agrarian fields as a money crop in the business vegetable developing regions and pretty much every country family has not many brinjal plants in the kitchen garden. It is a lasting however developed financially as a yearly harvest.

Brinjal has got much potential as raw material in pickle making and dehydration industries. It is supposed to contain certain medicinal properties and white brinjal is said to be good for diabetic patients. The fruits are employed as a cure for toothache. It is also an excellent remedy for those who suffering from liver complaints.

Brinjal is very popular in southern Europe, France and Italy and USA. Brinjal is reported to stimulate the intrahepatic metabolism of blood cholesterol. Leaf and fruit, fresh or dry produce had marked drop in blood cholesterol level. The de-collateralizing action is attributed to the presence of poly unsaturated fatty acids (linoleic and linolenic) which are present in flesh and seeds of fruit in higher amount (65.1%). The presence of Mg and K salts also helps in de-cholesterols action. Food ought to be liberated from risk materials like pesticide residue.

Although Bangladesh created gigantic measure of brinjal it is just a negligible part of the world's creation. In Bangladesh, north of 1,24,526 sections of land of complete cultivable land is committed to brinjal development (BBS, 2016). From Table 1.4 we can see that production rate of brinjal in Mymensingh district quite good. According to Table 1.4 in year 2018-2019 we can see that in Mymensingh district brinjal production is 4900(kharif) & 27440(Rabi) metric tons, Sherpur district production is 2294(kharif) & 8067(Rabi) metric tons, in Jamalpur district productions is 2396(kharif) & 28371 (Rabi) metric tons, in Netrokona area production is 410 (kharif) &1544(Rabi) metric

ton which is low production than other district because of low land and some parts hilly area. But in Jamalpur district the study area brinjal production so high than other district in Mymensingh divisions.

For this reason, we can realize economic importance of brinjal production in Jamalpur is quite good. The harvest is mostly developed on little family cultivates and is a significant wellspring of money pay for some asset helpless rancher. Many famers cultivate this vegetable, earn lots of money and change their economic condition.

1.7. Nutritional Importance of Brinjal

Many folks are most conversant in eggplants that are large and dark purple, but the form, size, and color can vary from small and oblong to long and thin and from reminder purple to white or green. Contrary to the common belief, it's high nutritive value should easily be compared with tomato (Chadha,1993). it's higher calorie, iron, phosphorus, riboflavin and vitamin C content than many other vegetables. A serving of eggplant can provide a minimum of 5% of a person's daily requirement of fiber, copper, manganese, B-6, and thiamine.

It also contains other vitamins and minerals. In addition, eggplants are a source of phenolic compounds that act as antioxidants. Antioxidants are molecules that help the body eliminate free radical's unstable molecules which will damage cells if they accumulate in large amounts. Food handling is a logical discipline depicting taking care of, arrangement, and capacity of food in manners that forestall food-borne sickness**.** Foods that contain antioxidants may help prevent a variety of diseases. Among the antioxidants in eggplants are anthocyanins, including Nasuni, lutein, and zeaxanthin.

Table1.3 Composition per 100 g of Edible Portion

Calories	24	Sodium (mg)	3
Fat (g)	0.3	Copper (mg)	0.12
Moisture content (percent)	92.7	Sulphur (mg)	44
Fiber (g)	1.3	Chlorine (mg)	52
Protein (g)	1.4	Folic Acid (μg)	34
Carbohydrates (percent)	4	Calcium (mg)	18
Oxalic acid (mg)	18	Magnesium (mg)	15
Thiamine (mg)	0.04	Phosphorus (mg)	47
Riboflavin (mg)	0.11	Iron (mg)	0.38
B-carotene (μg)	0.74	Zinc (mg)	0.22
Vitamin C (mg)	12	Vitamin A (I.U.)	124
Amino Acids	0.22	Potassium (mg)	2

Source: Gopalan et al. ,2007

1.8. Justification of the Study

Agribusiness assumes an imperative part through work age, destitution easing, food security improves, way of life by expanding pay level of the provincial individuals. However, the populace is expanding step by step which causes the reduction of homestead size horrendously. Land for individuals of Bangladesh is the single most significant resource.

Most of the families in Bangladesh generally depend ashore based exercises for their jobs. As very nearly 65% of the aggregate general population (or more 80% of the rural population) were rely upon agribusiness. To fulfill the need of flavors for the expanding

populace and to accomplish independence in flavors, the public authority of Bangladesh has given a lot of accentuation on5 brinjal creation. Critical compositional changes happened inside brinjal production. The region under study is a brinjal developing region under various courses of action furthermore this region brinjal expanded by a few times in the course of recent a long time due to dissemination of new innovations, for example, HYV seeds, compost, water system, insecticides, power turner and so forth This has most certainly changed the expense construction of brinjal creation.

Under such conditions, contrasted with past, if brinjal creation under plans isn't profitable for the farmers, they might be unengaged in brinjal production which has genuine ramifications on the Bangladesh economy all in all since brinjal is the principal area in agribusiness which actually contributes significant offer in the GDP. To proceed with brinjal production to fulfill expanding need for flavors for the country entire, farmers' financial motivator for brinjal production under various frameworks should be inspected. So, this review endeavors to quantify the benefit of brinjal delivering ranches under a distinctive framework. It additionally endeavors to quantify the financial qualities of the farmers in the review.

1.9. Possibilities of the Study

A presumption has been characterized as "the speculation that a clear truth or standard is valid considering the accessible proof" (Goode, 1945). A supposition that is taken as a truth or conviction to be valid without confirmation. So, the accompanying presumptions were as a main priority to the analyst while doing this review:

I) The respondents remembered for the example were fit for giving legitimate reactions to the inquiries of the meeting plan.

ii) Views and opinions well-found by the respondents were the representative views and opinions of the whole population of the study.

iii) The reactions outfitted by the respondents were solid and they really communicated their viewpoints on the productivity of brinjal development in the selected area of Jamalpur region.

iv) Data collected by the researcher were free from bias.

v) The analyst who went about as the questioner was balanced to the social also social climate of the review region. Subsequently, the respondents outfitted to their right conclusions decisively.

vi) The respondents had practically comparable foundation and appeared to be homogenous generally.

vii) The data looked for by the scientist uncovered the genuine circumstance to fulfill the destinations of the review

Considering the importance of brinjal production, present study will examine economic potentiality of brinjal farming in some selected areas in Jamalpur district. The specific objectives of the study are as follows.

Objectives:

1. To show the socio-economic profile of the brinjal farmers.
2. To determine the profitability of brinjal farming.
3. To identify the major challenges in brinjal farming in farmer's level.

1.10. Organization of the Study

The study consists of 5 chapters. Chapter 1 describes introduction of the study. Relevant review of literature, methodology, description of the study area, socioeconomic characteristics of the sample farmers, results and discussion, major factors affecting to the cultivation processes of Brinjal, problems of Brinjal growers and summary, conclusion and recommendations are presented in Chapter 2, Chapter 3, Chapter 4, Chapter 5 respectively.

CHAPTER II

Review of Literature

Studies on quantitative and qualitative characters of brinjal are receiving much attention in the tropical and sub-tropical countries. Although brinjal is a common and one of the most popular vegetables occupying a wider acreage under its cultivation in Bangladesh, information on its growth habit and productivity of different varieties/lines under varied agro-ecological conditions are very much lacking.

M R Hasan (2016) Study on analyzed the productivity of brinjal development in three regions specifically Mymensingh, Rajshahi and Comilla of Bangladesh. The outcomes showed that all out cost of brinjal was the most noteworthy in Mymensingh (Tk. 309,732/ha) contrasted with Rajshahi (Tk. 285,464/ha) and Comilla (Tk. 301,436/ha), while complete income from brinjal development was the most noteworthy in Comilla (Tk. 407,580/ha) contrasted with different regions. Once more, net ranch pay was found most noteworthy in Comilla (Tk. 106,144/ha) locale than different region.

Alam et al. (1992) reported that four winters and three summer vegetable were grown in the homestead area. The average returns per hectare of winter vegetables were about Tk 23400, 19600, 22000 and 39400, with Brinjal, Bottle gourd, Potato and Radish respectively, while those of summer vegetables were Tk. 15600, 19100 and 40000 with Ash gourd, snake gourd and Lady's finger respectively.

Aslam (1995) conducted a study on a comparative economic analysis of winter crop production in an area under Guaripur Thana in the district of Mymensingh. He found that the per hectare gross expenses of HYV potato, LV potato, Brinjal, Cucumber, Bottle gourd, Bean, Sweet potato, Groundnut were Tk.43,956, 34,892, 41,893, 45,219, 42,224, 27,362, 20.475 and 11,970 while the per hectare gross returns and net return were Tk. 77,000 and 33,034, Tk. 53,648, and 18,756, Tk. 72,061 and 30,168, Tk. 80,261 and 12,524, respectively. He also found that the variation in yield was greatly influenced by the use of human labor, animal.

Sultana (1992) looked into the relative profitability of some selected w vegetable like Potato, Brinjal and Radish in the two villages, Sutiakhali Bhabakhali under Mymensingh Sadar Thana It was revealed that Potato was profitable than Brinjal and

radish in the study area. She also found that factors us sowing/planting and harvesting dates were mostly responsible for variations yields of these vegetables.

Mahajan et at. (1994) conducted a survey on brinjal and tomato production in Thane district of Maharashtra. The paper analyses the economics of brinjal and tomato production in Thane district, Maharashtra, India. Data for the 1989/90 rabi season were collected from 100 brinjal and tomato growers randomly selected from Vasai, Palghar and Dahanu tahsils. Per ha cost-of cultivation was Rs 14714.76 and Rs 16690.95, for brinjal and tomato, respectively. Per ha gross return was Rs 23715.65 and Rs 23755.50, for brinjal and tomato, respectively. The corresponding figures for per ha net returns were Rs 9000.89 and Rs 7064 55, with benefit-cost ratios of 1.20 and 1.07, respectively.

Kitesur et al. (1993) conducted a study of the costs and returns of vegetable growing were carried out in Dharwad and Hubli taluks in Dharwad district, Andhra Pradesh, India. The sample included 81 tomato growers, 69 brinjal cultivators, 55 onion producers and 83 potato farmers. Data were collected for 1985/86. The costs of production were highest for potatoes followed by onions, tomatoes and brinjal. The highest net returns were obtained from brinjal (Rs 58/quintal) in Dharwad taluk, followed by onions and tomatoes. Net profit was lowest for potatoes.

Hossain et al. (1989) studied on utilization of homestead for production of seasonal vegetables in Bangladesh. It is reported that in case of production of leafy vegetables 36.61, 19.69, 38.75 and 3.38 percent positive answers were obtained in favour of puishak (Indian spinach), Lalshak (Amaranths). Datashak (Amaranths), Kalmi (kangkong) and others respectively. Regarding fruit vegetables 16.05, 7.38, 1.02, 6.49,17.03, 7.72, 5.77, 14.52, 10.29, 9.89, 2.98 and 0.85 percent positive answers were obtained in favor of production of Brinjal, Cauliflower, Tomato, Gourd, Lady's finger, Bitter gourd. Snake gourd, Bath sponge, sweet gourd, green banana and others respectively. It was also evident that with the increase in land holding size, proportion of homestead decrease.

Manish Sharma and KK Singh (2020) directed a review on: Economic study on the various cost and profit measures of Brinjal crop in Mau District of Uttar Pradesh, India with a list of all vegetable growers of each selected village was prepared and stratified into three groups viz. marginal, small, and medium farms. Multistage stratified random-cum-purposive sampling was applied for selecting the block, village and respondents.

Ultimately, 100 respondents (75 marginal,14 small and 11 medium) were selected, randomly. The study was pertained to the agriculture year 2019-20. The cost of cultivation was observed higher on marginal farms (Rs. 98091.00) followed by small farms (Rs. 93549.55) and medium farms (Rs. 91426.46), respectively. The overall average of the input-output ratio on the basis of various costs varies from 1:2.50 to 1:1.86 in the study area.

Shelton AM and Sarwer SH et al. (2020) directed a review on Impact of Bt Brinjal Cultivation in the Market Value Chain in Five Districts of Bangladesh with the based on a survey of Bt and non-Bt farmers, results indicate that Bt brinjal provided an average of 19.6% higher yield and 21.7% higher revenue compared to non-Bt varieties. On a per tonne basis, the revenue benefit of using Bt brinjal was 1.7%, reflecting different levels of acceptability among trade buyers and consumers. Labor use, expressed in 8-h days, for harvesting, grading, and packaging of Bt brinjal was 14% higher for Bt brinjal, reflecting the increased yields of Bt brinjal. 83.1% of Bt brinjal growers were satisfied with the yields obtained, and 80.6% were satisfied with the quality of fruit. This contrasts with non-Bt brinjal growers where 58.7% were satisfied with their yields and 28% indicated that a large portion of their fruit was infested, not a concern for Bt brinjal.

Upendra Kumar and Agarwal P.K. (2018) conducted to find out profitability in terms of cost and return from brinjal cultivation in birni block of Giridih district, Jharkhand. The key objectives were to analyze the cost and return structure of brinjal cultivation and to identify the major constraints faced by the farmers in brinjal cultivation. Five villages were purposively selected on the basis of prior information and a primary survey was done. From each village 12 farmers were selected based on their land area under brinjal cultivation. For further detail studies and thus making a sample size of 60. It was revealed from the study that the overall average cost of cultivation of brinjal per acre in Birni was found to be Rs. 41688.37 out of which total variable cost was Rs. 30564.41. Highest percentage expenditure was on manures and fertilizers followed by labor costs. The per acre output was 100.51 quintal The major problems in cultivation of brinjal were lack of water for irrigation, nonavailability of credit, lack of scientific knowledge among farmers, high cost of seeds, pest and diseases, awareness on optimum use of fertilizers, high cost of labor etc.

N. Ashoka and Y. Ravi et al. (2020) tried to estimate the area under cultivation of brinjal in Karnataka and also to estimation the demand for brinjal seedlings during 2019-20. In addition, this study has also tried to work out the economic possibility of investment on nursery under shade net condition. The results indicated that the area under brinjal cultivation was estimated to be 17238 hectares and the demand for brinjal seedlings worked out to 23.94 cores in the state of Karnataka for the year 2019-20. The capital costing technique indicated that, the nursery entrepreneurs had invested 2,59,735/- towards setting up of nursery in an area of 1000m^2 under shade net. Further the economic study pointed out that entrepreneurs have realized gross income of 2,74,540/- and net returns of 62,608/- per crop rotation The capital investment on brinjal nursery was found to be economically practical in terms of net present worth (1,21,723), benefit cost ratio (1.30) and Internal Rate of Return (89 per cent).

Mayuri Raut, Vanita Khobarakar, et al. (2020) study was conducted in Economics of production of Brinjal in Akola District. A sample of 90 Brinjal growers was selected based on random sampling. It was observed that, It is observed that, per hectare cost of cultivation of Brinjal at cost was highest in the large group i.e. Rs. 158038.79 followed by medium group (Rs. 153629.41) and small group (Rs.143751.95). Per hectare total cost of cultivation of Brinjal for overall farmers was Rs.151778.83. The average yield and gross returns per hectare increased with the increase in size of farms.

Rahman et al. (2016) directed a review on brinjal cultivation in Jamalpur area through productivity examination and elements influencing the making and normal yield per hectare of brinjal for farmers was 45775.19 kg. The ranch door cost was Taka10.00 per kg. Per hectare of net return, net edge, and net return/benefit of brinjal cultivation were Taka461954.45, Taka 326461.76 and Taka 317297.97 individually

Mridul Mondal (2019). study on financial examination of brinjal cultivation in India of the territory of West Bengal with 50 examples are chosen after Simple Random Sampling without Replacement (SRSWOR) strategy so as to gather the essential information connected with expenses and returns alongside the financial data. Study on expenses and returns structure uncovers that the example farmers have made a venture of Rs.164365.65/, Rs. 276502.12/and Rs. 347758.45/ha as far as Cost A1, Cost B and Cost C on a normal separately considering farmers of all size gatherings to understand a gross return of Rs. 382866.62/ha. The net returns are assessed to be Rs. 218500.97,

Rs. 106364.50 and Rs. 35108.17/ha over Cost A1, Cost B and Cost C with the return - cost proportions of 2.33,1.38 and1.10 separately.

Bresler et al. (1982) were reported that eggplant is highly sensitive vegetable crop and it has great potentiality to grow in saline soil. A basic nutrient solution contains 10mM NaCl reduce the number of leaves, number of flowers per cluster. A 50% reduction occurred on flowers per plant than the controls and when the pollen count was only about 30% of that of the control plants. However, the pollen fertilities of both control and salt treated were same. Reduction in the number of fruits per plant produced by saline conditions was probably due to a decrease in the number of flowers per plant, and not to lowering of pollen fertility Grunberg et al. (1995).

R. Jasothajini, K. Sooriyakumar et al (2017) conducted to Fertilizer Usage and Brinjal Cultivation in Thenmaradchi Area of the Jaffna involves indiscriminate application of large quantities of fertilizers. The overuse of fertilizer pollutes the water bodies and leads to health problems and also reduces the net profit of the farmers. The objective of this study was to determine the fertilizer requirement for maximum yield of brinjal cultivation and also it showed that there is a significant interaction effect of organic manure and chemical fertilizer on the brinjal production. Farmers are averagely getting 1072 kg of brinjal from one lacham. Brinjal farmers in this division are applying 3.7 kg of N, 2.4 kg of P, 2 kg of K and 0.4 load of organic manure per lacham on average. There is a significant negative interaction effect of inorganic N fertilizer and organic manure on yield & positive interaction effect of inorganic K fertilizer and organic manure on yield.

Islam (2005) reported that brinjal can be grown at homestead area and kitchen garden because of its popularity especially for urban people. About 8 million farm families are involved in brinjal cultivation.

Summary

According to the above-mentioned discussions, the studies primarily focused on the production and profitability analysis of brinjal. Despite this, no empirical research has been done specifically on the profitability of brinjal cultivation. As a result, a moderate effort has been made in this direction in the current study, which can be considered a pioneering work in this field in terms of systematic investigation into the costs analysis of this enterprise**.**

CHAPTER III

METHODOLOGY

3.1. Introduction

Methodology empowers the scientist to gather substantial data. It is difficult to direct research work flawlessly without appropriate methodology and it is truly challenging to address the goals with a logical way. It requires an exceptionally cautious thought with respect to the specialist to gather substantial and solid information and to break down something similar for significant end. A successive depiction of the methodologies was continued in leading this examination work has been introduced in this section**.**

3.2. Location of Study

The study was conducted in Jamalpur sadar Upazila under jamalpur district. Jamalpur District (Mymensingh division) area 2031.98 sq km, located in between 24°34' and 25°26' north latitudes and in between 89°40' and 90°12' east longitudes. In here main rivers of this districts are jamuna, old brahmaputra, banar, Jhinai . It has six upzilla and Jamalpur sadar is the largest one.Where Jamalpur sadar upazila has 102,578 household with 568726 population and a total area of 489.56 sq km. It is bounded by Bakshigonj upzilla on the north, Sharishabari upzilla on the south-west, Melandho,Madargonj ,Islampur and Dewangonj upzilla on the west. Jamalpur sadar upazila has 15 unions and out of 15 unions rashidpur union was selected purposively as the locale of the study. A map of Jamalpur sadar upazila is presented in Figure 3.1, 3.2 and 3.3.

Figure 3.1A map of Bangladesh showing Jamalpur district

source: Google

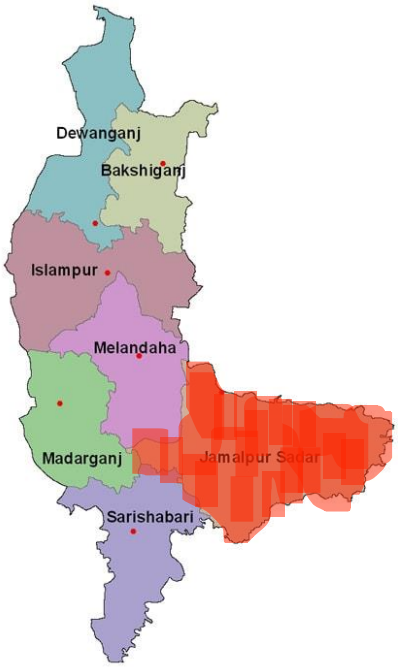

Figure 3.2A map of Jamalpur district showing Jamalpur sadar Upazila

source: Google

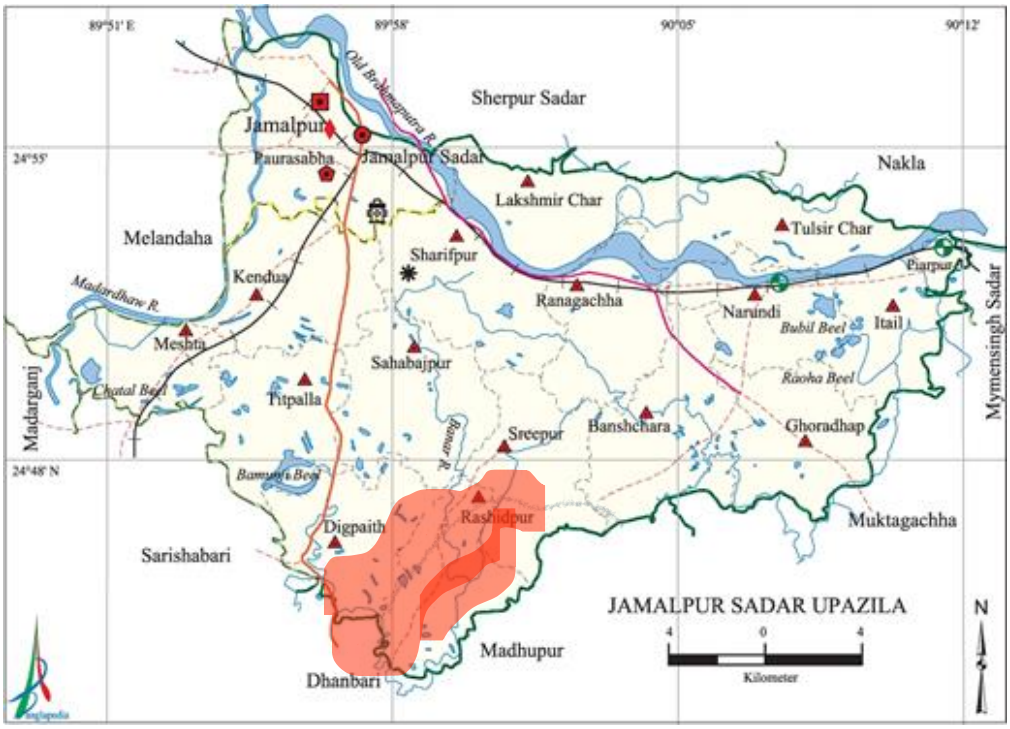

Figure 3.3 A map of union showing the study area

source: Google

3.3. Study Timeline

The research work including primary data collection through reconnaissance survey, questionnaire survey, key informant interview, transect walk brinjal production collection from field in between November 2020 and April 2021.

3.4. Questionnaire Preparation

After performing the preliminary survey, a structured questionnaire was prepared. The questionnaire was made to collect the required information regarding all those indicators and other relevant information. At first, a draft questionnaire was prepared and reviewed. After many reviews a final questionnaire was prepared for the brinjal production which was structurally divided into several parts. The first part of the questionnaire was used to identify the existing socioeconomic condition and the household status of the farmers. The second part of the questionnaire was to analysis Profitability of brinjal production.

3.5. Population and Sampling Technique

The research on profitability and factor impact on the gross return on brinjal production in these specific places have not been showed. Firstly, an update list of 760 farmers of Rashidpur union of three villages was collected from upazila Agriculture Office of Jamalpur sadar upazila. Among of them 70 farmers at the speed of 10% were randomly selected as a sample of this study. The chosen 70 farmers were brought together randomly during a discussion meeting. A reserve list of seven farmers was also formulated. Farmers within the reserve list were used only a respondent within the original list wasn't available. But actually reserve respondents aren't used when collection of knowledge. The distribution of the sample farmers and people within the reserved list from the villages is shown within the **table 3.2.**

Table 3.1 Distribution of Population and Sample of Farmers of The Selected Villages

Name of the union	Name of the villages	Population	Sample size	Reserve list
Rashidpur	Pakuilla	260	25	3
	Pukurtoli	270	25	3
	Tarakandi	230	20	2
Total		**760**	**70**	**8**

3.6. Financial Profitability Analysis

The net economic returns of brinjal were estimated using the set of financial prices. The financial prices were market prices received by farmers for outputs and paid for purchased inputs during the period under consideration in this study. The cost items identified for the study were as follows-

- Land tillage

- Seedling's cost
- Irrigation cost
- Fertilizer cost
- Pesticide cost
- Labor cost
- Material cost(bamboo)

The returns from the crops were estimated based on the value of main products. In this study, total variable cost (TVC) included land preparation, seedlings, fertilizer, insecticide, irrigation, human labor and. Fixed cost (FC) included only rental value of land. Total cost (TC) included total variable cost and fixed cost.

3.6.1. Cost of Land Tillage

Land preparation considered one of the most important components in the cultivation process. Land preparation for brinjal cultivation included ploughing, laddering and other activities needed to make the soil suitable for planting seedling. It was revealed that the number of ploughings varied from farm to farm and location to location.

3.6.2. Cost of Seed

Cost of seed varied widely depending on its quality and availability. Market prices of seeds of respected brinjal were used to compute cost of seed. The total quantity of seed needed per Hectare was multiplied by the market price of seed to calculate the cost of seeds for the study areas.

3.6.3. Cost of Irrigation

Water management helps to increase brinjal cultivation. Cost of irrigation varies from farmers to farmers. It was calculated based on how many times irrigation needed per Hectare and how was its cost.

3.6.4. Cost of Fertilizer

Fertilizer is one of the essential inputs in brinjal cultivation. Farmers used different kinds of fertilizer like Urea, TSP, DAP, MOP, Zinc, Cow dung &Ash for several times to enhance their crop growth and early fruiting. In order to calculate cost of fertilizer

the recorded unit of fertilizer (urea, tsp, mop, dap, zinc, cow dung & ash) per Hectare were multiplied by the market price of different fertilizer.

3.6.5. Cost of Insecticides

Farmers used different kinds of insecticides for several times to keep their crop free from pests and diseases. But brinjal harvest time insecticides are essential input that's why that time insecticides is given one day another. Cost of insecticides was calculated based on the market price of the insecticides which was used in the study areas per Hectare

3.6.6. Cost of Human Labor

Human labor cost was considered one of the major cost components in the cultivation process. It is generally required for different operations such as land preparation, sowing and transplanting, weeding, fertilizer and insecticides application, irrigation, harvesting and carrying, cleaning, storing etc. To calculate human labor cost, the recorded per day payment and varies how many labors are needed.

3.6.7. Cost of Material (Fencing and bamboo)

For brinjal cultivation, farmer used fence to keep their crop free from cattle and unethical person who try to steal brinjal. That's why some farmers buy net or fence from local market and some farmer made fence by using bamboo. To calculate the cost based on how much area of the land and how it was cost.

3.7. Measurement of Reliant Variable

Profitability of brinjal cultivation was measured as the reliant variable of the study. In this study, costs were measured in terms of variable and total cost basis. Per Hectare. Profitability of growing brinjal from the perspectives of individual farmers was measured in terms of total return.

Profitability from brinjal was measured as follows:

$$\mathbf{BCR} = \frac{\textbf{Total Return (Gross Return)}}{\textbf{Total Cost}}$$

3.8. Analytical Model

To identify the factors affecting the Profitability on brinjal production, the Cobb-Douglas production function has used:

To identify the factors affecting the Profitability on brinjal production, the Cobb-Douglas production function has used:

$\ln Y = \ln b_o + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + ei$

where,

Y_i = the productivity of brinjal cultivation,

X_1 = land tillage

X_2= Cost of seed/seedling per Hectare (Taka)

X_3=Cost of irrigation (Taka)

X_4 = Cost of fertilizer per Hectare (Taka)

X_5 = Cost of pesticide per Hectare (Taka)

X_6 = Cost of labor (Taka)

b_0= Intercept; On the other hand, b_1……. b_6 are regression coefficients of the corresponding independent variables(parameters), and "ei" is random error, which is normally and independently distributed with zero (0) mean and constant variance.

3.9. Measurement of Return to scale

In the present study the following return to scale measure by summation of all co-efficient of independent variable like Land tillage cost, Seedling's cost, Irrigation cost, Fertilizer cost, Pesticide cost, Labor cost

3.10. Hypothesis of the Study

In the present study the following null hypotheses were formulated: There is no profit in brinjal farming.

There is no difference among the characteristics of the farmers with their productivity of brinjal farming area of Jamalpur district in Bangladesh.

3.11. Data Collection Method

The researcher himself collected the data from the sample respondents through face-to-face contact with the help a pre-tested interview schedule. Whenever any respondent faced difficulty in understanding questions, more attention was taken to explain the

same with a view to enabling the respondent's local opinion leaders to answer properly. No serious problem was faced by the investigator during data collection but obtained cooperation from the respondents.

3.12. Data Analysis

All the collected primary and secondary data were compiled and interpreted for processing and analysis. The data from questionnaires were grouped, categorized and interpreted according to the objectives as well as the indicators. Some data continued numeric, and some contains narrative facts. For measurable and indicative answer data have been grouped in the Tabular forms. All the collected data were analyzed using computer by prominent program.

CHAPTER IV

Result and Discussion

This chapter enriched with the socio-economic background, existing production status comparing with previous period, impact on respondents' socio-economic status, benefit cost analysis of brinjal, inverse challenges behind this crop farming.

4.1. Socio-Economic Background

The socio-economic background is indispensable to have a broad idea about the existing household routines. Therefore, info pertinent to respondents age structure, arable size, education and technical know-how, land family size with family labor support were recorded as portrayed below:

4.1.1. Age Distribution

Many cultivars (55.7%) were in the age group of 31-50 years succeeded by the age group less than 30 years. Low percent was 15.7% under the age group more than 50 years (Table 05). It implied that young generation were more stimulated by prospective vision rather than age old cereal crop growing tradition.

Table 4.1 Age Distribution of Responded Participants in Study Area

Categories (years)	Responded producers					Mean
	Pukurtoli	Pakuilla	Tarakandi	Total	in %	
Young aged (up to 30)	7	8	5	20	28.5	39.32
Middle aged (31-50)	15	13	11	39	55.7	
Old (above 50)	3	4	4	11	15.7	

Source: Field study, 2021

4.1.2. Occupation Nature

Considering their household income bases, the respondents were classified into several sorts: agriculture, business, remittance privileged, official job (public/private), apprentice and other earning sources. Table data exposed that the highest proportion of the respondent (70%) had revenue from agriculture merely while 18.5% had to earn livelihood through brinjal farming activities as well as non-agricultural business.

Table 4.2 Earning Source of Responded Participants in Study Area

Categories	Responded households				
	Pukurtoli	Pakuilla	Tarakandi	Total	% in total
Agriculture	18	17	14	49	70
Business	4	5	4	13	18.5
Remittance privileged	2	1	1	4	5.7
Official job (public/private)	0	1	1	2	2.9
Institutional apprentice	1	1	0	2	2.9

Source: Field survey, 2021

4.1.3. Cultivated Land Size

Farmers were classified into several group based on land ploughed by them keeping land range pursued by department of Agricultural Extension. 27.1% growers had small land, 60% were marginal and 11.5% were landless in words. Only one medium level farmers were explored in the survey area. Small and marginal level farmers performed the mainstream agrarian activities.

Table 4.3 Agrarian Farm Size Held by Respondents in Study Area

Categories (decimal)	Responded farmers				
	Pukurtoli	Pakuilla	Tarakandi	Total	in %
Marginal (up to 50 d)	2	5	1	8	11.5
Small (> 50 d , < 100 d)	18	10	14	42	60
Medium (< 150 d)	2	6	5	13	18.5
Large (up to 200 d)	3	4	0	7	10

Source: BBS, 2008

4.1.4. Level of Educational and Technical Knowledge

About 22 percent farmers had secondary education and majority of the respondents were primary literate. However, 8% were basic educated and no higher educational cognizant were explored during survey.

Table 4.4 Respondents Education Level in Study Area

Categories (class)	Responded farmers				
	Pukurtoli	Pakuilla	Tarakandi	Total	in %
Illiterate (0)	3	2	1	6	8
Primary (1-5)	13	21	15	49	70
Secondary (6 – 10)	9	2	4	15	22

Source: Field study, 2021

4.1.5. Family Size and Family Labor Availability

The average family size comprises five to six members per family, which is higher than national statistics (4.7) in this divisional zone (BBS, 2011). Generally, farmers families were comparatively more populous than the town/urban living service holder families since ancestral time period. On an average, at least two individuals came from a household were attached with agrarian activities. In addition, 34% labor source were from own household resources.

Table 4.5 Responded Participants family size and labor availability Level in Study Area

Categories	Responded producers				% labor in respect to family members
	Pukurtoli	Pakuilla	Tarakandi	Mean	
Family members	6.2	5.76	5.45	5.82	34
Available family labor for brinjal	2.12	2	1.8	1.98	

Source: Field study, 2021

4.2. Brinjal Production Changes over Time Period

Brinjal production is receiving appreciation among and across survey area inhabitants. As economic profitability and health concern issues arise, such agrarian activities gain popularity. As a result, about 10% land area enhanced over a decade. Among three union, Pakuilla farmers were more stimulated by advanced brinjal farming activities.

Table 4.6 Current status of brinjal production comparing with initial moment production in farm

Categories	Brinjal production land (in Ha)				
	Pukurtoli	Pakuilla	Tarakandi	Mean	change %
Current time period	69.5	73.24	70.4	71.1	9.35
10 years back time period	65.15	69.7	64.65	66.5	

Source: Field survey, 2021

4.3. Impact on Responded Participant's Socio-Economic Position

Brinjal has made acknowledgeable impact to many of the respondent households in this study area. Exploration outcomes revealed that 87.1% respondent producers stated that engaging in brinjal production brought them significant impacts to attain infrastructure development. Meanwhile, 78.5% were involved with social influential or voluntary community/organization.

Table 4.7 Impact on food consumption, household, and social security

Categories	% of brinjal growers responded			All areas
	Pukurtoli	Pakuilla	Tarakandi	
Infrastructure upgrading	88	84	90	87.1
Social community engagement	84	80	70	78.5

Source: Field survey 2021

4.4. Profitability Analysis

Participants were enquired about their variable as well as fixed cost and gross return. Both cost and return are brought under consideration to measure the BCR.

The cost of production of brinjal crop varies depending on variety, place, and season. The production cost can be characterized into six major categories: land rent/lease, human/animal labor, seeds and saplings, manure and fertilizer, irrigation, insecticide, bamboo structure (including stand and fencing) mainly. Tables showed the allocation of average production costs of different area brinjal.

Table 4.8 Total Variable Cost Per Hectare

Variable items	Unit	Quantity	Price (TK)	Cost (TK)
Land Preparation				16600
Human labor	Man-days	226	500	113000
Seed \seedlings	Nos	6300	1	6300
Urea	Kg	335	20	6560
TSP	Kg	327	28	8400
MoP	Kg	250	19	4750
Gypsum	Kg	220	12	2670
Zinc	Kg	23	160	3680
Cow dung	Kg	7200	0.8	5040
Irrigation				6200
Insecticides	Tk.			1074280
Material cost				47350
Total Variable Cost	**Tk.**			**1294830**

Source: Field survey, 2021

4.4.1. Total Cost of Analysis Brinjal Production

Farmers used the land in accordance with the terms of the lease agreement. The term leasing cost refers to the cost incurred by brinjal production in obtaining a land lease that would be used for brinjal production for a set period. Leasing cost varies from one place to another depending on the location, soil fertility, topography of the soil and distance from the sources of water etc.

Table 4.9 Total Fixed Cost

Fixed Cost Items	Cost (Tk/ha)
Land use cost	140000
Total Fixed Cost	140000

Source: Field survey, 2021

Leasing cost was the single highest cost item in the study areas. The value of own land was calculated as opportunity cost concept. The rental value of per hectare land of brinjal was estimated Tk.144000 total fixed cost **(Table 4.9).** And total cost are calculate by summation of total variable cost and total fixed cost.

Table 4.10 Total Cost of Brinjal Production

Cost Items	Cost (Tk./ha)
a. Total variable cost	1294830
b. Total fixed cost	**1,40,000**
Total cost (a+b)	**1434830**

Source: Field survey, 2021

From **Table 4.10** we can get total cost of brinjal production by summation of total variable cost and total fixed cost which is1434830 taka

4.4.2. Returns of Brinjal Cultivation

4.4.2.1. Gross return

Per hectare gross return was calculated by multiplying the total amount of production by their market prices. Gross return was found to be Tk 2428800 per hectare. Here production is 121440 kg per hectare and price of brinjal 20 taka per kg (Table 4.11).

4.4.2.2. Net return

Net return is an important factor in determining the profitability of brinjal production. The difference between gross return and total costs is known as net return. Per hectare

net return of brinjal was estimated at Tk. 993970 indicates that brinjal production is profitable for this study area (Table 4.11).

4.4.2.3. Gross margin

Farmers usually want to gain maximum return over variable cost of production. Thus, gross margin analysis has been considered to calculate the relative profitability of brinjal production. The gross margin of brinjal production was estimated at Tk. 1133970 (Table 4.11).

Table 4.11 Gross margin and Benefit Cost Ratio of brinjal production Cultivation

Sl. No.	**Items**		**Amount (tk./ha)**
A.	Gross Returns (GR)		
	Yield (Kg/ha)	**Price/kg**	2428800
	121440	20	
B.	Total variable costs (TVC)		1294830
C.	Total fixed costs (TFC)		**1,40,000**
D.	Total costs (TVC+TFC)		**1434830**
E.	Net return (GR-TC)		993970
F.	Gross margin (GR-TVC)		1133970
G.	Benefit-cost Ratio (BCR)= GR/TC (Full cost basis)		1.70
K.	Benefit-cost Ratio (BCR)= GR/TVC (Cash cost basis)		1.87

Source: Field survey, 2021

4.4.3. Benefit cost ratio (BCR)

Benefit cost ratio was calculated by dividing gross return by total cost. It implies return per taka invested. It helps to analyze financial efficiency of the farm. It was evident from the study, the benefit cost ratio on full cost basis of brinjal production was 1.70 implying that Tk. 1.70 would be earned by investing Tk. 1.00 for brinjal production. Again, the benefit cost ratio on cash cost basis was 1.87 for brinjal cultivation. So brinjal cultivation was found profitable for farmers of this study areas (Table 4.11).

4.5. Factors Affecting the Brinjal Production

Cobb-Douglas production function was recognized to clarify the variable significance as well as relevance level. Under mentioned table demonstrated four significant cost factors that directly influenced the framer's revenue. Four significant cost are land preparation, cost of seed/seedlings, cost of fertilizer, cost of insecticides.

Table 4.12 Estimated values of coefficient and related statistics of Cobb-Douglas production model

Explanatory variables	Estimated coefficient	Standard error	P-Value
Intercept	- 0.38574	2.8180	0.892
Cost of land preparation (X_1)	- 0.00051	0.0002	0.035
Cost of Seedling (X_2)	0.00006	0.00003	0.070
Cost of irrigation (X_3)	- 0.00003	0.0003	0.390
Cost of fertilizer (X_4)	- 0.01569	0.0043	0.001
Cost of insecticides (X_5)	0.89028	0.1643	0.000
Cost of labor (X_6)	- 0.00879	0.1406	0.950
Adjusted R^2	0.7102		
F-Value	28.74		
Returns to scale	0.86538		

Source: Field survey, 2021

The statistical significance of the test was found in the 'P-value' column in the model (Table-4.6).

Cost of land preparation (X_1) was explored negative association representing -0.00051 at 5 percent significant level for brinjal production. It implies that 1 percent increase in the land tillage expenditure, keeping other factors constant, would decline gross revenue by 0.0051 percent.

Cost of seedling (X_2) had a positive liaison with brinjal output revenue. Estimated coefficient of seedling was 10 percent significant with value 0.00006. It implies that 1 percent increase in the cost of seedling as additional expenditure, remaining other factors constant, would increase gross returns by 0.006 percent.

The coefficient of **irrigation expenditure (X_3)** was found to be negatively related to the farm revenue and found insignificant.

The regression coefficient of **fertilizer cost** (X_4 = - 0.01569) was negative but significant for brinjal cultivation. It implies the 1 percent increase in the fertilizer expenditure, keeping other factors constant, would decrease entire revenue by 1.57 percent.

The **insecticide cost (X_5)** was found high impact on brinjal output. Estimated co-efficient 0.89028 indicated that 1 percent rise in the cost of insecticide application for brinjal farming, remaining other factors constant, would ensure gross returns by 89.03 percent increase.

Finally, **labor expenditure (X_6)** was also found to be negatively related to the brinjal revenue and insignificant.

The **adjusted R^2** for brinjal commercialization was found to be 0.71 which indicated that about 71 percent of the variations of the output were explained by the explanatory variables included in the model. Meanwhile, The **F-value** for the brinjal production was measured at 28.74 which were highly significant at 1 percent level. It means that the explanatory cost variables included in the model were imperative for explaining the variation in gross revenue of brinjal farming.

4.6. Returns to Scale in Brinjal Cultivation

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

1. Constant Return to scale (=1)

2. Increasing Return to scale (>1) and

3. Decreasing Return to scale (<1)

The summation of all the production coefficients of brinjal cultivation was equal to 0.87. This means that production function for Brinjal cultivation exhibits decreasing returns to scale. This means that, if all the variables specified in the model were increased by 1 percent, yield would also be decreased by .87percent for brinjal.

4.7. Concluding Remarks

Except for the insignificant effects of irrigation cost, labor cost, the Cobb-Douglas production function model revealed that the included key variables had a significant and positive and negative both effect on brinjal cultivation. As a result, key factors in the brinjal cultivation production process had a positive effect. It is possible to boost brinjal yields by importing improved variety seed.

4.8. Adverse Challenges During Cultivation and Marketing

Brinjal commercialization evidenced a spring for bucolic individuals, but this group people confronted most of suffering. The crucial complications were disease and viral infection (86%) and environmental complexity (83.7%). Furthermore, labor shortage (79%), lack of proper marketing facilities (49%), storage insufficiency (54%) and timely technical support absence (71%) were also asserted at household levels.

Table 4.13 Barriers confronted at household level

Particulars	% Of participants responded			All areas	Rank
	Pukurtoli	Pakuilla	Tarakandi		
Lack of quality seedlings	64	60	51	58.3	6th
Disease and viral infection	86	82	90	86	1st
Environmental complexity	82	85	84	83.7	2nd
Labor shortage	76	78	83	79	3rd
Improper marketing infrastructure	46	50	51	49	8th
Inadequate storage facilities	52	55	55	54	7th
Low price of harvest	70	72	70	70.7	5th
Lack of technical support	68	75	70	71	4th

Source: Field survey, 2021

4.9. Discussions

4.9.1. Characterizations of Socio-Economic Circumstances Across Survey Area

Study found active age group ranged 31-50 years majorly up to 55.7% followed by the age group lower than 30 years. Research also revealed that 60% farm size was small in nature and over 18% producers had medium farm size. Most of the farmers (70%) were

primary literate. On an average, at least two individuals came from a six persons household were attached with agrarian activities.

In addition, middle aged farmers were more activated in brinjal farming. Consequently, almost 10% more land was brought under brinjal production than a decade before.

4.9.2. Socio-Economic Position Advancement

After linked with vegetal farming, almost 87% household confronted a significant welfare and most of them led a reformed life with household upgradation. More than 78% producers were attached with village association/organization. This found the similarity with Kabir (2016) and BSS (2011) reports.

4.9.3. Profitability Analysis of Brinjal Crop

Human labor and insecticide were the most expensive inputs in the production brinjal commercialization. Farmers often practiced the insecticides haphazardly and exercised chemical fertilization including Urea, TSP, MOP, DAP, Gypsum, Zink Sulphate for brinjal production. Most of the land was prepared by using manual human labor and power tiller for land preparation. In this survey area, farmers used purchased reserved seeds. The number of irrigations relied on soil type and economic condition of the growers.

Eight cost items: land preparation, seedling, irrigation, fertilizer, insecticide, bamboo structure, human as well as mechanical labor and land use rent were considered as variable and fixed cost for estimating the total cost. Insecticide was the major cost items succeeded by labor, human labor, seedling, fertilizer, irrigation, insecticides, bamboo structure and land rent. Average paid for land preparation, seedling, irrigation, fertilizer, insecticide, bamboo structure, human as well as mechanical labor and land use rent were BDT 16,600; BDT 6,300; BDT 6,200; BDT 26350; BDT 1,074,280; BDT 47,350; BDT 113,200; and BDT 140,000 by respectively (Table 2). Per hectare of total variable cost, total fixed cost, total cost of brinjal farming were BDT 1,294,830, BDT 140,000, and BDT 1434830 individually.

The average yield per hectare of brinjal was 121440 kilograms. The average purveyed price was BDT 20 per kilogram. Per hectare of gross return, gross margin, and net return/profit of brinjal production were BDT 24,28,800; BDT 1133970 and BDT

993970 respectively (Table 4.11). Per hectare benefit cost ratio was estimated at 1.70. It is double times profitable enterprise based on cost.

Therefore, farmers were easily ennobled with brinjal farming and forego to cultivate the traditional crops.

4.9.4. Interpretation of Cobb-Douglas Function Estimated Values

After processing information, Cobb-Douglas production function was structured. The values of R^2, adjusted R^2 and F asserting 73.24%, 70.69% and 28.74 indicated the variance of explanation in the dependent variable with respect to independent ones and ultimately represented the suitable data fitness of model.

4.9.4.1. Land Preparation and Irrigation Cost

Cost of land preparation and irrigation were found negative association with farm revenue. While land preparation was found at 5 percent level of significance, irrigation was insignificant. 1% preparation cost rise entailed 0.0051 percent revenue down in one-hectare brinjal land cultivation.

4.9.4.2. Seedling Cost

Seedling cost had a positive liaison with brinjal turnover at 10 percent significant level. However, exploration found negative associated insignificant labor expenditure.

4.9.4.3. Fertilizer and Insecticide Cost

Fertilizer expenditure was negatively but significantly associated for brinjal output. It asserted that 1 percent excessive fertilizer application over required level caused 1.57 percent total farm profits decline. Meanwhile, insecticide had high impact on brinjal output. As brinjal is high susceptible numerous insects and pathogens, a well insecticide management would do the task. Current study explored that 1 percent more insecticide cost generation would entail almost double output than before.

4.10 Conclusion Remarks

Although brinjal farming was rationally profitable, farmers confronted multi facet hindrances during production. Economic damage due to disease and viral infection, environmental complexity, labor shortage, market fluctuation of brinjal and technical support inadequacy were found from top to toe in widespread expansion of brinjal revolution. If these complexities could be lessened, then a promising economic

expediency would be attained for affixing comprehensive bucolic engagement as well as assuaging rural poverty and ultimately SDG target would be accomplished with rampant progression.

CHAPTER V

Summary and Conclusion

This Chapter summaries the thesis and provides conclusions according to the significant findings of the study, suggests and limitations of the study for Brinjal production.

5.1. Summary

Brinjal (Solanum melongena. L.) is one of the most important and popular vegetables in Bangladesh as well as in South Asia. It is mostly grown by small land-holding farmers who cultivate vegetable for their livelihood. In Bangladesh, brinjal is grown throughout the year. During the hot humid rainy season, it is one of the few vegetables available to urban and rural market at reasonable prices. Bangladesh is one among the main horticultural countries in South Asia. Brinjal (Eggplant) is a famous vegetable that gives a significant kind of revenue for little, asset helpless Bangladeshi farmers. The biggest constraint to brinjal production is the eggplant fruit and shoot borer. Even then brinjal production is increasing day by day and demand also increased rapidly. As brinjal production is economically an important vegetable of Bangladesh, any problem this production faces should be studied carefully and should be removed as early as possible. It is also being observed that recently different organizations organizing seminars, symposium etc. and publishing various articles in newspaper regarding present ailing situation on raw brinjal production and goods. Therefore, the present study is conducted to determine the existing status and practices of brinjal cultivation and to identify the existing constraints which hindering brinjal cultivation of the brinjal farmers. Brinjal is cultivated in every district to some extent.

This study also will enrich the literature of menace aversion and help to improve potentiality and profitability of brinjal farming in Bangladesh. For moderating the increasing demand of vegetable as well as high profit, high nutritive value and the problems of self-employment, vegetable farmers are progressively increasing. So, it is very important to identify the potential and production observes followed by the vegetable farmers in the socio-economy background of Bangladesh. In addition, brinjal cultivation in the selected area of Bangladesh is most profitable.

The specific objectives of the study are as follows.

Objectives:

1. To show the socio-economic profile of the brinjal farmers.
2. To determine the profitability analysis of brinjal farming.
3. To identify the major challenges in brinjal farming in farmer's level.

The sampling frame for the present study were selected purposively as to select the area where the brinjal cultivation was intensive. On the basis of higher attentiveness of brinjal crop production, Jamalpur sadar under of Jamalpur was nominated. A sample size of 70 is normally observed as the minimum constraint for larger population that will yield a sufficient level of certainty. In this case, who were cultivating different varieties of brinjal in the selected areas were selected as samples.

Data for the present study have collected in the period of November 2020 to January 2021. Primary data were collected from primary producers. Respondents were interviewed personally with the assistance of pre-tested questionnaires. The collected data were tested and verified for the sake of regularity and completeness. Editing and coding were done before putting the data in computer. All the collected data were summarized and analyzed carefully to eliminate all possible errors. Data entry was made in computer and analysis was done using the concerned software Microsoft Excel and STATA. Economic profitability is a foremost criterion to make decision for producing any crop at farm level. It can be restrained based on net return, gross margin and ratio of return to total cost.

Study found active age group ranged 31-50 years majorly up to 55.7% followed by the age group lower than 30 years. Research also revealed that 60% farm size was small in nature and over 18% producers had medium farm size. Most of the farmers (70%) were primary literate. On an average, at least two individuals came from a six persons household were attached with agrarian activities. In addition, middle aged farmers were more activated in brinjal farming. As a consequence, almost 10% more land was brought under brinjal production than a decade before. About 10% were large farmer. Meanwhile, 18.5% grower had medium, 60% had small farm size and 11.5% were marginal in words. Small level farmers performed the mainstream agrarian activities. About 22 percent farmers had secondary education and majority of the respondents were primary literate. However, 8% were basic educated and no higher educational cognizant were explored during survey.

Human labor and insecticide were the most expensive inputs in the production brinjal commercialization. Farmers often practiced the insecticides haphazardly and exercised chemical fertilization including Urea, TSP, MOP, DAP, Gypsum, cow-dung for brinjal production. Most of the land was prepared by using manual human labor and power tiller for land preparation. Cost items are land preparation, seedling, irrigation, fertilizer, insecticide, bamboo structure, human as well as mechanical labor and land use rent were considered as variable and fixed cost for estimating the total cost. Insecticide was the major cost items succeeded by labor, human labor, seedling, fertilizer, irrigation, insecticides, bamboo structure and land rent. Average paid for land preparation, seedling, irrigation, fertilizer, insecticide, bamboo structure, human as well as mechanical labor and land use rent were BDT 16,600; BDT 113,200; BDT 6,300; BDT 35,280; BDT 6,200; BDT;1,074,280; BDT 47,350 and BDT 140,000 by respectively (Table 2). Per hectare of total variable cost, total fixed cost, total cost of brinjal farming were BDT 1,299,210, BDT 140,000 and BDT 1,439,210 individually. The average yield per hectare of brinjal was 121440 kilograms. The average purveyed price was BDT 21 per kilogram. Per hectare of gross return, gross margin, and net return/profit of brinjal production were BDT 2,550,250; BDT 1,251,040 and BDT 1,111,040 respectively (Table 2). Per hectare benefit cost ratio was estimated at 1.77. It is double times profitable enterprise based on cost.

Profitability analysis reflects the capability of a farmer to gain the maximum possible productivity from a particular level of inputs and production technology. Economical potentiality is then measured as the deviation of a farmer from the best-practice frontier. The regression coefficients of land preparation (X_1), Irrigation cost(X_3), Fertilizer cost (X_4), and Human labor cost(X_6), were negative but the coefficient of Seed (X_2) and insecticides(X_5) was found positive.

Farmers faced a lot of problems in producing brinjal. The problems were social and cultural, financial and technical. Lack of quality seed was one of the most important limitations of producing Brinjal in the study area. Lack of operating capital, high price of quality seed, high cost of irrigation water, shortage of human labor and lack of quality preparation were the major problems faced by farmers. These are the major constraints for the producers of Brinjal in the study area. Public and private initiatives should be taken to reduce or eliminate these problems for the sake of better production of brinjal.

5.2. Conclusions

Brinjal farming can serve apposite perennial healthful food item, strengthen bucolic economy, enhancing youth participation and national progress in the end. Year round brinjal production elevated the socio-economic position of the rural households and entailed in optimistic results. Precisely, this exploration accredited some of influential expenditure factors affecting the grass root level farm turnover in three specified areas of Jamalpur district. The results depicted that cost of land preparation, seedling, fertilizer and insecticide significantly dominated the brinjal production. In addition, this research asserted arable brinjal land enhancement scenario along with numerous contemporary cultivation perplexities. Furthermore, this paper also suggested introducing advanced marketing facilities supervised by agricultural authorities, letting more underprivileged community engagement and formulating policies aimed at efficiently addressing farmers would boost the brinjal commercialization that ultimately led toward country horticultural welfare.

5.3. Suggestion

At present, Brinjal is in great demand able vegetables rather than other, due to the moderate price, different taste, high nutrient value and profitable farming. These vegetables are most popular in the market as well. That’s why brinjal production in Bangladesh is progressively increasing. However, it is a matter of great regret that our farmers fail to manage their production cost many reasons. Cost of productions becomes higher, but the price of brinjal becomes lower at the time of harvest. So, farmers become looser.

Based on the results of the study, the following suggestion are given.

- ✓ Farmers should be given encouraged by DAE officers to use appropriate dose of fertilizer and proper irrigation and allocate their resources optimally and timely for increasing brinjal production.
- ✓ Despite certain restrictions, the study's results suggest that famer should be encouraged to enlarge brinjal farming on this particular area because farmers may earn a great net return from brinjal farming.

- ✓ Farmers should be given encouraged by DAE officer to use appropriate dose of insecticides which is badly impact on consumers many disease
- ✓ The study's results suggest that farmers should be used integrated pest management rather than overused of pesticide.
- ✓ The factors which is impact on negatively for brinjal production that should be reduced.
- ✓ Increasing mechanical use to reduce the shortage of labour.
- ✓ For reducing environmental complexity crops insurance for farmer and creating some new both drought and water resistant by several agricultural research institution.
- ✓ Government should take necessary show effects of overused pesticides and taken some measure which have positive significant impact on yield.
- ✓ The government should take appropriate steps to ensure that farmers receive fair prices for their output.
- ✓ The government should develop well-structured marketing facilities and ensure good transportation facilities by making infrastructure.
- ✓ Brinjal farmers had to sell their product at low or moderate price during the harvesting or just after harvest.
- ✓ Furthermore, study should emphasis on developing varieties that are appropriate for this arrangement
- ✓ Farmers should be given training, adequate extension services, information, and the tools they need to deal with new and changing circumstances.
- ✓ Additional fact study is needed to identify the appropriate observes for loss reduction in handling, transportation, storage, and processing of quality brinjal in the value chain.

5.4. Limitation of the Study

There are some limitations of the study thus are specified below.

a) Most of the data were collected through interview of the farmers and sometimes they did not well-cooperate with the interviewer.

b) The information was gathered mostly through the memories of the farmers which were not always correct.

c) Due to resource and time limits, broad based and in-depth study was hampered to some extent.

d) Farmers were unavailable at home sometimes.

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APPENDIX

SOME COMMONLY USED ABBREVIATIONS AND SYMBOLS

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

An Interview Schedule on

PROFITABILITY ANALYSIS OF BRINJAL PRODUCTION AND SOCIO-ECONOMIC CONDITION OF BRINJAL FARMER IN JAMALPUR DISTRICT

(This interview schedule is entitled for a research study)

Serial No:

Respondent Name:

Village:

Union:

Upazilla:

District:

[Please provide the following information. Your information will be kept confidential and will be used for research purpose only.]

1. Age Answer.....years.

2. Education

Please mention your level of education.

a) I can't read and write

b) Primary education (class:1 to 5)

c) Secondary education ((class:6 to 10)

d) Secondary education ((class:11 to 12)

3. Family Size:

Please mention the members of your family who are involve in agriculture a) Male member person

b) Female member..... person

c) Child member.....person

d) Total member..... person

4. **Member involved in brinjal cultivation ……person**

5. **Experience in brinjal Cultivation:**

Please state the duration of your direct involvement in brinjal cultivation. Ans……..years

6. **Farm Size:**

6.1.1. Please indicate the area of land under your possession**:**

Sl No.	**Types of land use**	**Land area**	
		Local unit	**Hectare**
1.	Homestead area		
2.	Own land under own cultivation		
3.	Given to others as borga		
4.	Taken borga from others		
5.	Taken lease from others		
	Total		

7. **Land under brinjal cultivation ..... ha/Local unit**

8. **Training on brinjal Cultivation:**

Have you received any training on brinjal cultivation? Ans: (Yes) (No)

If yes, please give the following information:

Sl. No.	Name of the Training	Sponsoring Organization	Duration (Days)
1.			
2.			
3.			
Total			

9. Annual Family Income:

Please indicate the income of your family from different sources in the last year.

- Agriculture Ans: (Yes) or (No)
- Business Ans: (Yes) or (No)
- Remittance privileged Ans: (Yes) or (No)
- Job (public & private) Ans: (Yes) or (No)
- Apprentice Ans: (Yes) or (No)
- Other earning sources Ans: (Yes) or (No)

10. Income from brinjal cultivation .....Taka

11. Socio-economic impact

- Infrastructure development Ans: (Yes) or (No)
- Organization participation Ans: (Yes) or (No)

12. Cost-effectiveness of brinjal cultivation:

Please mention following information:

a. Total cost per unit

Sl No	**Item of cost**	**Cost (tk)**
1.	Land Preparation	
2.	Seed	
3.	Irrigation	
4.	Fertilizer	
5.	Pesticide	
6.	Labour cost	
7	Other material cost (fencing, bamboo)	
	Total	

a. **Total return per unit**

Sl. No.	Sources of return	Amount of Production kg/ha	Price Kg/taka
1.			

BCR= $\frac{\text{Total Return}}{\text{Total Cost}}$

Thank you for your co-operation.

Date…….…

Signature of interviewer