COMPARATIVE PROFITABILITY BETWEEN ORGANIC AND CONVENTIONAL COUNTRY BEAN FARMING IN NARSINGDI DISTRICT OF BANGLADESH

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COMPARATIVE PROFITABILITY BETWEEN ORGANIC AND CONVENTIONAL COUNTRY BEAN FARMING IN NARSINDI DISTRICT OF BANGLADESH

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CIRTIFICATE

This is to Certify that the thesis entitled **"Comparative profitability between organic and conventional country bean farming in Narsingdi district of Bangladesh"** submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University, Dhaka in the partial fulfilment of the requirements for the degree of Master of Science (MS) in **AGRIBUSINESS AND MARKETING,** embodies the result of a piece of bona fide research work carried out by **HAFSHA AKTER,** Registration Number: **19-10355** 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 duly been acknowledged.

Dated:

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DEDICATED TO MY BELOVED PARENTS AND HUSBAND

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Abstract

Country bean is a common winter vegetables and farmer can grow it in the field and also in homestead area. In Narsingdi district, country bean is grown with other winter and summer vegetables and also as a solo crop in both organic and conventional farming. The research aims to compare the profitability of country bean farming between organic and conventional in Narsingdi district. Endogenous treatment effect analysis is also used to compare the profitability of organic and conventional farming. 100 organic and 100 conventional country bean farmers were selected for this study. The variable costs for organic country bean production were Tk. 175423.68/ha and Tk. 206182.76/ha for conventional country bean production. Total fixed cost of organic country bean production was Tk. 98529.98/ha and Tk. 71351.93/ha for conventional country bean production. Total revenue, gross margin, and net margin of country bean for organic farming were Tk. 35346.1/ha, Tk.178042.45/ha and Tk. 66597.93/ha respectively. For conventional farming, total revenue, gross margin, and net margin of country bean were Tk. 385705.34/ha, Tk. 179522.58/ha and Tk. 89493.29/ha respectively. The benefit-cost ratio on the basis of variable cost was 1.99 and BCR on the basis of total cost was 1.23 for organic farming. For conventional farming, the benefit-cost ratio on the basis of variable cost was 1.86 and BCR on the basis of total cost was 1.30. The endogenous treatment effect model estimation result indicates that conventional country bean farmers got 22.9% more gross margin than organic country bean farmers. Major problems faced by organic farmers were lack of demand, high labor cost, low price at peak season, lack of storage facilities, lack of middlemen, lack of transportation, lack of marketing facilities, lack of credit facilities, high price of organic fertilizer, high disease damage. However, major problems faced by conventional country bean farmers were high labor cost, low price at peak season, lack of storage facilities, lack of middlemen, lack of transportation, lack of credit facilities, high price of fertilizer, high disease damage. Both organic and conventional country bean farmers suggested some recommendations to solve the problems.

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ABBREVIATION

Agril.	=	Agricultural
BADC	=	Bangladesh Agricultural Development Corporation
BARI	=	Bangladesh Agricultural Research Institute
BBS	=	Bangladesh Bureau of Statistics
BCR	=	Benefit Cost Ratio
DAE	=	Department of Agriculture Extension
Et al.	=	All Others
FAO	=	Food and Agriculture Organization
FY	=	Fiscal Year
Ha	=	Hectare
Kg	=	Kilogram
M	=	Million
MS	=	Master of Science
No.	=	Number
Tk.	=	Taka
gm	=	Gram
mg	=	Milligram
%	=	Percent
K cal	=	Kilo calories
IPM	=	Integrated Pest Management

CHAPTER I

INTRODUCTION

1.1 Present status of vegetable production in Bangladesh

Bangladesh is an agricultural country and the economy of Bangladesh mostly depends on its agriculture sector. About 70% people directly or indirectly depends on agriculture (Imdad, 2021). There are 28.5% people live below the poverty line and child malnutrition rate is 28% in Bangladesh (BBS, 2020). In Bangladesh, vegetables were grown in 2.57% of total cultivable land (Haque, 2021) and the land area of vegetable cultivation rose by 29% and ranked third in vegetable production (Hasan, 2020).

Vegetables are highly rich in carbohydrate, vitamins (such as vitamin A, vitamin B, Vitamin C, riboflavin and thiamin) and minerals (like iron and potassium) which makes human diet balanced. "As vegetables provide nutrients and dietary fibre which is necessary for digestion and health as well as removing malnutrition, curing nutritional disorders. To alleviate poverty and malnutrition, it is necessary to increase production and consumption of nutritious and health promoting vegetables" (Chowdhuri *et al*., 2014). From table 1.1, it is seen that there is 2684130.21 metric tons of vegetables were produced in 2020-21 fiscal year and total cultivable land is 581081.34 acres. It is also shown that, total production area and total production is increasing every year.

Table 1.1 : Present status of vegetable production in Bangladesh

Year	Cultivated amount in metric tons	Land in acres
2020-21	2684130.21	581081.34
2019-20	2575959.00	566075.00
2018-19	2464949.00	548456.00
2017-18	2372351.00	538133.00
2016-17	2363939.00	538146.00
2013-14	19.4	0.97

Source:BBS,2021

Over the years, country bean production is increased as well as total vegetable production. In 2015, total bean production was 122.09 thousand tones and in 2021, the production was 170 thousand tones (Table 1.2). Other vegetables production also increased from previous years production.

Table 1.2: Scenario of different vegetables production over the years 2015-2021

Vegetables	Total production (tones)						
	2015	2016	2017	2018	2019	2020	2021
Tomatoes	413610	368121	388725	385038	387653	415000	448000
Spinach	76000	79000	79000	82000	83000	88000	98000
Pumpkins	278000	291000	295000	303000	320000	340000	365000
Potatoes	9254285	9474099	10215957	9744412	9655082	9607000	9887000
Cabbages and other brassicas	258608	295744	311650	321719	331020	384000	380000
Beans	122091	128676	137495	134860	144050	170000	170000

Source: BBS,2021

1.2 Present status of country bean in Bangladesh

Country bean is a major leguminous winter vegetable cultivated in Bangladesh. It grows well on loam and sandy loam soils. Aside from cultivable land, it grows well on road-side area, roofs, and also on tree. As a leguminous vegetable, it may help to improve soil fertility. So, farmers have been cultivating it in farm and also in homestead area. Winter is the main production season for country bean and it also cultivated in summer season.

Table 1.3 presents that in 2015 total production area for country bean was 19907 hectares and total production was 122091 tons. In 2019, total production area was increased and was 20873 hectares and total production was 144050 tons. United Nations Food and Agriculture Organization (FAO) stated that 5,65,127 tons of vegetable in 1990; 6,40,000 tons of vegetable in 1995; 9,11,000 tons of vegetable in 2000; 10,31,000 tons of vegetable in 2005; 12,90,000 tons of vegetable in 2010; and 14,81,000 tons of vegetable in 2015 were produced in this country.

Table 1.3: Present status of country bean in Bangladesh

Particular	Unit	2015	2016	2017	2018	2019
Area harvested	Ha	19907	20211	20880	20594	20873
Yield	Hg/Ha	61331	63666	65850	65485	69013
Production	Tons	122091	128676	137495	134860	144050

Source: FAO,2019

Organic vegetable farming is a natural way farming system where synthetic fertilizer, pesticide, growth regulatory hormones and antibiotics are prohibited. It maintains and improves soil fertility and biodiversity. Country bean is a leguminous crop which can improve the soil quality. Country beans can be consumed raw, sprouted, cooked, or processed to make flour. The beans contain calories 131.98 per 100 gm, carbohydrates 23.72 gm, protein 8.84 gm, fat 0.52 gm, vitamins 6.86 mg, mineral 596.99 mg, water 65.7 gm per 100 gm of beans (USDA, 2012). Country beans have the lowest fats, oils, and carbohydrates. Maximum 2-3% fat can be found in beans. For a low fat diet, they are the ideal meal. It may assist in lowering cholesterol level due to its high fiber content and no cholesterol (Jobaer, 2021). In Bangladesh, beans are cultivated in about 69013 ha of lands with production of 144,050 metric tons (BBS, 2019).

Farmers of Narsingdi district are growing vegetable in large scale. As people are aware about what they eat, the organic farming is gain more priority in this region. This study focuses on comparative profitability between organic and conventional country bean farming. Organic vegetables provide people with nutritious and toxic free vegetables. Besides conventional farming system uses inorganic fertilizers and pesticides for increasing the production of vegetables and degrades the soil fertility and biodiversity and also natural environments. So, conventional farming is a threat for soil and environment and hence could be a potential threat to food security (Khan and Damalas, 2015).

"Alternative solution to produce crops will be organic farming that promise minimum usage of costly pesticides, herbicides and synthetic fertilizers. It avoids nutrient exploitation and improves

soil quality" (Aslam and Hong, 2018). Profitability of a farm depends on its production, market price of the product, cost of inputs and also farmer's efficiency and management capacity. Any deviations from the above variables can change the profitability.

1.3 Background of the study

In conventional farming system, chemical fertilizers and pesticides are used for high production. Famers regularly use conventional method of farming for more production. But using chemicals degrades the soil quality and reduces productivity in long term and also harm people's health by causing various diseases. Country bean is a common winter vegetables and farmer can grow it in field and also in homestead area. In Narsingdi district, country bean is grown with other winter and summer vegetables and also as a solo crop. Many of farmers in Narsingdi district are showing their interest in the cultivation of chemical and pesticide free vegetables not only for economic prospects but also for good health prospect of the crop. DAE Narsingdi took various necessary steps to produce chemical and pesticide free vegetables and providing training to the farmers and also the department is training them about the bad effects of using pesticides and chemical fertilizers in vegetables fields. A large number of farmers are now cultivating more chemical free vegetables using cow dung, vermi-compost and other organic fertilizers. A good number of women in Shibpur, Balabo, Polash, Raipura and Monohardi Upazilas are now engaged in producing chemical and pesticide free vegetables.

The research on profitability of country bean production may increase farmers interest on growing country bean and improving the sustainable vegetable production in organic way. This study would be helpful for policymakers about making policy guidelines about organic farming system.

1.4 Justification of the study

Country bean is a vegetable which is largely grown in winter and also in summer season. In conventional farming system, farmers use chemical fertilizers and pesticides for high production, but it is harmful for human health and also for environment. People are interested in purchasing chemical free vegetables. Organic fertilizers and pesticides are used in organic farming system. So this research is time demanding.

Now-a-days farmers of Narsingdi district are more interested in organic farming for vegetable production. Country bean is a common winter vegetable grown in Narsingdi district. In Monohardi Upazila, country bean is grown both conventionally or in organic farming system. This study is related with comparative profitability analysis on conventional and organic country bean farming.

There is numerous research on high yielding country bean production and profitability of country bean. But research on organic country bean production and profitability is very few. Besides there is no research on comparative profitability between organic and conventional country bean production. It is very important for farmers who want to adopt organic farming. This study will increase the awareness for organic country bean production and also help to improve agricultural policies related with country bean. Researcher also did not find any research related with endogenous treatment effect analysis on country bean. So this research will help other researchers who want to work on this analysis.

1.5 Research objectives

The main objective of this study was to compare the profitability between organic and conventional country bean farming in Narsingdi district. The specific objectives of this study were as follows:

- To study the socioeconomic characteristics of the organic and conventional country bean growers.
- To examine the profitability of organic country bean production in the study areas.
- To investigate the profitability of conventional country bean farming.
- To compare the profitability between organic and conventional country bean farming.
- To identify the major problems of organic and conventional bean production and give some policy to solve the problems.

1.6 Scope of the study

The study's results will be especially relevant to the Monohardi Upazila in the Narsingdi district. These results may also be relevant to other areas of Bangladesh with comparable environmental, cultural, and socioeconomic characteristics to the research area. In conventional farming, farmers

get flawless appearance of vegetables, but chemical fertilizer is used to produce country bean and it is harmful for human health. Organic vegetables are not looking as good as conventional country bean. But it does not contain any harmful chemical and healthy. Organic country bean farming is also profitable. Thus, the research may benefit policymakers, planners, extension employees, and field workers in developing effective strategies for increasing organic country bean production compare to conventional country bean production and also for the sustainability and profitability of organic country bean farmers.

1.7 Limitations of the study

Data collection from the farmers was the most difficult task during the survey. Due to time and resource restrictions researcher had to collect data from a specific small area and gathered all data as quickly as possible. Farmers didn't have written document about country bean farming, so they needed to memorize it. It was time consuming and respondents didn't have enough time to recheck it. Some farmers were reluctant to give appropriate information as they grow country bean with other vegetables.

1.8 Organization of the Study

This study is organized with eight chapters. First chapter includes a brief introduction about the study. The second chapter presents review of literature on organic country bean production and profitability analysis from different sources. The third chapter describes about study area and methodology. Socioeconomic characteristics of both conventional and organic country bean farmers are discussed in chapter four. The fifth chapter is about comparative cost and return of country bean between conventional and organic farming. Chapter six discusses about endogenous treatment effect analysis on organic and conventional country bean farming system. Chapter seven present problems related with production and marketing of country bean and possible suggestions suggested by farmers. The last chapter is about summary, conclusion and recommendations.

CHAPTER II

LITERATURE REVIEW

2.1 Review of comparative profitability between organic and conventional country bean farming

This chapter includes review of some previous work related to present research work. Review of literature helps researcher to gain knowledge about previous study. It is necessary to study previous papers to know information about the study. It provides necessary guideline for understanding the findings, identifying research gap and solving the research problem.

Alam et al. (2023) conducted research on financial profitability of winter vegetables cultivation in some selected areas of Narsingdi district. They stated that vegetables were typically labor intensive crops and thus deliver a large amount of food as well as a pledge to create expanded opportunities for rural jobs. They selected two Upazila from Narsingdi district, namely Shibpur and Raypura. For sample collection, a random sampling technique was applied by them. 60 farmers were chosen for the analysis by random sampling. Socio-economic characteristics of vegetable farmers, description of the size of vegetable land, production methods, inputs used and returns of vegetable farmers were included the tabular technique study. They found that the variable cost per acre of production of Country beans was calculated to be tk. 66680, and their corresponding fixed cost was Tk.13334. The per acre gross cost of the production of Country beans was Tk. 120522. The per acre net return of the production of Country beans was Tk. 149406. The undiscounted profit cost ratio per acre of production of Country beans was 3.70, respectively. The vegetable producers in the study areas were facing various problems which were broadly classified by them into production problems. Some of the production problems were inadequate capital, attack of pest and diseases, lack of quality seed, lack of availability of adequate inputs and higher cost of inputs.

Jobaer (2021) conducted a research about profitability analysis on bean production in Narsingdi district. He stated that production of country bean was lucrative. In his study, the estimated variable cost and fixed cost Tk. 151209 and Tk. 12338 per acre respectively, where the total return were Tk. 224977 and the benefit-cost ratio was 1.375. He also did the functional analysis which showed that the cost of MoP and labor had a major influence in determining the degree of profit gained

from country bean production out of 10 explanatory variables. Low prices for products, high costs for water, seed, and fertilizers, inadequate storage facilities, and insect and disease attacks, long chain of middlemen, malpractices in the market, lack of transportation facilities were the major problems faced by farmers. For improving the farmers economic condition through country bean, he recommended to lowering input prices, easy access to credit, and adequate training facilities should be organized by various government and non-government organizations.

Taslim et al. (2021) studied on financial analysis of country bean in Narsingdi district of Bangladesh. They examined the profitability, problems and probable solutions of country bean production in Belabo Upazila of Narsingdi district of Bangladesh. Financial calculation of the cost and return were done to the evaluation process. Besides the problems and solutions of bean cultivation were also analyzed. To meet the objectives, a convenience sampling technique was selected and one hundred and twenty five country bean growers were chosen from the selected area. The study found that the total cost of bean cultivation was found Tk. 163866.35 per ha, net return was Tk. 60850.28 per ha and benefit cost ratio was 1.37. The study found low price, lack of scientific knowledge in farming, transportation problems and poor storage facilities as major constraints. Besides, the farmers mentioned that they need proper training, reduction in price risk, credit support, cold storage facilities and transportation facilities. The study showed that per hectare yield, gross returns, gross margin, net return and benefit cost ratio of bean were higher. Therefore, the study showed that bean production was highly profitable and it would help to improve the socio-economic condition of farmers in Narsingdi district. Besides, the study identified several problems faced by the bean growers and possible solutions to overcome those constraints were proposed.

Hasan, et al. (2020) conducted research on profitability and technical efficiency of vegetable production Bangladesh. He studied the level of profitability and technical efficiency of bean, brinjal and tomato production in Bangladesh and documented the crucial problems of vegetables producing farms. Profitability of vegetable was analyzed by using gross margin, net return and Benefit-Cost Ratio (BCR). Cobb-Douglas stochastic frontier production function model was used to estimate the farm level technical efficiency. The study showed that total costs were Tk. 196,198 (US$ 2,312.56)/ha for bean, Tk. 220,047 (US$ 2,593.66)/ha for brinjal, and Tk. 240,063 (US$ 2,829.59)/ha for tomato production. Net return was Tk. 28,601 (US$ 337.11)/ha for bean, Tk.

36,557 (US$ 430.89)/ha for brinjal and Tk. 49,762 (US$ 586.53)/ha for tomato production. The net return and the BCR indicated that different vegetables production were profitable in the study areas. The major problems of farmers were lack of capital and lower output prices of vegetables.

Aslam and Hong (2018) found that organic vegetable farms have employed comparatively marginal fraction of the extents as compare to the conventionally grown vegetables. Financial analysis of the study illustrated that due to low level yield, plantation of organic vegetables had economically less attraction to the consumer than conventional. Although the production cost of organic vegetables was higher, farmers were still showing their interest to grow organic vegetables on small scale to fulfil their household desires. The study shown that directly or indirectly exception of subsidies synthetic fertilizers and pesticides and price of organic vegetables could enhance the financial performance of organic vegetable farming.

Biswas (2015) conducted a project on summer country bean raises farm income in Bangladesh. He studied that market prices fall for the country beans and the farmers usually sold their product in a throw away price and became looser by growing these commercial varieties. Moreover, input costs, labor cost etc. were rising and farmers were not getting much profit by selling their seasonal type vegetables. That's why they were now shifting to the cultivation of off season type vegetables. He also found that consumers were also getting the taste of the off season vegetables and they were ready to pay extra price for the vegetables. So heat tolerant summer type country bean lines had been developed at BRAC Agricultural Research and Development Centre (BARDC, Gazipur, Bangladesh) which not only producing fruits in the off season, these lines were also found to be profitable for the commercial growers. Even more, fresh country beans could also be harvested satisfactorily from the same plant of some of these advance lines (which already produced fruit in the summer) allowing these plants to grow in the main season.

Chowdhuri et al. (2014) conducted research on profitability analysis of winter vegetables production in a selected area of Narsingdi district in Bangladesh. They showed that, per hectare profitability of growing vegetables was measured in terms of gross return, gross margin and value addition. The gross costs of brinjal, country bean and cabbage production were Tk. 241277, Tk. 162337 and Tk. 204152 per hectare respectively, and average yields of brinjal, country bean and cabbage were estimated at 24175 kg/ha ,15774 kg/ha, and 24707 kg/ha respectively. Per hectare

net returns of brinjal, country bean and cabbage were Tk. 242223, Tk. 184691, and Tk. 289988, respectively. He found that cost of production was higher for brinjal than cabbage and country bean. The study also showed that per hectare yield, gross returns, gross margin, net return and benefit cost ratio of cabbage were higher than those of country bean and brinjal.

Hasan et al. (2014) conducted research on profitability of cauliflower and bean production in bangladesh -a case study in three districts. They studied to analyze examine the revenues and costs of bean and cauliflower in three districts namely, Mymensingh, Comilla and Rajshahi in Bangladesh. Primary data were collected from farm household survey by using pretested semi-structured questionnaire from May to July, 2014. They found that total cost of bean was higher in Comilla than Mymensingh while net farm income was higher in Mymensingh than Comilla. They also found bean productions were profitable in the case study areas. The Problem Confrontation Index (PCI) was applied to rank each problem faced by the farmers. Correlation analysis indicated that farmer's age, education, number of agriculture training, numbers of extension contact and farmer's homestead area were significantly and negatively correlated with problem confrontation. Extension services should pay more assistance to the farmers, providing more training on disease, insects and pests identification and control.

Tschering (2002) conducted a profitability analysis of bean production in Honduras. The study was based on assessment of the cost pattern of inputs and labor and consequently a profitability analysis of bean production for farmers growing traditional and improved bean varieties. It was observed that farmers growing modern varieties had higher average yields and earned higher profits or suffered less loss than the farmers growing traditional varieties.

Conclusion

The above literature review indicates that a few studies had been conducted on country bean production and profitability, financial analysis, economic efficiency, impact of organic and inorganic fertilizer on yield. The study results are different for various reasons and most of the studies deal with production and profitability of country bean. There is no research on endogenous treatment effect analysis on country bean. Also study on comparative profitability analysis between organic and conventional country bean farming is not found. Considering the above perspective, this study is undertaken. The result of the study will help the farmer to take decision

on organic country bean farming. This study will assist as base for further study related with comparative profitability and endogenous treatment effect analysis.

CHAPTER III

METHODOLOGY

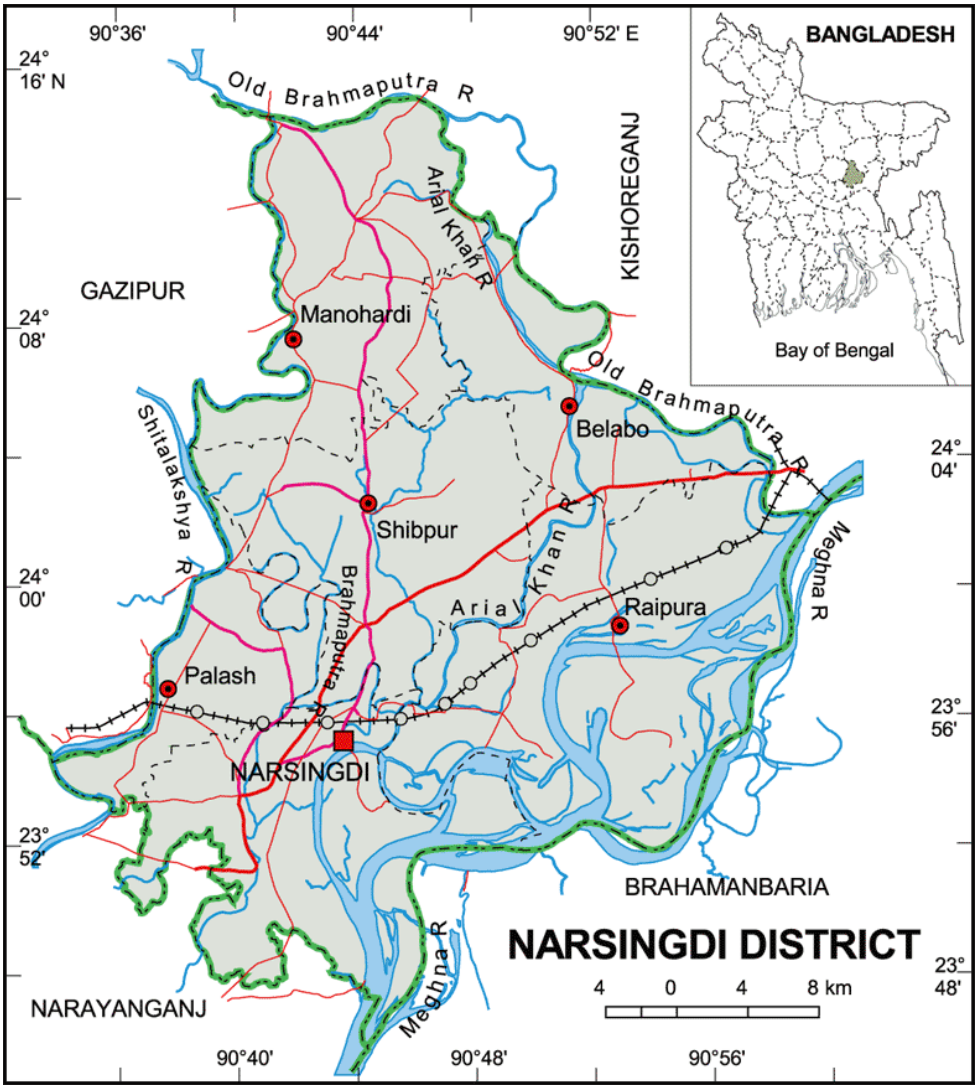
3.1 Introduction

In a systematic research, methodology is an important part and it helps researcher to get valid and reliable data. The methodology chapter includes selection of study area, sampling design, research instrument, type of data used for research and its source, data collection procedure, tabulation and analysis of data, analytical technique and profitability analysis. Improper methodology can mislead the result of research paper. So, a researcher needs to carefully follow a scientific and organized methodology for carrying out his research. All the methodologies used at various phases of research are described in this chapter.

3.2 Selection of study area

Research area selection is an important phase of a research. The study area selection depends on where concentration of study related respondents is higher. Therefore, the research was conducted at Monohardi Upazila of Narsingdi district which was purposively selected to compare the profitability of organic and conventional country bean production.

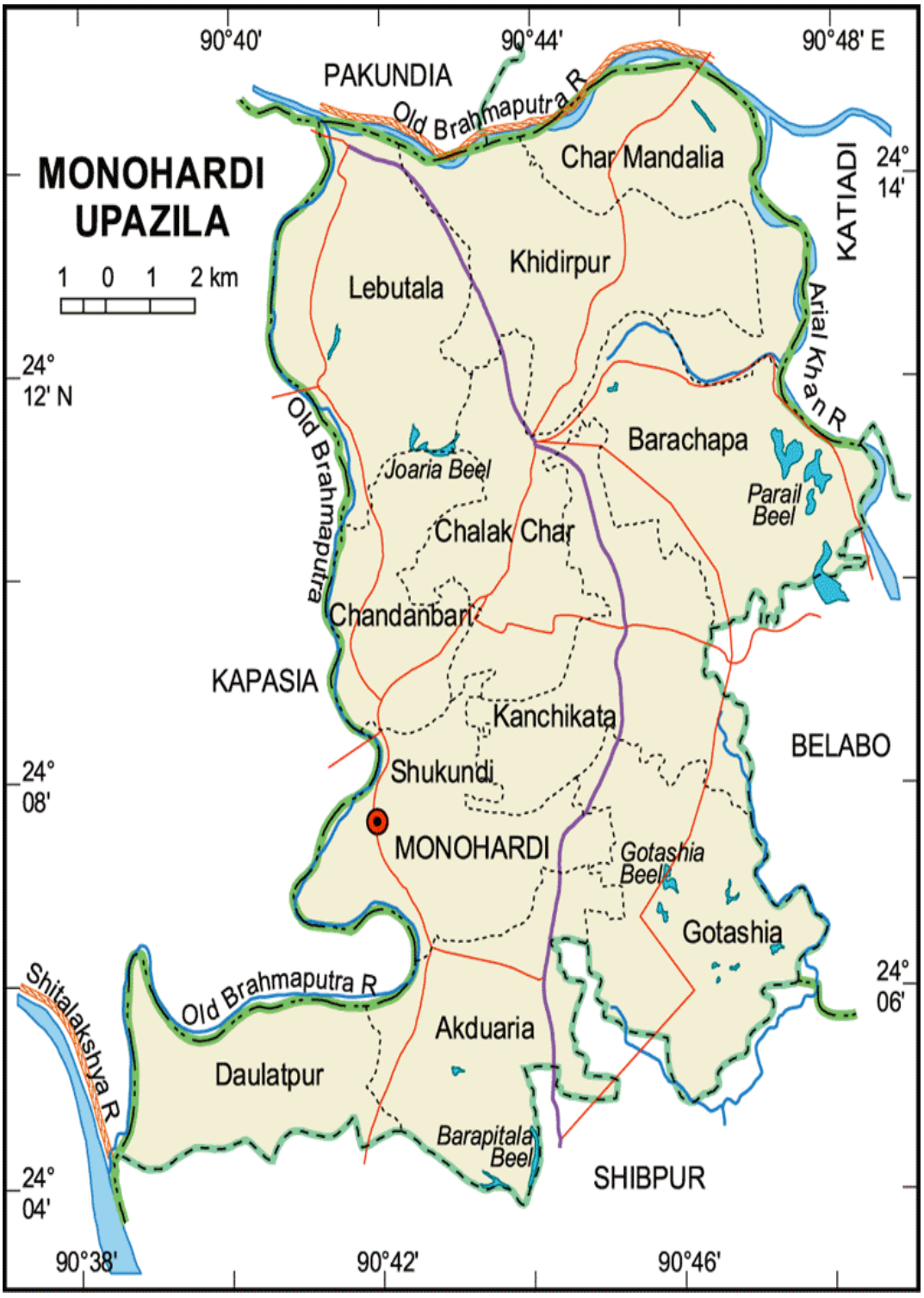
The area of Narsingdi district is about 1140.76 square kilometers and is located between 24.1344° north latitudes and 90.7860° east longitudes. It is surrounded by Kishoreganj district on the north, by Narayanganj and Brahmanbaria districts on the south, by Kishoreganj and Brahmanbaria districts on the east, and by Gazipur district on the west. Agriculture is the primary source of income for 42.73 percent people of this district (*en.banglapedia.org*).



Source: en.banglapedia.org

Figure 3.1: Map of Narsingdi district

The area of Monohardi Upazila is about 193.87 square kilometers and is located between 24.1278° north latitudes and 90.7000° east longitudes. It is bounded by Pakundia and Katiadi Upazilas on the north, Shibpur Upazila on the south, Belabo and Katiadi Upazilas on the east, and Kapasia on the west.



Source: en.banglapedia.org

Figure 3.2 : Map of Monohardi Upazila

The reasons for selecting this study area were-

1) In this area number of country bean growers is higher, significant amount of farmers land is used for vegetable production. People of this region are more interested on organic farming.

2) Soil type of this area is suitable for vegetable farming.

3) Community has easy access to transport and communication facilities.

Narsingdi district is a leading district in different types of vegetable production. DAE of Narsingdi district also work for introducing sustainable agriculture. Different types of program and training facilities were given to the grower level. Country bean is one of main crop for winter season and some improved varieties are also cultivated in summer season. Farmers grow country bean on farm land and also on abandoned lands and homestead area.

So, a large number of country bean producer is found in this district and research also conducted in this region.

3.3 Sampling design

Due to time limits and resource constrains, it was not possible to interview all farmers in this study area. According to the objectives of the study, the target population was organic and conventional country bean farmers in Narsingdi district. Narsingdi district was purposively selected for this study. A total of 100 organic country bean farmers and 100 conventional country bean farmers were selected for this study. Data collected from 4 different villages of four unions of Monohardi Upazila in Narsingdi district. Primary data were collected using pre-tested interview schedule through personal interview. The samples were randomly selected in the study area that is shown in Table 3.1.

Table 3.1: Sample respondent categories in the study area

Respondent category	Sample size
Organic country bean farmer	100
Conventional country bean farmer	100
Total country bean farmer	200

3.4 Research instrument

The proper design of the schedule is needed for a successful research and survey work. Interview schedules for both organic and conventional country bean were pre-tested with a few farmers of the study area by the researcher. During data collection, if any correction or modifications were needed then field editing was done and thus some parts of the schedule were improved and modified with practical experience. The schedule was finally selected after pretesting.

3.5 Type of data and its source

In this study, both primary and secondary data were needed and collected to fulfil the study objectives. The types of data and sources were described below-

Primary data: Primary data are mostly cross-sectional data that are collected at the same time for different variables. Primary data were collected through personal interview with country bean farmers of Narsingdi district. The study's main objective was to find out comparative profitability between organic and conventional country bean farming, so the data were related with cost of input, production, price of country bean and also socioeconomic characteristics of country bean farmers. Problems related with production and marketing and possible suggestions mentioned by country bean farmers were also included.

Secondary data: The data that are not collected directly by researcher from respondents but collected from different published sources are called secondary data such as DAE, BBS, BRAC, DAM, BRRI, Internet, research reports, publications, district office of Narsingdi district, etc.

3.6 Collection of data

Data were collected from respondents through interview schedule by researcher. The objectives of the study were clearly explained to the respondents. The respondents could respond easily because they were interviewed during their leisure time. The questions were asked according to interview schedule in simple word. Data was collected in local units as farmers understood it easily and converted into standard unit when data were tabulated. After data collection, each interview schedule was checked to make sure that each item was answered properly and recorded clearly. If there were any items which were contradictory, the respondents were again interviewed for correction.

3.7 Tabulation and analysis of data

After collecting data, data were carefully listed on Microsoft excel and analyzed by using Microsoft excel. For endogenous treatment effect analysis, STATA15 software was used. Data were analyzed according to the objectives of the study.

3.8 Profitability analysis

To compare the profitability between organic and conventional country bean farming, cost and return for both farming system needed to find out. Total cost includes variable cost, fixed cost, marketing cost and transportation cost. Gross returns were calculated using the market price of country beans and other goods. Country bean's gross margin and net margin were also calculated by using a set of financial pricing. Benefit cost ratio (BCR) was calculated on the basis of all cost and also variable cost. The cost items included Seed cost, Power tiller cost, Labor cost, Urea cost, TSP cost, MoP cost, Manure cost, Integrated pest management cost, Pesticide cost, Irrigation cost, Bamboo cost, Transportation cost, Marketing cost and Land use cost. These cost items were common for both organic and conventional country bean production without Pesticide, Urea, TSP and MoP costs which are related with conventional farming and IPM is for organic farming system. There are chemical fertilizers and pesticides that are not used in organic farming system.

3.8.1 Cost of seed

Seed price of country bean is varied on the basis of varieties, qualities and availabilities. The market price of bean seed that was paid by the farmers was used to determine the cost of seed. Per hectare seed cost was measured by calculating total amount of seed needed per hectare multiplied by the price of seed.

3.8.2 Cost of tillage

Tillage is the main component of land preparation. Ploughing, laddering and other actions are necessary before seed sowing. In country bean farming, land preparation is varied according to the farming procedure. Sometimes it need not to ploughing all over the land, only need to plough the specific area where seed is planted. Cost of tillage is varied across farms and locations and on land types.

3.8.3 Cost of human labor

Human labor cost is one of the critical components of cost items in country bean production. In this study, human labor cost includes family labor and hired labor. Family labor is included in fixed cost; it can also be counted as opportunity cost. Hired labor cost is included in variable cost. Country bean production is a labor based production system, so it is necessary for completing variety of tasks in farming, harvesting and also in marketing. Labor cost was calculated by multiplying total man days with the pay per man day for one hectare.

3.8.4 Cost of urea

In conventional country bean production, urea is an important element. The cost of urea was calculated by using market price of urea multiplied by total quantity of urea per hectare. In organic farming, urea is not used as it is an inorganic fertilizer.

3.8.5 Cost of TSP

Triple Super phosphate (TSP) is also used in conventional farming system as it is chemical fertilizer. Cost of TSP was measured by using market price of TSP. In this study, total amount of TSP per hectare is multiplied by per unit TSP price.

3.8.6 Cost of MoP

Murate of Potash (MoP) is used in conventional country bean farming and in organic country bean farming, it is not used. In this study, cost of MoP is calculated on per hectare basis. The price of MoP was determined by the price mentioned by farmers.

3.8.7 Cost of manure

The cost of manure depends on quantity of manure used in land and the price of manure. In both organic and conventional farming, manure is the key element of fertilizer. It is used to improve the soil quality and also for high production. Total quantity of manure per hectare used by country bean farmer was multiplied by unit price of manure paid by farmer.

3.8.8 Cost of pesticides

Famer used chemical pesticides in conventional farming and organic pesticides and pest management system for organic farming of country bean. Farmer applied pesticides for controlling the disease of country bean for higher production. Per hectare amount of pesticide was multiplied by market price of pesticides.

3.8.9 Cost of irrigation

The cost of irrigation differs from area to area and also on land types. In this study, cost of irrigation was calculated on per hectare basis. Irrigation cost was determined by number of times of irrigation multiplied by per irrigation cost.

3.8.10 Cost of bamboo

Bamboo and other costs were also calculated on per hectare basis. In both organic and conventional country bean farming, this cost didn't differ for farming techniques. Cost of Bamboo was calculated on the basis of how much it cost per decimal country bean Production.

3.8.11 Cost of marketing

This cost was determined by the cost related with selling country bean. It included cost of sorting, weighing, packaging and also selling related cost.

3.8.12 Cost of transportation

Transportation cost related with country bean production and marketing were included in this cost. This cost didn't count as specific times, it was estimated as farmer's information that they thought.

3.8.13 Interest on operating capital

Interest on operating capital was calculated on opportunity cost basis for both organic and conventional farming system and included in fixed cost. As country bean is a seasonal crop, interest on operating capital was calculated only for four months and the Interest was calculated at 6% rate. The equation used for calculating the Interest on operating capital was-

$$I = \frac{TVC \times r \times 4}{2 \times 12}$$

Here

TVC = Total Variable cost

r = Interest rate

3.8.14 Land use cost

Land use cost was also an opportunity cost. If the land was not cultivated for country bean but rented for other purposes, then the farmer would get that price for his land and that price was counted as land use cost. It was also included in fixed cost.

3.8.15 Total variable cost

The equation for total variable cost -

Total variable cost for conventional country bean farming-

TVC=Seed cost+ Power tiller cost+ Hired Labor cost+ Urea cost+ TSP cost+ MoP cost+ Manure cost+ Pesticide cost+ Irrigation cost+ Bamboo cost

Total variable cost for organic country bean farming-

TVC=Seed cost+ Power tiller cost+ Hired Labor cost+ Organic manure cost+ Pesticide cost+ Irrigation cost+ Bamboo cost

3.8.16 Total fixed cost

Fixed cost equation for both organic and conventional country bean farming-

TFC= Family labor cost + Interest on operating capital + Land use cost

3.8.17 Total cost

The equation of total cost was-

TC= Variable cost + Fixed cost+ Marketing cost + Transportation cost

3.8.18 Total production

Total production of country bean for organic and conventional farming was calculated on per hectare production.

3.8.19 Total revenue

Total revenue is the total return from country bean production. It included return from country bean selling and also from selling used materials.

Total revenue = Total production in Kg × Price per Kg + Price of selling used materials

3.8.20 Gross margin

Gross margin was computed by subtracting variable cost from total revenue. The equation was-

Gross margin = Total revenue - Total variable cost

3.8.21 Net margin

Net margin was calculated by subtracting total cost from total revenue.

Net margin = Total revenue - Total cost

3.8.22 Benefit cost ratio (variable cost basis)

BCR was calculated by the ratio of total revenue to total variable cost. It is a critical component for determining profitability.

$$\text{BCR} = \frac{\text{Total revenue}}{\text{Total variable cost}}$$

3.8.23 Benefit cost ratio (total cost basis)

Profitability also calculated on total cost basis benefit cost ratio. Total cost basis BCR was calculated by-

$$\text{BCR} = \frac{\text{Total revenue}}{\text{Total cost}}$$

3.9 Endogenous treatment effect analysis

3.9.1 Farming decisions

The gross margin from organic country bean farming can be expressed with respect to a vector of respondent explanatory variables in a latent variable framework as

$W_i^* = \beta X_i + u_i$ ……..(i)

$W_i^* = 1$, if $W_i^* > 0$ otherwise, $W_i = 0$

Where W is a binary indicator variable that means if a farmer uses organic farming system, W equals to 1 and otherwise it is 0; β is a vector of parameters to be estimated, X includes all the observable factors that may influence organic farming decision such as farmers and farm-level characteristics and u is the error term with mean zero.

3.9.2 Impact evaluation and selection bias

This study observes the impact of organic farming on farmer's gross margin. Given that this vector of outcome is a linear function of observed farm and farmer's characteristics, the outcome variable can be expressed as

$Y_i = \alpha J_i + \eta W_i + e_i$ ……..…….(ii)

where Y_i represents a vector of outcome variable (gross margin); W_i as previously described in (i) is an indicator of farming system; J_i is a vector of observed farm and farmer's characteristics; α and η are vectors of parameters to be estimated; e_i is the error term.

In (ii), the impact of adoption on the outcome variable is measured by the estimates of the parameter η. This approach however, may generate biased estimates because the decision of farmers towards farming system is not random or voluntary and may be based on individual self-selection in which case, the undeclared factors, e_i in (ii) tend to influence on u in (i).

3.9.3 Endogenous treatment effect model

The Average Treatment Effect (ATE) is estimated by the endogenous treatment effect model and other parameters of a linear regression model that also includes an endogenous binary-treatment variable. Estimation is by full information maximum likelihood.

This model is expressed in two sets of equations as

Outcome equation: $Y_i = \alpha J_i + \eta W_i + e_i$

And Selection equation: $W_i^* = \beta X_i + u_i$, $W_i^* = 1$, if $W_i^* > 0$ otherwise, $W_i = 0$

Where W_i is the dummy variable indicating the farming system (i.e. $W_i = 1$, if farmer i is in the organic farming system, otherwise $W_i = 0$) and Y_i is the outcome variable of the regression equation (observed for both $W_i = 1$ and $W_i = 0$).

CHAPTER IV

COMPARATIVE SOCIO-ECONOMIC CHARACTERISTICS OF ORGANIC AND CONVENTIONAL FARMERS

4.1 Introduction

This chapter will demonstrate socio-economic characteristics of both organic and conventional country bean famers of Narsingdi district. A brief discussion about socio-economic characteristics of the respondents is necessary for analyzing the research's objective. The selected characteristics of the respondents are farmer's age, education level, occupation status, family size, farmer's type, farm's type, homestead area of farmer, number of agricultural training per year, number of extensional contact per year, farming experience of farmers, organizational participation, farmer's access to television, farmer's access to mobile phone, farmer had internet connection, framer's had agricultural apps in mobile phone, distance from home to local market, distance from home to agricultural office, used hybrid seed, time spent with other farmer.

4.2 Farmer's age

Table 4.1 shows percentage distribution of country bean farmer's age for both organic and conventional vegetable farming. Here it is seen that in organic country bean production, 40% respondents' age were more or equal to 50 years. In conventional farming 43% farmers age were more or equal to 50 years. In organic farming, less than 30 years age of respondents were 22% and 30 years to 49 years of farmers age were 38%. In conventional farming, 24% of growers were less than 30 years old and 33% were from 30 years to 49 years old. Farmers whose age were greater than 30 years were more involved in farming then farmers whose age were less than 30 years. So, it is clearly showed that the new generations people are less involved in farming.

Table 4.1: Percentage distribution of country bean farmer's age

Age Range (in year)	Organic farmers (%)	Conventional farmers (%)
Less than 30	22	24
30 to 49	38	33

Greater or equal 50	40	43

Source: Farmer's household survey, 2021

4.3 Educational level

Table 4.2 shows the percentage distribution of education level. Education level of farmers is one the most important socio-economic characteristics of country bean farmers. Education influences the adoption of farming techniques. It is seen that 30% organic country bean farmers and 28% conventional country bean farmers didn't receive any institutional education. 17% organic producers and 16% conventional country bean producers had primary level of education. 25% organic country bean growers had secondary level of education and 33% conventional farmers had secondary level of education. 28% organic and 23% conventional country bean farmers had higher educational qualification.

Table 4.2 Percentage distribution of educational level

Education level	Organic farmers (%)	Conventional farmers (%)
Illiterate	30.0	28.0
1 to 5	17.0	16.0
6 to 10	25.0	33.0
11 to 18	28.0	23.0

Source: Farmer's household survey, 2021

4.4 Percentage distribution of primary occupation

Primary occupation of respondent means the main source income for that respondent and by which they maintain their livelihood. In this study, maximum respondents were mainly and solely engaged in farming. It is seen from table 4.3 that agriculture is the main occupation for 56% organic country bean growers and 69% conventional country bean growers. 19% organic farmer's primary occupation was job employment and it was 12% for conventional country bean growers. Day labor is the primary occupation for 7% organic farmers and 8% for conventional country bean farmers. 12% organic and 10% conventional farmers are doing petty business as their primary

occupation. There are 1% farmers for both organic and conventional country bean farming are engaged in other occupation as primary occupation.

Table 4.3: Percentage distribution of primary occupation

Occupation	Organic farmers (%)	Conventional farmers (%)
Agriculture	56.0	69.0
Employment	19.0	12.0
Day labor	7.0	8.0
Petty business	12.0	10.0
Others	1.0	1.0

Source: Farmer's household survey, 2021

4.5 Percentage distribution of secondary occupation

In this study, farmers who were selected for data collection. But all farmers were not only dependent on farming for their earning. There were some farmers whose main occupation were not farming but farming was their secondary source of income. Some farmers were doing farming only for meeting their daily fresh food need, not for making profit. From table 4.4, it is seen that agriculture is the secondary occupation for 43% organic country bean growers and 28% conventional country bean growers. 2% organic farmer's secondary occupation was job employment and it was also 2% for conventional country bean growers. There is no day labor as secondary occupation for organic farmers and conventional country bean farmers.10% organic and 6% conventional farmers are doing petty business as their secondary occupation. There are 3% farmers for organic and 2% for conventional country bean farming are engaged in other occupation as secondary occupation.

Table 4.4: Percentage distribution of secondary occupation

Occupations	Organic farmers (%)	Conventional farmers (%)
Agriculture	42.0	28.0
Employment	2.0	2.0
Day labor	0.0	0.0

Petty business	10.0	6.0
Others	3.0	2.0

Source: Farmer's household survey, 2021

4.6 Percentage distribution of family size

Family size is an important socio-economic characteristic. It influences the family labor sources as well as farm's fixed cost. From table 4.5, it was found that family sizes were range from 1 to 7 or greater than 7. Family size were 1 to 3 members for 54% organic farmers and 49% conventional country bean farmers. 46% organic country bean farmers and 49% conventional country bean farmers had a family of 4 to 6 members. 2% conventional farmers had a family of 7 or above 7.

Table 4.5: Percentage distribution of family size

Family size	Organic farmers (%)	Conventional farmers (%)
1 to 3	54.0	49.0
4 to 6	46.0	49.0
Greater or equal 7	0.0	2.0

Source: Farmer's household survey, 2021

4.7 Percentage distribution of farmer type

Farmer type represents if famers have their own land or not. Farmer who had their own land, got some advantages then tenant. In term of investment, they got extra benefit and tenant need to share their cost. Table 4.6 represents the percentage distribution of farmer's type. 72% organic farmers 67% conventional country bean farmers were owner operator. There were 9% organic country bean farmers and 8% conventional country bean farmers were pure tenant. 25% conventional country bean farmers and 19% organic country bean farmers were owner cum tenant farmers.

Table 4.6: Percentage distribution of farmer type

Farmer's type	Organic farmers (%)	Conventional farmers (%)

Owner operator	72.0	67.0
Pure tenant	9.0	8.0
Owner cum tenant	19.0	25.0

Source: Farmer's household survey, 2021

4.8 Percentage distribution of farm type

Farm type presents the total land area that is holding by farmers. As an overpopulated country, most of Bangladeshi vegetable farmers are marginal. Day by day, farm size is declining. Table 4.7 shows the percentage distribution of farm type. Farm area was categorized into 4 types. 44% organic country bean farmers and 52 percent conventional country bean farmers had 0 to 100 decimal farm lands. 43% organic country bean farmers and 34% conventional country bean farmers had 101 to 200 decimal farm lands. In 201 to 300 decimal farm lands, there were 10% organic country bean farmers and 13% conventional country bean farmers. 1% conventional country bean farmers had more than 300 decimal land and 3% organic country bean farmers had more than 300 decimal farm land.

Table 4.7: Percentage distribution of farm type

Area in decimal	Organic farmer (%)	Conventional farmer (%)
0 to 100	44.0	52.0
101 to 200	43.0	34.0
201 to 300	10.0	13.0
More than 300	3.0	1.0

Source: Farmer's household survey, 2021

4.9 Distribution of farming information and technical knowledge

Table 4.8 shows that average homestead area in decimal, average number of agricultural training per year, average number of extensional contact per year, average farming experience in years ,

average organizational participation, farmers access to mobile phone , farmers access to television, farmers had internet connection, Agricultural apps in mobile phone, distance from home to local market, distance from home to agricultural office, farmers using hybrid seed and time spent with other farmers per day for both organic country bean and conventional country bean farming.

Average family size of organic country bean farming was 3.5 members and for conventional, the average family size was 3.83 members. Organic country bean's farmers had average 8.84 decimal homestead area and conventional country bean's farmers had average 11.31 decimal homestead area. Organic country bean farmers took average 0.77 agricultural training per year and conventional country bean farmers took average 0.53 agricultural training per year. Organic country bean farmers had average 0.60 extensional contacts per year and conventional country bean farmers had average 0.65 extensional contacts per year. Average farming experience of organic country bean growers was 25.38 years and for conventional country bean was 27.43 years. 98% organic farmers participated in different organization and 56% conventional farmers involved in different organizations. 99% organic country bean farmers had access to television and it was 100% for conventional country bean farmers. Each organic and conventional country bean farmer had access to mobile phone and 97% organic country bean farmers had internet connection on mobile phone and conventional country bean farmers had 100% access to internet on mobile phone. 6% organic farmers had agricultural apps in mobile phone and there were no agricultural apps on conventional country bean farmer's mobile phone.

Table 4.8: Distribution of farming information and technical knowledge

Item	Organic farmer	Conventional farmer
Average age (years)	43.94	44.06
Average family size (members)	3.50	3.83
Homestead area (in decimal)	8.84	11.312
Number of Agricultural training per year	0.77	0.53
Number of extensional contact per year	0.60	0.65
Farming experience(years)	25.38	27.43
Organizational participation (%)	98.0	56.0

Farmer's access to television (%)	99.0	100.0
Farmer's access to mobile phone (%)	100.0	100.0
Farmer had internet connection (%)	97.0	100.0
Famer's had agricultural apps in mobile phone	0.06	0.0
Distance from home to local market (Km)	1.0	0.85
Distance from home to agricultural office (Km)	10.97	10.97
Used hybrid seed (%)	8.0	68.0
Time spent with other farmer (minutes)	145.8	123.0

Source: Farmers household survey, 2021

Average distance from home to local market was 1 kilometre for organic country bean farmers and it was 0.85 kilometre for conventional country bean growers. The average distance from home to agricultural office was 10.97 kilometres for both organic and conventional country bean farmers. 8% organic country bean farmers and 68% conventional country bean farmers used hybrid seed for country bean production. Organic country bean growers spent 145.8 minutes per day with other farmers in average and for conventional country bean growers, the average time spent with other farmers was 123 minutes per day.

4.10 Discussion

The average age of conventional farmers (44.06 years) is higher than organic farmer's age (43.94 years). Hasan et al., (2020) found that average age of farmers was 44.4 years. Hasan et al., (2014) found that average age of farmers was 42.5 years in Mymensingh district in Bangladesh. Illiteracy rate is higher for the organic farmer (30%) than conventional farmers (28%). According to Taslim et al., (2021) 31.2% farmers did not receive any institutional education in Narsingdi district of Bangladesh. Jobaer (2021) found that 31.2% farmers had no institutional education in Narsingdi district of Bangladesh. Hasan et al., (2020) found that farmers had average 5.51 years of education. Hasan et al., (2014) found that farmers education level was 5.3 years. More conventional country bean farmer's (69%) main occupation is agriculture than organic country bean's farmers (56%). Farmers who are job employed are more engaged in organic farming (19%) than conventional

farming (12%). Highest 42% organic farmers secondary occupation was agriculture whereas highest 28% conventional farmers secondary occupation was agriculture. Taslim et al. (2021) found that 20% farmers only depend on agriculture and 49.6% farmers depend on agriculture and allied activities in Narsingdi district of Bangladesh. Organic farmers are more involved in petty business than conventional farmers. According to Jobaer (2021), 52% of farmers main occupation was farming and 48% farmers engaged with farming and other activities in Narsingdi district of Bangladesh. The family size is larger for conventional farmers (3.83 members) than organic country bean farmers (3.50 members). The percentage of farmers who are owner operator is higher in organic farming (72%) than conventional farming (67%). More conventional farmers are owner cum tenant than organic country bean farmers. The homestead area of organic farmers (8.84 decimal) is smaller than conventional country bean farmers (11.31 decimal). Hasan et al., (2020) found that farmers homestead area was 0.053 ha. Taslim et al., (2021) found that 73% of farmers land holding sizes ranged 1-3 acres in Narsingdi district of Bangladesh. Jobaer (2021) found that 58.4% farmers land holding sizes ranged 1-3 acres in Narsingdi district of Bangladesh. The present study found that organic country bean farmers (77%) received more agricultural training per year than conventional country bean farmers (53%). Farmers received average 1.42 numbers of agricultural training (Hasan et al., 2014). Jobaer (2021) found that 69.6% of farmers did not receive any training or had no technical knowledge in Narsingdi district of Bangladesh. Hasan et al., (2014) found that farmers received average 1.5 numbers of agricultural training. Conventional country bean farmers (27.43 years) had more farming experience than organic country bean farmers (25.38 years). According to Taslim et al. (2021), 24% of farmers had more than 10 years of farming experience. Hasan et al., (2020) found that farmers had 12.2 years of farming experience in Mymensingh district of Bangladesh. Jobaer (2021) found that 19.2% farmers had more than 10 years of farming experience in Narsingdi district of Bangladesh. Hasan et al., (2014) found that farmers had 17.2 years of farming experience. Organic farmers (98%) participated more in different organizations than conventional farmers (56%). The present study found that access to television, access to mobile phone and internet connection for both organic and conventional country bean farmers are almost same. Some organic farmers (6.0%) had agricultural apps in mobile phone but there were no agricultural apps in conventional farmer's mobile phone. This study found that the distance from home to agriculture office is same (10.97 km) for both organic

and conventional farmers. The present study found that the conventional farmers (68%) used more hybrid seed in farming than organic farmers (8%). Organic farmers (145.8 minutes) spent more time with other farmers than conventional country bean farmers (123 minutes).

CHAPTER V

COMPARATIVE COST AND PROFITABILITY ANALYSIS OF ORGANIC AND CONVENTIONAL COUNTRY BEAN FARMING

This chapter includes comparative profitability analysis between conventional and organic country bean farming. Profitability analysis includes production cost of country bean, marketing cost of country bean, transportation cost, land use cost, interest on operating capital, total revenue, gross margin, net margin, benefit cost ratio on the basis of variable cost and total cost.

5.1 Total input quantity per hectare country bean production

The main objective of this study is to compare the profitability between organic and conventional country bean production. In both conventional and organic country bean farming, seed, human labor, tillage, fertilizer, pesticides and irrigation are used as input. Chemical fertilizers and pesticides are used in conventional farming but in organic farming farmers use organic manure only.

5.1.1 Inputs use pattern in a hectare of land for organic bean production.

Input items are the basic requirements for any type of production. For organic country bean production, chemical fertilizers and pesticides are not used. From table 5.1, it is seen that seed required for organic country bean farming is 10.98 kg per hectare. Average tillage numbers per hectare is 59.45. In organic farming, average family labor is required 139.67 men days per hectare and 125.69 man days hired labor per hectare. Organic farming needed 2587.10 kg organic manure, 45.18 times pest management and 64.56 times irrigation per hectare.

Table 5.1: Inputs use pattern in a hectare of land for organic bean production.

Input Items	Quantity
Seed (Kg/ha)	10.98
Tillage (Numbers/ha)	50.45
Family labor (Day/ha)	139.67
Hired labor (Day/ha)	125.69

Organic manure (Kg/ha)	2587.10
Integrated Pest Management (times/ha)	45.18
Irrigation per hectare (no.)	64.56

Source: Farmer's household survey, 2021

5.1.2 Inputs use pattern in a hectare of land for conventional bean production.

For conventional country bean farming, farmers used 10.89 kg seed in a hectare of land (table: 5.2). They used 86.24 man days family labor and 180.33 man days hired labor in a hectare of land. Farmers used 50.97 times tillage for per hectare land. They used average 99.79 kg urea, 163.56 kg MoP, 99.79 kg TSP as chemical fertilizer and like organic farming, they also used 2444.79 kg manure for per hectare country bean farming. Farmers also used 50.07 litres pesticides and 65.13 times irrigation in a hectare of land.

Table 5.2: Inputs use pattern in a hectare of land for conventional bean production

Input Items	Quantity
Seed (Kg/Ha)	10.89
Family labor (Day/Ha)	86.24
Hired labor (Day/Ha)	180.33
Tillage (Numbers/Ha)	50.97
Urea (Kg/Ha)	99.79
MoP (Kg/Ha)	163.56
TSP (Kg/Ha)	99.79
Manure (Kg/Ha)	2444.79
Pesticides (litre /Ha)	50.07
Irrigation no. per hectare	65.13

Source: Farmer's household survey, 2021

5.2 Total variable cost per hectare country bean production

A change in a variable input can change the production. Total variable cost includes different variable costs like seed cost, power tiller cost, hired labor cost, manure cost, inorganic fertilizers (Urea, MoP, TSP) cost, pest management cost, pesticide cost, irrigation cost, bamboo cost etc.

5.2.1 Total variable cost per hectare country bean production in organic farming

Table 5.3 presents that total variable cost in a hectare of land for organic country bean production. The average seed cost per hectare organic country bean is about Tk.16307.28 that is 9.29% of total variable cost. The average cost of tillage is about Tk. 12897.85 per hectare which is 7.35% of total variable cost. Average hired labor cost per hectare organic country bean is Tk. 63091.82 and this cost is 35.79% of total cost. Average manure cost per hectare organic country bean is Tk. 14117.37 and this cost is 8.05% of total cost. Integrated pest management cost for organic country bean is 4.25% of total variable cost. The average cost of pest management for country bean is Tk. 7457.76 per hectare. The average irrigation cost per hectare organic country bean is Tk. 7568.21 that is 4.32% of total variable cost. The average cost of bamboo is Tk. 53983.3 per hectare which is 30.77% of total variable cost. The total variable cost per hectare organic country bean is total Tk.175423.68.

Table 5.3: Total variable cost per hectare country bean production in organic farming

Cost items	Cost (Tk./Ha)	Percentage
seed cost	16307.29	9.29
Power tiller cost	12897.85	7.35
Hired labor cost	63091.82	35.97
Manure cost	14117.37	8.05
Pest management cost	7457.76	4.25
Irrigation cost	7568.21	4.32
Bamboo and others cost	53983.39	30.77
Total variable cost	175423.68	100.0

Source: Farmer’s household survey, 2021

5.2.2 Total variable cost per hectare country bean production in conventional farming

Table 5.4 shows total variable cost in a hectare for conventional bean production. The average seed cost per hectare conventional country bean is Tk. 16147.60 which is 7.84% of total variable cost. Power tiller cost is Tk. 12977.13 for conventional country bean which is 6.29% of total variable cost. Average hired labor cost per hectare organic country bean is about Tk. 90267.35 and this cost is 43.95% of total cost The average urea cost per hectare conventional country bean is Tk. 1953.39 that is 0.95% of total variable cost. The average MoP cost per hectare conventional country bean is Tk. 3282.30 which is 1.60% of total variable cost. The average TSP cost per hectare conventional country bean is Tk. 2673.56 which is 1.29% of total variable cost. Average manure cost per hectare conventional country bean is Tk. 12056.53 and this cost is 5.85% of total cost. The average cost of pesticides for country bean is about Tk. 7258.60 per hectare which is 3.52% of total variable cost. Average irrigation cost per hectare conventional country bean is about Tk. 7628.14 and this cost is 3.7% of total cost. The average cost of bamboo is about Tk. 51578.17 per hectare which bean is 25.01% of total variable cost. The total variable cost per hectare conventional country bean is total Tk. 206182.75.

Table 5.4: Total variable cost per hectare country bean production in conventional farming

Cost items	Cost (Tk./ha)	Percentage
seed cost	16147.60	7.84
Power tiller cost	12977.13	6.29
Hired labor cost	90627.35	43.95
Urea cost	1953.39	0.95
TSP cost	2673.56	1.29
MOP cost	3282.30	1.60
Manure cost	12056.52	5.85
Pesticide cost	7258.60	3.52
Irrigation cost	7628.14	3.70
Bamboo+ others cost	51578.17	25.01
Total variable cost	206182.75	100

Source: Farmer's household survey, 2021

5.3 Total fixed cost per hectare country bean production

Total fixed cost per hectare of organic bean production is shown in the Table 5.5. Total fixed cost includes family labor cost, interest on operating capital and land use cost. The fixed costs per hectare organic country bean production are discussed below. Average family labor cost of organic country bean production is Tk. 69767.48 per hectare that is 70.81% of total fixed cost. Interest on operating cost is Tk. 1754.24 per hectare for organic country bean farming and it is 1.78% of total fixed cost. Land use cost is Tk. 27008.26 per hectare which is 27.41% of total fixed cost for organic country bean production. Total fixed cost is Tk. 98529.98 per hectare for organic country bean production.

Table 5.5: Total fixed cost per hectare country bean production in organic farming

Cost items	Cost (Tk/ha)	Percentage of total fixed cost
Family labor cost	69767.48	70.81
Interest on operating cost @ 6% per season	1754.24	1.78
Land use cost	27008.26	27.41
Total fixed cost	98529.98	100

Source: Farmer's household survey, 2021

5.3.2 Total fixed cost per hectare country bean production in conventional farming

Total fixed cost per hectare of conventional bean production is shown in the Table 5.6. Average family labor cost of conventional country bean production is Tk. 43305.07 per hectare that is 60.69% of total fixed cost. Interest on operating cost is Tk. 2061.83 per hectare for conventional country bean farming and it is 2.89% of total fixed cost. Land use cost is 36.42% of total fixed cost for conventional country bean production. The average land use cost is Tk. 25985.03 per hectare for conventional country bean farming. Total fixed cost is Tk. 71351.93 per hectare for conventional country bean production.

Table 5.6: Total fixed cost per hectare country bean production in conventional farming

Cost items	Cost (Tk./ha)	Percentage of total fixed cost
Family labor cost	43305.07	60.69
Interest on operating cost @ 6% per season	2061.83	2.89
Land use cost	25985.03	36.42
Total fixed cost	71351.93	100

Source: Farmers household survey, 2021

5.4 Total cost per hectare country bean production in organic and conventional farming

Total cost per hectare of both organic and conventional bean production is shown in Table 5.7. Total variable cost for organic country bean farming is Tk. 175423.68 per hectare and Tk. 20612.76 per hectare for conventional country bean farming. Here, variable cost of conventional farming is higher than organic farming. In organic country bean farming, total fixed cost is Tk. 98529.98 per hectare and in conventional country bean farming, total fixed cost is Tk. 71351.93 per hectare. Total transportation cost in organic country bean farming is Tk. 5270.48 per hectare and in conventional farming, the cost is Tk. 5471.03 per hectare. Table 5.7 shows that total marketing cost for organic country bean farming is Tk. 7644.07 per hectare and for conventional farming it is Tk. 13206.34 per hectare. The total cost of organic country bean farming is Tk. 286868.20 per hectare and the total cost of conventional country bean farming is Tk. 296212.05 per hectare. So, total cost of conventional country bean is higher than organic country bean farming.

Table 5.7: Total cost per hectare country bean production in organic and conventional farming

Items	Organic farming (Tk./ha)	Conventional farming (Tk./ha)
Total variable cost	175423.68	206182.76
Total fixed cost	98529.98	71351.93
Total transportation cost	5270.48	5471.03
Total marketing cost	7644.07	13206.34
Total cost	286868.20	296212.05

Source: Farmer’s household survey, 2021

5.5 Total return per hectare country bean production in organic and conventional farming

Total return of country bean per hectare for both organic and conventional farming is shown in Table 5.8. The yield of organic country bean is 8499.27 kg per hectare and the yield of conventional country bean is 9450.22 kg per hectare. The average price of organic country bean was Tk. 38.35 per kg and conventional country bean was Tk. 38.03 per kg. Total selling price of conventional country bean is Tk. 359350.42 per hectare and for organic country bean, it is Tk. 325956.02 per hectare. The selling price of used materials is Tk. 26354.92 per hectare for conventional country bean farming and Tk. 27510.11 per hectare for organic country bean farming. Total revenue for conventional country bean is Tk. 385705.34 per hectare and for organic it is Tk. 353466.13 per hectare. The gross margin for conventional country bean farming is Tk. 179522.58 per hectare and Tk. 178042.45 per hectare for organic country bean farming. The net margin of organic country bean is Tk. 66597.93 per hectare and Tk. 89493.29 per hectare for conventional country bean farming. Benefit cost ratio is used to compare benefit per unit of cost. The BCR on variable cost basis is 1.86 for conventional country bean farming and 1.99 for organic country bean farming. BCR is 1.86 means that each taka invested in variable cost yielded 1.86 taka. Table 5. 8 shows that the BCR on total cost basis is 1.30 for conventional country bean farming and 1.23 for organic country bean farming. So, conventional country bean farming had higher benefit per unit cost of farming.

Table 5.8 Total return per hectare country bean production in organic and conventional farming

Items	Conventional farming	Organic farming
Yield (Kg/ha)	9450.22	8499.27
Country bean price (Tk./ kg)	38.03	38.35
Total return (Tk./ha)	359350.42	325956.02
Total selling price of used materials (Tk./ha)	26354.92	27510.11
Total Revenue (Tk./ha)	385705.34	353466.13
Gross margin (Tk./ha)	179522.58	178042.45
Net margin (Tk./ha)	89493.29	66597.93

BCR (variable cost basis)	1.86	1.99
BCR (total cost basis)	1.30	1.23

Source: Farmer's household survey, 2021

Although conventional country bean farming had higher BCR than organic country farming, organic farming is more sustainable than conventional farming. For present situation, it seems to be profitable for conventional country bean farming. But it is not good for soil as it needs chemical fertilizer for country bean production. In the long run, the soil will loss fertility and the production system will be hampered and will cause food threat for future generation.

5.6 Discussion

This study found that the seed quantity for organic bean (10.98 kg) production is higher than conventional bean (10.89 kg) production. Average tillage number is higher for conventional farmers (50.97) than organic farmers (50.45). Organic farmers (139.67 man-days) used more family labor than conventional farmers (86.28 man-days). For hired labor, conventional farmers (180.33 man-days) used more than organic farmers (125.69 man-days). Chawdhuri et al. (2014) found that 141 man-days human labor was used for one hectare in Narsingdi district of Bangladesh. In organic farming, farmers only used organic manure (2587.10 kg) for bean production but conventional farmer used chemical fertilizers and pesticides. In this study, total seed cost per hectare organic country bean production was Tk. 16307.29 in Narsingdi district of Bangladesh. Hasan et al. (2014) found that total seed cost of bean production was Tk. 11173/ha in Mymensingh district of Bangladesh. Taslim et al. (2021) found that total seed cost of country bean was Tk. 8408.33/ha in Narsingdi district of Bangladesh. Jobaer (2021) also found that total seed cost of country bean was Tk. 8408/ha in Narsingdi district of Bangladesh. Chowdhuri et al. (2014) also found that the seed cost of country bean was Tk. 2090/ha in Narsingdi district of Bangladesh. This study found that the power tiller cost was Tk. 12897.85/ha for organic country bean production. Power tiller cost for conventional farming was Tk. 12977.13/ha. Hasan et al., (2020) found the power tiller cost was Tk. 11745/ha in Mymensingh district of Bangladesh. According to Taslim et al. (2021), total power tiller cost was Tk. 13322.08/ha in Narsingdi district of Bangladesh. Jobaer (2021) also found that the power tiller cost was Tk. 13004/ha in Narsingdi district of Bangladesh. Chowdhuri et al. (2014) also found that the cost of labor was Tk. 88887/ha in Narsingdi district of

Bangladesh. This research found that hired labor cost was Tk. 63091.82/ha. Hasan et al., (2020) found that total labor cost was Tk. 72156/ha in Mymensingh district of Bangladesh. Taslim et al. (2021) found that total labor cost of country bean was Tk. 63735.37/ha in Narsingdi district of Bangladesh. According to Jobaer (2021), total labor cost was Tk. 63735/ha in Narsingdi district of Bangladesh. In this study, organic bean producing farmers integrated pest management cost was Tk. 7457.76/ha. Hasan et al., (2014) found that the cost of pest management was Tk. 4619/ha in Mymensingh district of Bangladesh. Taslim et al. (2021) also found that pest management cost was Tk. 10390/ha in Narsingdi district of Bangladesh. According to Chowdhuri et al. (2014), pest management cost was Tk. 11884/ha in Narsingdi district of Bangladesh. In organic country bean production, irrigation cost was Tk. 7568/ha. Hasan et al., (2014) found that irrigation cost was Tk. 13831/ha in Mymensingh. Taslim et al. (2021) found that the irrigation cost was Tk. 14546/ha in Narsingdi district of Bangladesh. Jobaer (2021) also found that irrigation cost of country bean was Tk. 14546/ha in Narsingdi district of Bangladesh . In conventional country bean production, urea cost was Tk. 1953.39/ha. According to Chowdhuri et al. (2014), urea cost per hectare was Tk. 975 in Narsingdi district of Bangladesh. Hasan et al., (2014) found that urea cost was Tk. 13108/ha in Mymensingh district of Bangladesh. Taslim et al. (2021) found that the urea cost was Tk. 12526.75/ha in Narsingdi district of Bangladesh. Jobaer (2021) also found that urea cost of country bean was Tk. 12527/ha in Narsingdi district of Bangladesh. TSP cost was Tk. 2673.56/ha for conventional country bean production in this study. Chowdhuri et al., (2014) found that TSP cost was Tk. 3000/ha in Narsingdi district of Bangladesh. Hasan et al., (2014) found that TSP cost was Tk. 6984/ha in Mymensing district of Bangladesh. Taslim et al., (2021) found that the TSP cost was Tk. 9202.17/ha in Narsingdi district of Bangladesh. Jobaer (2021) also found that TSP cost of country bean was Tk.9202/ha in Narsingdi district of Bangladesh. In country bean production, MoP cost was Tk. 3282.30/ha for conventional country bean production. Hasan et al., (2014) found that MoP cost was Tk. 1508/ha in Mymensingh district of Bangladesh. Taslim et al., (2021) found that the MoP cost was Tk. 1415/ha in Narsingdi district of Bangladesh. Jobaer (2021) also found that MoP cost of country bean was Tk. 1415/ha in Narsingdi district of Bangladesh. Chowdhuri et al., (2014) found that MoP cost was Tk. 1300/ha in Narsingdi district of Bangladesh. Total variable cost of organic farming is less than conventional farming. In this study, total variable cost is Tk. 175423.68/ha for organic bean farming and Tk. 206182/ha is for conventional farming. Jobaer

(2021) found that the total variable production cost for country bean was Tk. 151209/ha in Narsingdi district of Bangladesh. According to Taslim et al., (2021) total variable cost was Tk. 151528.31/ha in Narsingdi district of Bangladesh. Chowdhuri et al., (2014) found that total variable cost was Tk. 130876/ha in Narsingdi district of Bangladesh. Hasan et al., (2014) found that total variable cost was Tk. 136487/ha in Mymensingh district of Bangladesh. Total fixed cost is higher for organic country bean farming than conventional farming. Taslim et al., (2021) found that total fixed cost was Tk. 12338.04/ha in Narsingdi district of Bangladesh. Jobaer (2021) found the total fixed cost was Tk. 12,338/ha in Narsingdi district of Bangladesh. Alam et al., (2023) found total fixed cost was Tk. 13,334/ha in Narsingdi district of Bangladesh. In the present study total fixed cost was Tk. 71351.93 per hectare for conventional farming and Tk. 98529.98 per hectare for organic farming. Taslim et al., (2021) found that total cost of country bean was Tk. 163866.35/ha in Narsingdi district of Bangladesh. Hasan et al., (2020) found that total cost of country bean was Tk. 196,198/ha in Mymensingh district of Bangladesh. In this study, total cost of bean cultivation was Tk. 296212.05 per hectare for conventional farming. According to Chawdhuri et al., (2014), total fixed cost of country bean was Tk. 31461/ha in Narsingdi district of Bangladesh. Hasan et al., (2014) found that total cost of bean cultivation was Tk. 193073/ha in Mymensingh district of Bangladesh. Total revenue is higher for conventional country bean farming than organic farming. Hasan et al., (2014) found total revenue of country bean was Tk. 219798/ha in Mymensingh district of Bangladesh. The gross margin and net margin are also higher for conventional farming than organic country bean farming. According to Hasan et al., (2020), net margin of country bean was Tk. 28,601/ha in Mymensingh district of Bangladesh. Chowdhuri et al., (2014) found that gross margin of bean was Tk. 162337/ha and net return was Tk. 184691/ha in Narsingdi district of Bangladesh. Hasan et al., (2014) found that net farm income was Tk. 26724/ha in Mymensingh district of Bangladesh. On total cost basis, benefit cost ratio is higher for conventional farming (1.30) than organic farming (1.23). Taslim et al., (2021) found BCR 1.37 and Jobaer (2021) found BCR 1.375 for Country bean in Narsingdi district of Bangladesh. Chowdhuri et al., (2014) found that returns to scale was 1.41 for country bean in Narsingdi district of Bangladesh. Hasan et al., (2014) found BCR 1.6 on variable cost basis and BCR on total cost basis was 1.1 in Mymensingh district of Bangladesh.

CHAPTER VI

ENDOGENOUS TREATMENT EFFECT ANALYSIS

6.1 Farming decisions

Suppose the choice of a given farmer is binary such that farmers choose to either organic or conventional farming system, the farming decision-making process and impact of organic farming on farm income can be modelled in an optimization framework. Given that farmer want to optimize their utility by maximizing farm output as well as farm income. We can evaluate the gross margin (W^*) associated with organic and conventional farming system, denoted by (K_{Oi}) and (K_{Ci}), respectively. To the extent that only the farming system is known to the researcher, but the farmers preferences like gross margin are known to only the farmer, the gross margin of farmer i which is unobserved is represented by ($W^*=K_{Oi}-K_{Ci}$). The gross margin from organic country bean farming can be expressed with respect to a vector of respondent explanatory variables in a latent variable framework as

$W_i^* = \beta X_i + u_i$ ……..(i)

$W_i^* = 1$, if $W_i^* > 0$ otherwise, $W_i = 0$

Where W is a binary indicator variable that means if a farmer uses organic farming system, W equals to 1 and otherwise it is 0; β is a vector of parameters to be estimated, X includes all the observable factors i. e. Bean farming, bean yield, age of the respondent, education, household size, farm size, number of trainings received, extension contact, farming experience and participate any organization that may influence organic farming decision such as farmers and farm-level characteristics. Here, u is the error term with mean zero.

6.2 Impact evaluation and selection bias

This study observes the impact of organic farming on farmer's gross margin. Given that this vector of outcome is a linear function of observed farm and farmer's characteristics, the outcome variable can be expressed as

$Y_i = \alpha J_i + \eta W_i + e_i$ .....(ii)

where Y_i represents a vector of outcome variable (gross margin); W_i as previously described in (i) is an indicator of farming system; J_i is a vector of observed farm and farmer's characteristics and these characteristics are Bean farming, bean yield, age of the respondent (year), education (year of schooling), household size (number), farm size (decimal), number of trainings received, extension contact (contact=1), farming experience (years) and participate any organization (Participate=1) ; α and η are vectors of parameters to be estimated; e_i is the error term.

In (ii), the impact of adoption on the outcome variable is measured by the estimates of the parameter η. This approach however, may generate biased estimates because the decision of farmers towards farming system is not random or voluntary and may be based on individual self-selection in which case, the undeclared factors, e_i in (ii) tend to influence on u in (i).

This implies that the correlation coefficient of the error terms is not equal to zero, hence OLS tend to yield biased estimates. To cope with this selection bias problem, the PSM approach is commonly used. However, a major drawback of the PSM approach is that it only accounts for observables factors. To simultaneously estimate the determinants and impact of farming, while accounting for both observable and unobservable factors considering the endogeneity of farmer's farming system, the "Endogenous Treatment Effect Model" is employed following Mekonnen (2017).

6.3 Endogenous treatment effect model

The Average Treatment Effect (ATE) is estimated by the endogenous treatment effect model and other parameters of a linear regression model that also includes an endogenous binary-treatment variable. Estimation is by full information maximum likelihood.

This model is expressed in two sets of equations as

Outcome equation: $Y_i = \alpha J_i + \eta W_i + e_i$

And Selection equation: $W_i^* = \beta X_i + u_i$, $W_i^* = 1$, if $W_i^* > 0$ otherwise, $W_i = 0$

Where W_i is the dummy variable indicating the farming system (i.e. W_i =1, if farmer i is in the organic farming system, otherwise W_i =0) and Y_i is the outcome variable of the regression equation (observed for both W_i =1and W_i =0).

$Prob\ (W_i = 1 \mid X_i) = \Phi\ (X_i\beta)$

and

$Prob\ (W_i = 0 \mid X_i) = 1 - \Phi(X_i\beta)$

where e_i and u_i are bivariate normal with mean zero and covariance matrix $\begin{bmatrix} \sigma 2 & \rho\sigma \\ \rho\sigma & 1 \end{bmatrix}$. Here σ^2 is the variance of the disturbance term e_i in (ii), the variance of the error term u_i in (i) is assumed to be 1 and $p\sigma$ is the covariance of e_i and u_i.

6.4 Estimation results and discussion

From the table 6.1, The endogenous treatment effect result shows that organic farming system for country bean has less return than conventional farming system.

The major factors for outcome equation that significantly affect the gross margin are bean farming system (organic or conventional), household size and organizational participation. In the outcome equation, the coefficient is 0.229 and the coefficient is negative. Hence, all things being equal, the farmers who cultivated bean conventionally get 22.9% higher gross margin in comparison to organic bean growers

6.4.1 Bean yield

In the selection equation, the coefficient of bean yield is negative and significant at 1% level.

The result showed that due to increase of higher yield in conventional bean farming. The probability of adoption of conventional farming increase 0.1%.

6.4.2 Age of respondent

In the selection equation, the age of respondent is positive and significant at 5% level. This result showed that if the farmers age increase, then the probability of adoption of organic farming increase 5.3%.

6.4.3 Household size

In the outcome equation, the coefficient of household size is negative and significant at 10% level. This result showed that if Household size increased then gross margin of conventional bean farming increases 2.5% compare with the organic bean production.

6.4.4 Farming experience

In the selection equation, the coefficient of farming experience is negative and significant at 5% level.

This result showed that if farmers farming experience increase, then probability of adoption of conventional farming increase 4.9%.

6.4.5 Participation in any organisation

In the selection equation, the coefficient of participate in any organisation is positive and significant. Participation in any organisation will significantly influence farmers to adopt organic farming.

In the outcome equation, the coefficient of participation in any organisation is positive and significant. Any organizational participation increases gross margin by 14.8% of organic farming than conventional country bean farming.

In selection equation column, we see that bean yield, age of respondents, farming experience and organizational participation were all statistically significant.

Table 6.1 Endogenous treatment effect estimation result of country bean production in the study location.

Items	Outcome equation (ii)			Selection equation (i)		
	Coefficient	Robust SE	P value	Coefficient	Robust SE	P value
	Log of gross margin			Bean farming (organic=1)		
Dependent variable: (log of gross margin)						
Bean farming (organic=1)	**-0.229*** **	**0.032**	**0.000**	-	-	-
Bean yield (kg/ha)	-	-	-	-0.001***	0.0001	0.000

Age of the respondent (year)	-0.002^{NS}	0.003	0.583	0.053**	0.023	0.023
Education (year of schooling)	0.004^{NS}	0.003	0.199	0.023^{NS}	0.018	0.218
Household size (number)	-0.025*	0.013	0.058	-0.050^{NS}	0.074	0.500
Farm size (decimal)	0.000^{NS}	0.0002	0.476	-0.001^{NS}	0.001	0.496
Number of trainings received	0.037^{NS}	0.031	0.237	0.277^{NS}	0.166	0.096
Extension contact (contact=1)	-0.006^{NS}	0.019	0.752	-0.075^{NS}	0.10	0.455
Farming experience (years)	0.002^{NS}	0.003	0.542	-0.049**	0.024	0.049
Participate any organization (Participate=1)	0.148**	0.07	0.032	0.837**	0.40	0.039
Constant	12.158***	0.10	0.000	10.924***	1.26	0.000
Sample size	200					
Log pseudolikelihood	-25.32					
Wald chi^2	58.59					
Probability of chi^2	0.000					
rho	0.89					
sigma	0.23					
lambda	0.21					
Wald test of independent equations (rho=0): chi^2 (1) = 58.91						

Note: NS means not significant
***, ** and * indicates significance at the 1%, 5% and 10% levels respectively

Conclusion: Our main purpose of this analysis is to find the impact of country bean farming system on gross margin. The result of endogenous treatment effect estimation indicates that conventional country bean farming has 22.9% more gross margin than organic country bean farming.

CHAPTER VII

PROBLEMS AND SUGGESTIONS MENTIONED BY COUNTRY BEAN'S FARMER

Farmers face problems from production to marketing of a product. This chapter discussed about the problems faced by both organic and conventional country bean growers and suggestions mentioned by the growers.

7.1 Problems mentioned by organic country bean's farmer

In organic country bean farming, one of the most common problems faced by growers is lack of demand for organic vegetables. While people buying vegetables, a few people about its growing process and asked if it is chemical free or not. But maximum buyers don't ask and only buy vegetable with low prices. From table 7.1, it is seen that all organic farmers faced that problem. 76% growers mentioned about high labor cost. Because of industrialization, many farmers convert their work from farm to industry. There is less workers available for farming and the wage per man days is increasing day by day. Country bean is a seasonal vegetable, so during winter the price is high for few weeks. After that period of time price is low as market is full of supply.

Like other agricultural product, country bean is also highly perishable. 56% farmers mentioned about lack of storage facilities. Farmers get good price when the vegetable is in fresh condition. 58% farmers faced problems with lack of middlemen. If the transportation facility is available, farmers could go to the market where they got their expected buyers. 39% farmers faced problems related with transportation. 61% farmers mentioned about lack of marketing facilities.

Day by day cost of production is increasing, 53% farmers wanted credit facilities. Organic farming requires organic fertilizers and pesticides. 58% growers mentioned that the price of organic fertilizers and pesticides are high. As the farmers can't use chemical pesticides in organic vegetables, so the vegetables have high disease damage which hampers production. 78% famers mentioned about disease damage (table 7.1).

Table 7.1 Problems mentioned by organic country bean's farmer

Problems	Percentage of farmer
Lack of demand	100.0

High labor cost	76.0
Low price at peak season	76.0
Lack of storage facilities	56.0
Lack of middlemen	58.0
Lack of transportation	39.0
Lack of marketing facilities	61.0
Lack of credit facilities	53.0
High price of organic fertilizer	58.0
High disease damage	78.0

Source: Farmers household survey, 2021

7.2 Problems mentioned by conventional country bean's farmer

Conventional farmers use chemical fertilizer for their production. Table 7.2 is listed the problems faced by conventional country bean growers. 73% farmers mentioned about high labor cost. 92% farmers said that the price is low at peak season. Lack of storage facilities is mentioned by 75% growers.

56% farmers faced problems related with lack of middlemen and lack of transportation is mentioned by 62%. 51% farmers want credit facilities and 82% farmers said that price of fertilizers is high. 74% farmers faced problems with high disease damage (table 7.2).

Table 7.2: Problems mentioned by conventional country bean's farmer

Problems	Percentage of farmer
High labor cost	73.0
Low price at peak season	92.0
Lack of storage facilities	75.0
Lack of middlemen	56.0

Lack of transportation	62.0
Lack of credit facilities	51.0
High price of fertilizer	82.0
High disease damage	74.0

Source: Farmers household survey, 2021

7.3 Possible suggestions suggested by organic country bean's farmer

Farmers not only mentioned problems but also suggested some ideas to solve these problems. 72% farmers suggested a market place for organic vegetables. Labor intensive technology for farming was mentioned by 53% growers. 47% farmers wanted storage facilities for keeping their product fresh. Many farmers have no capital for investing. If there is credit facilities with low interest, they would more engage in farming. 50% farmers suggested stable price for vegetable and 39% farmers wanted available transportation. As the price of organic fertilizers is high, so 53% farmers mentioned subsidy in organic fertilizers. 40% growers suggested disease resistance variety for high production.

Table 7.3: Possible suggestions suggested by organic country bean's farmer

Suggestions	Percentage of farmer
Need available market for organic vegetable	72.0
Labor intensive technology for farming	53.0
Need storage facility	47.0
Availability of credit with low interest rate	67.0
Ensuring stable price	50.0
Available transportation	39.0
Subsidy for organic fertilizer	53.0
Disease resistance variety	40.0

Source: Farmer's household survey, 2021

7.4 Possible suggestions suggested by conventional country bean's farmer

Like organic country bean farmers, 45% conventional country bean growers wanted labor intensive technology for farming. 70% farmers mentioned about stable price and 57% farmers mentioned about storage facilities. 50% farmers wanted a market place for country bean and 65% suggested about transportation facilities. Farmers suggested credit availabilities with low interest rate and 95% farmers wanted the government to controlling and monitoring the price of fertilizer. 60% farmers suggested about disease resistance variety for high production.

Table 7.4: Possible suggestions suggested by conventional country bean's farmer

Suggestions	Percentage of farmer
Labor intensive technology for farming	45.0
Ensuring stable price	70.0
Need storage facilities	57.0
Need available market for country bean	50.0
Available transportation	65.0
Availability of credit with low interest rate	83.0
Controlling the price of fertilizer	95.0
Disease resistance variety	60.0

Source: Farmer's household survey, 2021

In both organic and conventional farming, farmers face almost same problems while producing and marketing of country bean. Farmers suggested possible solutions to overcome the problems they mentioned.

CHAPTER VIII

SUMMARY, CONCLUSION AND RECOMMENDATION

8.1 Summary

The research found that country bean production is profitable in the study area. In this study, variable costs for country bean was respectively Tk. 175423.68 and Tk. 206182.76 per hectare for organic and conventional farming, which included seed, labor, land preparation, irrigation, fertilizer, insecticides, bamboo, and other inputs. Then the total fixed cost of country bean production was respectively Tk. 98529.98 and Tk.71351.93 per hectare for organic and conventional country bean.

Total revenue, gross margin, and net margin per hectare for organic farming were Tk. 353466.13, Tk.178042.45 and Tk. 66597.93 respectively. For conventional farming, total revenue, gross margin, and net margin per hectare were Tk. 385705.34, Tk. 179522.58 and Tk. 89493.29 respectively. The benefit-cost ratio on the basis of variable cost was 1.99 and on the basis of total cost BCR was 1.23 for organic farming. For conventional farming, the benefit-cost ratio on the basis of variable cost was 1.86 and on the basis of total cost BCR was 1.30. The endogenous treatment effect estimation result indicates that conventional country bean farming has 22.9% more gross margin than organic country bean farming.

Major problems faced by organic farmers were lack of demand, high labor cost, low price at peak season, lack of storage facilities, lack of middlemen, lack of transportation, lack of marketing facilities, lack of credit facilities, high price of organic fertilizer, high disease damage and major problems faced by conventional country bean farmers were high labor cost, low price at peak season, lack of storage facilities, lack of middlemen, lack of transportation, lack of credit facilities, high price of fertilizer, high disease damage.

8.2 Conclusion and Recommendations

Country bean is a common winter vegetable and in Narsingdi district, this vegetable is grown largely both organic and conventional way. From this study, it is seen that conventional farming is more profitable than organic farming. But in conventional farming chemical fertilizer and pesticides are used and soil is losing fertility day by day. It can cause a threat in food security. But

organic farming is improving soil quality and sustainable. So, from this aspect, farmers need to adopt organic farming in vegetable production. Inorganic country bean contains harmful chemical that causes disease. Besides, organic farming is also profitable. But organic country bean producers face different problems. Government should make farmer's friendly policy for encouraging them to produce organic vegetables commercially. To keep farmers interest to grow organic vegetables, following recommendations are made by this study-

i) People want to buy fresh, bright and big vegetable, but they don't think about the chemical contamination in it. Organic vegetables are healthy but not always look fresh and buyers don't want to buy it. So DAE should increase awareness about organic vegetables and create a market place for organic vegetables growers.

ii) High labor cost increases the total inputs cost and also decrease the profit. So technology based farming should be introduced in vegetable production.

iii) Marginal and small farmers don't have enough money to invest properly in farming. So they need credit facility with low interest rate.

iv) Government should monitor and inspect the inputs price of bean production like price of seed, fertilizer and pesticides. Stable price of inputs to ensure high production and farmers get possible profit from production.

v) If the storage facilities are available, farmers can keep their vegetable fresh until they sell it. So, there will be not over supply during the peak period and price of vegetables will be stable.

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APPENDICES

Survey schedules

Department of Agribusiness and Marketing
Sher-e-Bangla Agricultural University
Dhaka-1207

Research Title: Comparative Profitability between Organic and Conventional Country Bean Farming in Narsingdi District of Bangladesh

Survey Schedule for Organic Vegetable Farmer

Serial No: Date:

1. Name: 2. Spouse Name:
3. Mobile No.: 4. Age:
5. Gender: 6. Family member:
7. Address

   Village: Union:

   Upazila: District:
8. Education (Year of Schooling):
9. Occupation

   Primary: Secondary:

Code: 1 = Agriculture, 2 = Employment, 3 = Day labor, 4: Petty Business, 5: Others

10. Type of farmer:

Code: 1= Owner operator, 2= Pure tenant, 3= Owner cum tenant

11. Farm Type:
Code: 1= Small(0.5-2.49), 2= Medium(2.50-7.49), 3= Large(7.50+)

12. Organic vegetable production: Yes/ No

13. Different characteristics of farmer

Characteristics	Value
1 Age	
2 Education	
3 Father's education	
4 Mother's education	
5 No. of agricultural training(per year)	
6 No. of extension contact (per year)	
7 Years of farming experience (year)	
8 Organizational participation (NGOs, Cooperative)	Yes/ No
9 Farmer has access to TV	Yes/ No

10 Farmer has mobile phone	Yes/ No
11 Famer has internet connection on mobile phone	Yes/ No
12 Homestead area (decimal)	
13 Farm size (decimal)	
14 Organic vegetable production land (decimal)	
15 Farmer used hybrid seed	Yes/ No
16 Total number of technology used in organic vegetable production	
17 Distance from home to local market (km)	
18 Time spent with other farmers(minutes)	
19 Distance to Upazila agriculture office from house(km)	
20 Do you use agricultural apps in your mobile phone?	Yes/ No

14. Cost of organic country bean production per decimal

Costs items	Price(Tk/ Kg)	Total quantity (Kg)	Total cost (Tk)
1. Seed			
2. Power tiller			
3. Labor			
4. Family labor			
5. Hired labor			
6. Organic fertilizer			
7. Manure			
8. Irrigation			
9. Bamboo			
10. Land rent (Tk/ decimal/ season)			
11. Marketing cost			
12. Labor cost			
13. Transportation cost			

15. Profitability of organic country bean production per decimal

Particulars	Value
Total production (Kg/ decimal)	
Price (Tk./ kg)	
Income for selling used materials	

16. Problems with production and marketing of country bean

Problems	Tick Mark
High seed cost	
High labor cost	
Low price during pick season	
Lack of storage facilities	
Lack of marketing facilities	
Lack of middlemen	

Lack of transportation	

17. Different problems faced by farmers for organic vegetable production

Problems	Tick mark
Low price of organic vegetable	
Lack of capital	
Lack of credit facilities	
Lack of storage facilities	
High price of organic fertilizer	
High disease damage	
High insect damage	
Unavailability of organic fertilizer	

18. Possible suggestion mentioned by farmers to solve their problems

Suggestions	Tick mark
Need storage facilities.	
Need capital with low interest rate.	
Need available market for organic market.	
Need high price for organic vegetable.	

Signature of the data collector

Department of Agribusiness and Marketing
Sher-e-Bangla Agricultural University
Dhaka-1207

Research Title: Comparative Profitability between Organic and Conventional Country Bean Farming in Narsingdi District of Bangladesh

Survey Schedule for Inorganic Vegetable Farmer

Serial No: Date:

1. Name: 2. Spouse Name:
3. Mobile No.: 4. Age:
5. Gender: 6. Family member:
7. Address

   Village: Union:

   Upazila: District:
8. Education (Year of Schooling):
9. Occupation

   Primary: Secondary:

Code: 1 = Agriculture, 2 = Employment, 3 = Day labor, 4: Petty Business, 5: Others

10. Type of farmer:

Code: 1= Owner operator, 2= Pure tenant, 3= Owner cum tenant

11. Farm Type:
Code: 1= Small(0.5-2.49), 2= Medium(2.50-7.49), 3= Large(7.50+)

12. Organic vegetable production: Yes/ No

13. Different characteristics of farmer

Characteristics	Value
1. Education	
2. Father's education	
3. Mother's education	
4. No. of agricultural training(per year)	
5. No. of extension contact (per year)	
6. Years of farming experience (year)	

7. Organizational participation (NGOs, Cooperative)	Yes/ No
8. Farmer has access to TV	Yes/ No
9. Farmer has mobile phone	Yes/ No
10. Famer has internet connection on mobile phone	Yes/ No
11. Homestead area (decimal)	
12. Farm size (decimal)	
13. Organic vegetable production land (decimal)	
14. Farmer used hybrid seed	Yes/ No
15. Total number of technology used in organic vegetable production	
16. Distance from home to local market (km)	
17. Time spent with other farmers(minutes)	
18. Distance to Upazila agriculture office from house(km)	
19. Do you use agricultural apps in your mobile phone?	Yes/ No

14. Cost of inorganic vegetable (country bean) production per decimal

Costs items	Price(Tk./ Kg)	Total quantity (Kg)	Total cost (Tk.)
1. Seed			
2. Power tiller			
3. Labor			
a. Family labor			
b. Hired labor			
4. Fertilizer			
a. Urea			
b. Triple Super Phosphate			
c. Di-ammonium Phosphate			
d. Muriate of Potash			
e. Zinc Sulfate			
f. Gypsum			
g. Boric Acid			

5. Manure			
6. Irrigation			
7. Bamboo			
8. Land rent (Tk./ decimal/ season)			
9. Marketing cost			
10. Transportation cost			

15. Profitability of inorganic vegetable (country bean) production per decimal

Particulars	Value
Total production (kg/ decimal)	
Price (Tk./ kg)	
Income for selling used materials	

16. Problems with production and marketing of country bean

Problems	Tick Mark
High seed cost	
High labor cost	
Low price during pick season	
Lack of storage facilities	
Lack of transportation	
Lack of product's price information	

17. Different problems faced by farmers for inorganic vegetable production

Problems	Tick mark
Low price of vegetable	
Lack of capital	
Lack of credit facilities	
Lack of storage facilities	
High price of seed and fertilizer.	
High disease damage	
High insect damage	

18. Possible suggestion mentioned by inorganic vegetable producing farmers

Suggestions	Tick Mark
1. Production	
a) Low price of inputs	

b) Low price of irrigation	
c) Availability of labor	
d) Availability of inputs	
2. Marketing	
a. Low transportation cost	
b. Need storage facilities	
c. Need marketing facilities	
d. Need market to sale vegetables	

Signature of the data collector