COMPARATIVE ECONOMIC ANALYSIS OF BEAN AND BOTTLE GOURD PRODUCTION IN SELECTED AREA OF GOPALGONJ DISTRICT

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CERTIFICATE

This is to certify that thesis entitled, ***"COMPARATIVE ECONOMIC ANALYSIS OF BEAN AND BOTTLE GOURD PRODUCTION IN SELECTED AREA OF GOPALGONJ DISTRICT*** *submitted to the Faculty of AGRIBUSINESS MANAGEMENT, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***MASTER OF SCIENCE*** *in* ***AGRICULTURAL ECONOMICS,*** *embodies the result of a piece of bona fide research work carried out by* ***SHARMIN ZAHAN BITHI****, Registration No:****08-02676*** *under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

3 Dec, 2014

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CONTENTS

CONTENTS (Continue)

CONTENTS (Continue)

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

BAU	= Bangladesh Agricultural University
AVRDC	= Asian Vegetable Research and Development Centre
BBS	= Bangladesh Bureau of Statistics
BER	= Bangladesh Economic Review
GOB	= Government of Bangladesh
GDP	= Gross Domestic Product
BCR	= Benefit Cost Ratio
FAO	= Food and Agricultural Organisation
FFYP	= Fourth Five Year Plan
Fig.	= Figure
Ca	= Calcium
Cal	= Calorie
e.g.	= Example
gm	= Gram
ha	= Hectare
HSC	= Higher Secondary Certificate
SSC	= Secondary School Certificate
i.e.	= That is
kg	= Kilogram
ln	= Natural log
MP	= Muriate of Potash
IU	= International Unit
Tk	= Taka
TSP	= Triple Super Phosphate
DAE	= Department of Agricultural Extension
BARI	= Bangladesh Agricultural Research Institute

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ABSTRACT

The present study was designed with a view to analyze the comparative economic aspects of the selected vegetables such as bean & bottle gourd production. A total of 60 bean & bottle gourd producing farmers were randomly selected from two villages under Gopalgonj sadar and Muksudpur Upazila in Gopalgonj. Mainly tabular analysis was done to achieve the major objectives of the study. Cobb-Douglas production function model was also used to identify and measure the specific effects of the factors on vegetables production. The findings of the study revealed that the productions of selected vegetables were profitable. The per hectare total costs of production of bottle gourd and bean were Tk. 156434 and Tk. 148183, respectively and the corresponding gross incomes were Tk.305000 and Tk. 242500, respectively. The estimated net return of producing bottle gourd and bean were Tk.148566 and Tk.94317, respectively. The results indicate that bottle gourd farmers received the highest gross return and net return compared to bean producers. Functional analysis revealed that the variation of yield was greatly influenced by the human labour, fertilizers, manure and irrigation. These factors were directly or jointly responsible for the variation of yields. The study also revealed that the farmers faced various types of problems, such as lack of irrigation facilities, shortage of human labour, high price of fertilizers and insecticides, non-availability of quality seeds, low market price of product at harvest period, lack of storage facilities and inadequate transportation facilities.

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Chapter I

INTRODUCTION

1.1 Focus of the Study

Agriculture is the foundation of Bangladesh economy and rice is the main food item for the people of the country. Rice alone cannot solve the demand for balanced diet. Nutritional deficiency is a very serious problem of the people of Bangladesh today. Vegetables provide dietary fiber necessary for digestion and health and combating malnutrition, curing nutritional disorders and diseases like anemia, blindness, scurvey, goiter etc., including physical and mental growth.Vegetables also help increase efficiency of labour and span of working life, which eventually influence the economic potentials of the nation. Vegetables are the most inexpensive and rich sources of vitamins. In Bangladesh a good number of vegetables are grown throughout the year both in winter and summer seasons. In view of increase in income, population, and nutritional consideration, there is a great need for vegetable cultivation.

The present nutritional situation of the people of Bangladesh is a matter of great concern. The prime nutritional problem of the country is that of malnutrition. Bangladesh like other developing countries of the world is confronted with the serious problem of hunger, excess population and poverty. The result of these maladies is serious protein-calorie malnutrition the direct victims are the children, and the pregnant and nursing mothers. To overcome this acute problem of protein malnutrition, per capita intake of protein must be increased by the production of protein-rich food through the application of scientific method of agriculture. The major sources of protein are animals and plants. Animal proteins are of generally better quality. But then, for a thickly populated country like Bangladesh, where animal competes with man for land, an excessive increase in animal production is hardly a feasible proposition. Besides, the process of development of animal protein is time consuming, and it requires higher financial inputs for processing, preservation andmarketing. Consequently, animal protein is very scarce and expensive in our country. Nutrition expert believe that quantitative increase in per

capita protein consumption hasto come from plant sources. In Bangladesh about 85% of the total protein consumed came from plant sources (Rashid, 2001).

It is believed that vegetables production can be increased in Bangladesh, particularly in winter season. The winter season is more suitable for vegetables production due to the availability of suitable land and favorable climate. As the winter vegetables are relatively short duration crops, farmers can take advantage of a quick harvest and thereby can increase their farm income and improve nutritional status. Besides local demand, there is a good scope of export of vegetables to Middle East and some European countries. The winter vegetables those were cultivated in the study area were potato, brinjal, cucumber, bottle gourd, beans and the yields of these crops in Bangladesh are lower than those of any other developed and developing country.

In addition to shortage of food grains, vegetables supply in the country is much below the 200 gm/capita/day level of requirement recommended by Asian Vegetables Research Development Country (AVRDC). The situation is further aggravated by the seasonal and annual fluctuations in vegetable production. Vegetables are major and efficient source of micro nutrients considering both per unit area of land and per unit cost of production (Sultana, 2005).

1.2 Importance of Vegetables Production

A good number of vegetables are grown by the farmers of Bangladesh throughout the year. Although there is a great need for commercial vegetables production, farmers usually grow vegetables in and around the homestead areas.In order to make human diet complete and balanced, intake of vegetables is essential. Vegetables are the sources of many essential vitamins such as vitamin A, C, niacin, rivoflavin and thiamin and minerals such as calcium and iron. They contribute to the intake of essential nutrients from other food by making them more palatable. They provide dietary fibre necessary for digestion and health and curing nutritional disorders. As a matter of fact, vegetables are considered to be protective food. Hence vegetables constitute an essential part of balance diet.Dieticians, in general, recommended a daily allowance of 285 gm vegetables and 80 gm pulses for a balanced diet (Ramphall and Gill, 1990). Out of 285

gmvegetables, 85 gm should come from root vegetables, 115gm from green leafy vegetables and 85 gm from other vegetables.Dietary composition based on calorie requirementis shown in Table 1.1.

Table 1.1Dietary composition based on calorie requirement.

Food items	**Daily intake (gm) for**			
	2700 cal. Diet	2332 cal. diet	2200 cal. diet	1900 cal.diet
Cereals	434	397	408	394
Pulses	112	74	58	28
Gur and sugar	29	34	29	29
Meat	16	37	15	-
Milk	64	99	58	_
Fish and eggs	116	26	29	29
Vegetables	634	355	233	256
Fruits	56	31	29	29
Oils	6	17	15	10
Total	1371	1070	874	773

Source: FAO, 1994

The nutritional status of the poor and low income people of Bangladesh has deteriorated over time due to low intake of vegetables, fruits and milk.Table 1.2 shows that vegetables are rich in vitamin and mineral sources (Sultana, 2005).

Table 1.2: Nutrient contents of various food and vegetables products (per 100 gm)

Food items	Water percentage (gm)	Carbohydrate (gm)	Protein (gm)	Fat (gm)	Caloric (cal)	Vitamin(mg)				Minerals(mg)	
						Carotin	B_1	B_2	VitC	Calcium	Iron
Rice	12.60	77.40	8.50	0.06	349	0.01	0.27	0.12	-	10	2.80
Wheat	12.80	71.20	11.80	1.50	346	1.06	0.45	0.13	-	41	4.90
Meat	74.30	-	22.60	2.60	114	-	0.15	0.06	2	10	0.80
Milk	87.50	4.40	3.20	4.10	67	0.01	0.05	0.19	2	120	0.20
Vegetable	88.50	4.30	2.90	0.40	36	6.80	0.06	0.15	54	145	9.00
Tubers	87.50	9.10	1.60	0.10	44	0.58	0.03	0.08	19	84	0.70
Fruits	88.00	8.40	2.20	0.50	46	1.00	0.04	0.02	25	35	0.80
Roots and vegetables	80.70	16.20	1.50	0.20	89	1.34	0.10	0.04	11	24	0.70

Source: Sultana, 2005

The per capita daily production of vegetables in Bangladesh is considerably lower than that of other countries like China, India, Indonesia, Japan, and Thailand. Per capita consumption of vegetables in Bangladesh is the lowest amongst the South Asia and South East Asia. Only 3 percent of total land covering 429000 ha belonged to vegetables cultivation (Rehana, 2006).The daily per capita consumption of vegetables in Bangladesh is only 50 gm against the required amount of 200 gm. This gap causes malnutrition among the people of Bangladesh, since almost all vegetables are rich in vitamins and minerals.

For several decades, Department of Agricultural Extension (DAE) has been trying to increase crop production simultaneously in the field as well as in homestead garden especially through cultivation of winter vegetables. The production of vegetables, and the knowledge of nutrition did not get adequate importance in the past. In order to popularize vegetable cultivation, Bangladesh Agricultural

Research Institute (BARI) initiated a project named intensive vegetable production project.

Table: 1.3Per capita consumption of vegetables in some Asian countries

Country	Per capita consumption of vegetables(gm/day)
Bangladesh	50
China	292
India	80
Indonesia	117
Japan	432
Thailand	257

Source: Rehana, 2006

1.3 Production of Bean and Bottle Gourd in Bangladesh

The problems of malnutrition and ill health can be reduced to a great extent by taking leafy and green fleshy vegetables like bean and bottle gourd which supply sufficient amounts of carbohydrate, vitamins, minerals and protein in the human diet. The vegetables which are generally grown during October to March in Bangladesh have been termed as winter vegetables. The present study has been conducted on two winter vegetables- bean and bottle gourd**.**

Bean

Leguminous crops like beans play a vital role to meet up our protein requirement. Beans contain 20-30% protein on a dry weight basis which is nearly three times than that in most cereals. Among all the leguminous crops, beans are very popular and nutritious vegetables in Bangladesh. Beans provide a good amount of protein in addition to vitamins and minerals. In Bangladesh total land area under bean cultivation is 15385 hectares and the production is 83,000 metric tons during 2006-2007(BBS,2008). There is a great demand of bean seeds in the overseas market which may open a new horizon of export of this vegetables in those markets. Hundreds grams of green pods of country bean *(Dolichos lablab)* contain 3.8 gm protein, 8 gm carbohydrate, 85 gm moisture, 1.8 gm fiber, 0.7 gm fat,48

kilo calorie heat energy and 312 IU(International unit) carotene (Rehana, 2006). Protein deficiency is a severe problem in Bangladesh where 77% of the population is suffering from insufficient protein intake. Unavailability is the major constraint of consumption, and the availability of protein rich food like bean seeds may be increased by improving post harvest management (Rehana,2006).Hyacinth bean can be grown in a wide range of soil of average fertility. It is adapted to tropical and sub-tropical region.

Bottle gourd

Bottle gourd *(Lagenariasicenarid)* is one of the winter vegetables in Bangladesh. It is commonly known as 'Lau'. It is originated from India or Africa (Aslam,1995).Green bottle gourd are used as curry. Its leaves and tender stem are also used as delicious and nutricious vegetables. It is reported as an easily digestible vegetable which keeps the body cool and prevents constipation. Hundred grams of edible portion of bottle gourd contains about 96 gm water, 1.10 gm protein, 26 gm calcium, 10 gm phosphorus, 0.6 gmfibre, 0.3 mg niacine, 0.6 gm minerals and 0.10 gm fats. It's early production ensures a handsome price for the commercial growers. Leafs and soft steam of bottle gourd are very nutritious and delicious vegetable(Mawla,1998).Area and production of bottle gourd and bean for the period from 2005-2006 to 2009-10 are shown in Table 1.4. There is noticeable variabilities among the existing bottle gourd germplasms of Bangladesh. An understanding of the nature and magnitude of the variability among the genetic stocks of bottle gourd is of prime importance for the breeder. A good knowledge of genetic wealth might also help in identifying desirable cultivers for commercial cultivation.

Table 1.4: Area and production of bottle gourd and bean in Bangladesh

Year	Bottle Gourd			Bean		
	Area(ha)	Production (M.ton)	Yield (M.ton)	Area(ha)	Production (M. ton)	Yield (M.ton)
2000-01	11.012	96	8.72	10.98	50	4.55
2001-02	11.040	96	8.96	11.21	51	4.54
2002-03	11.222	95	8.46	11.47	50	4.35
2003-04	11.69	99	8.46	12.48	59	4.72
2004-05	12.09	101	8.3	13.02	61	4.6

Source: BBS, 2010

1.4 Justification of the Study

Farmers in Bangladesh are traditionally inclined to rice production. Although the agro-climatic condition of Bangladesh are suitable for cultivation of a large variety of crops but 80 percent of the gross cropped area is at present confined to the production of rice and wheat. The increase in the production of rice and wheat, however, will not be sufficient to meet the food requirements of the growing population of Bangladesh. Since the mid sixties all the governmental programs have been aimed to achieving self-sufficiency in food grain production. This illusive chasing towards self-sufficiency in food grain production led to adverse effects on the acreage and production of winter crops. As a result, the people of Bangladesh is suffering from severe malnutrition.

Realizing the above situations, the government of Bangladesh has recently placed greater importance on crop diversification strategy to reduce the dependence on rice cultivation. The fourth five year plan has categorically emphasized the importance of crop diversification on valid agronomic, nutritious and economic reasons. The government of Bangladesh has also placed much emphasis for increasing employment opportunities and income of the farmers.

Before giving emphasis on the production of these crops, relevant and adequate information on different aspects of production of these crops at farm level are required. Such knowledge of production is also necessary to make appropriate decision by the growers especially when several alternatives are open to them.

However, little systematic economic investigations on these crops have been undertaken either by the government or private organization in order to satisfy the demand of extension workers, policy makers, research personnel and the farmers.

For these reasons, an attempt has been made to analyse and compare the relative profitability of bean and bottle gourd production. Thus the results of the analysis are likely to be helpful to farmers as well as policy makers in providing information for taking appropriate production decisions of these crops. This study might help extension workers to learn the various problems of the selected winter vegetables growers, so that they can equip themselves with adequate knowledge for giving solution to the farmers.

1.5 Objectives of the Study

Thegeneral objectives of this study was to asses the comparative profitability of bean and bottle gourd production. However the following specific objectives were spelled out.

1. To investigate socio-demographic profile of selected farm households.
2. To compare the costs and returns of bean and bottle gourd production.
3. To determine the factors influencing bean and bottle gourd production.
4. To identify the major problems associated with production and marketing of the bean and bottle gourd production.

Chapter II

REVIEW OF LITERATURE

The purpose of this chapter is to review the research works related to the present study. The economic studies on winter crops, specially vegetables are limited in Bangladesh.

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

Aslam (1995) conducted a study on a comparative economic analysis of winter crop production in an area under Gauripurthana in the district of Mymensingh. He studied economic aspects of winter crop such as potato, bringal, bottle gourd, bean , cucumber, sweet potato, mustard and ground nut. He found that the per hectare gross expenses of HYV potato, LV potato, brinjal, bottle gourd, bean, cucumber, sweet potato, mustard and ground nut were Tk.43956,Tk. 34892,Tk. 41893,Tk. 45219, TK. 42224, Tk.27362, Tk.20475 and Tk. 11970 while the per hectare gross return and net return were Tk.77000 and Tk.3303, Tk. 53648 and Tk.18756, Tk.72061 and Tk.30168,Tk.80261 and Tk.12524, respectively. He also found that the variation in yield was greatly influenced by the use of human labour, animal labour, application of fertilizers and date of transplanting and sowing. The factors were directly or jointly responsible for variation in winter crop yields

Mawla (1998) conducted a research on some selected winter vegetables in a in a selected area of Norshingdi district. He included winter vegetables namely cauliflower, cabbage, tomato, radish, bean and bottle gourd. He conducted his study in three villages namely Jalalabad, Baroycha and Hossen Nagar of Narayanpur union under Balbo thana of Norshingdi district. He found that per hectare gross expense of cauliflower were Tk. 50875; while the per hectare gross return, net returns above gross expenses and cash expenses were Tk. 68580, TK.17750 and Tk.

43665,respectively. Gross expensefor producing per hectare of cabbage was Tk. 51794 of which cash and non cash expenses shared 49 percent and 59 percent, respectively. Net return above gross expenses and net return above cash expenses were Tk. 69848, Tk.18052 and Tk. 44509 per hectare, respectively. Gross expense for producing per hectare of tomato was Tk. 5505, while the per hectare gross return, above cash expenses were Tk. 46200, Tk. 12500, and Tk.30220, respectively. The per hectare gross expense and gross return of bean production were estimated at Tk.38772 and Tk.47513 while the per hectare net returns above gross and cash expenses amounted to Tk. 8741 and TK.35475, respectively. Gross expenses for producing bottle gourd per hectare were Tk. 43614 while the per hectare gross return, net returns above gross expenses and net return above cash expenses were Tk. 58480, TK.14866, and TK. 40989 , respectively.

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

Pramanik (2008) carried out a research on Vegetables production strategy in Rajshahi region of Bangladesh. This study was conducted at six villages namely Tonapara, Mypara, Noapara, Shakepara, Bharuahra and Tarapur of Puthiaupazilla under Rajshahi district of Bangladesh during the period from January to June 2008 to find out the profitability of vegetables production, to examine the input use pattern in vegetables production, identify the problems lie in production of vegetables in Rajshahi Region.. The gross return and margin was the highest in tomato (Tk. 510000/ha, Tk. 338630/ha) followed by brinjal (Tk.495000./ha; Tk.324080/ha) and cauliflower (Tk.440000/ha; Tk.274640/ha) and the lowest in

white gourd (Tk.220000/ha; Tk.59638/ha) and sweet gourd (Tk.225000/ha;Tk. 63240/ha). The total cost was highest in potato (Tk.183760 /ha) followed by tomato (Tk.171370/ha) and brinjal (Tk.170920/ha) and red amaranth (Tk.38650/ha) and spinach (Tk. 89830/ha). Among the vegetables crop tomato gave higher benefit cost ratio (2.98) followed by brinjal (2.90) and cauliflower (2.66) and white gourd (1.37) and sweet gourd (1.39). Considering the yield cost and return the tomato, brinjal, cauliflower, cabbage and bottle gourd cultivation were more profitable in Rajshahi region of Bangladesh

It may be concluded from the above discussion that there are large number of studies conducted on vegetables production but a little research conducted on comparative economic analysis of bean and bottle gourd production. The present study aims to examine the profitability of bean and bottle gourd production in some selected areas of Gopalgonj district. Thus, the results of the study are expected to provide useful information which would help farmers and researchers.

Chapter III

METHODOLOGY

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

3.1 Selections of the Study Area

Selection of the study area is an important step in a farm management study and it largely depends upon the objectives set for the study. Therefore, careful thought has to be given to select an area where a particular set of objectives can be fulfilled. Keeping in view the objectives, one village namely Bongram of Muksudpurupazila and another village Nizra of Gopalgonjsadar of Gopalgonj district were selected.

The main criteria behind the selection these villages were:

- Most of the winter vegetables such as bean and bottle gourd are grown abundantly in these villages.
- Familiarity of the researcher with the language and other socioeconomic characteristics of the farmers in the selected villages and the high anticipated cooperation from the respondents to obtain reliable data.
- No study of this type was carried out previously in these area.

3.2 Selection of Sample and Sampling Technique

In selecting samples for a study two factors need to be taken into consideration. The sample size should be as large as to allow for adequate degrees of freedom in the statistical analysis. On the other hand, administration of field research, processing and analysis of data should be manageable within the limitation imposed by physical, human and financial resources. However, because of diversity in the technical and human environment, it is necessary to sample several numbers of the population before any conclusion can be drawn. Therefore, the purpose of sampling is to select a sub-set of the population that is representative of the population (Rahman 1993).

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

Table 3.1: The number of sample of bean and bottle gourd growers

Vegetables Produced	No. of farmers selected
Bottle Gourd	30
Bean	30

Source: Field survey, 2015

At first two upazila were selected from Gopalgonj district. Then two villages were selected from two upazila. Total number of population was 100. Among them 60 vegetable farmers, taking 30 farmers for bean and 30 farmers for bottle gourd, were randomly selected. Thus, the selected farmers were interviewed to achieve the ultimate objectives of the study.

3.3 Preparation of the Survey Schedule

In conformity with the objectives of the study, a draft survey schedule was prepared in such a way that all factors associated with the phonemic organization and performance ofthe farm business could be included. A set of interview schedule was prepared for eliciting desired information from the farmers. The draft survey schedule was pretested by interviewing some farmers. In the pretest

survey, attention was paid to inclusion of any new information which was not included in the draft schedule. Thus, the draft schedule was improved, rearranged and modified in the light of the actual and practical experiences. After making necessary adjustments, a final survey schedule was developed in logical sequences.

3.4 Study Period and Period of Data Collection

In the present study, necessary information were collected by the author herself through personal interviews. Data were collected during the period from July, 2015 to September, 2015.

3.5 Method of Data Collection

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

3.6 Analytical Technique

Data were analyzed with the purpose of achieving the objectives of the study. In order to arrive at a meaningful conclusion, tabular technique and statistical analysis were employed i.e. tabular technique; correlation or regression analysis etc. To explore the relationship between production and inputs used, Cobb-Douglas production function was used.

3.7 Tabular Technique

Tabular technique is a well known and widely used technique to show the results of farm management study because it is simple, convenient and very easy to understand. Per hectare net return of selected vegetables were calculated by using the following algebraic equation presented below.

To determine the net returns of bottle gourd and bean production the following equation was used

$$\pi = P_y Y_y + P_b Y_b - \sum_{i=1}^{n} P_{xi} X_i - TFC$$

Where,

π = Net return (Tk./ha)

P_y = Per unit price of the product (Tk./kg)

Y_y= Quantity of the product (kg/ha)

P_b=Per unit price of by product (Tk./ha)

Y_b=Quantity of by product (kg/ha)

P_{xi}= Per unit prices of i^{th} inputs (Tk/kg)

X_i= Quantity of the i^{th} inputs per hectare (kg/ha)

TFC = Total fixed cost (Tk)

i = 1, 2, 3,..., n (number of inputs)

3.8 Functional analysis

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

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

The specification of the Cobb-Douglas production function model was as follows:

$$Y_i = \alpha\ X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta 7} e^{ui}$$

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

$$In\ Y = \ln \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + u$$

Where,

a = Constant or Intercept

Y = Gross return (Tk/ha)

X_i = Human labour cost (Tk/ha)

X_2 = Land preparation cost (Tk/ha)

X_3= Seed/ Seedling cost (Tk/ha)

X_4= Fertilizer and manure cost (Tk/ha)

X_5 = Irrigation cost (Tk/ha)

X_6 = Insecticides cost (Tk/ha)

X_7 = Fence and Mancha cost (Tk/ha)

$\beta_1, \beta_2, ...\beta_3$ = Coefficient of respective variables:

ln = Natural logarithm

e = Base of natural logarithm

u_i = Error term.

3.9 Procedure for Computation of Costs and Returns

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

3.9.1 Cost of human labour

One of the most important input used in the production process of winter vegetables was human labour. Human labour was classified into two: (i) family

labour for which no cash payment was made by the farmers and ii) hired labour for which farmers had to pay in cash. To determine the cost of family labourthe opportunity cost concept was used. In this study the opportunity cost of family labour was assumed to be the market wage rate i.e the wage rate which the farmers actually paid to the hired labour. In the study a man day was considered to be 8 hours of work by an adult man. For female and children, the working day assumed to be 6 and 4 hours of work of an adult man, respectively. The daily wage rate varied from Tk 250 to Tk 300 per man-day in the study area.

3.9.2 Land preparation cost

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

3.9.3 Cost of seeds

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

3.9.4 Cost of fertilizer

The farmers used four kinds of fertilizers, namely, urea, triple super phosphate(TSP), muriate of potash (MP), and Gypsum. The cost of chemical fertilizers were charged on the basis of actual payment made by the farmers for their purchases.

3.9.5 Cost of insecticides

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

3.9.6 Irrigation charge

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

3.9.7 Cost of manures

For producing bean and bottle gourd most of the farmers used manures, such as cowdung. The costs of purchased cowdung were calculated at the prevailing local market price. It was also charged for farm supplied manures.

3.9.8 Cost of fencing and mancha

Wire, bamboo, dhaincha and other sticks were used for making mancha and fencing the crop plots. In this study, these were used for potato, brinjal, cucumber, bean and bottle gourd cultivation. The costs offences were estimated at the prevailing market rate.

3.9.9 Interest on operating capital (IOC)

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

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

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

3.9.10 Land use cost

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

3.9.11 Returns

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

Chapter IV

SOCIOE DEMOGRAPHICPROFILE OF HOUSEHOLD POPULATION

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

4.1 Composition of the Family Size

Family size is important in relation to production of enough food grain for farm family. In this study family has been defined as the total number of persons living together and taking meals from the same kitchen under the control of one head of the family. The family members considered as wife, sons, unmarried daughter, father, mother, brother and other relatives who live permanently in the family.

Table 4.1: Family size and distribution of household members

Farmers	Family member (No)	Less than 1 5 years		15-60 years (working member)		Average family size
		Male	Female	Male	Female	
Bean farmers	140	30	25	50	35	4.66
Bottle gourd farmers	134	30	25	47	32	4.46

Source: Field survey, 2015

The sample of 60 household in the study area comprised a total population of 274 , among them 80 were male and 60 were female in case of bean farmers.On other hand, in the case of bottle gourd farmers the male and the female were 77 and 57, respectively. The average family size of bean and bottle gourd producing farmer was 4.66 and 4.46, respectively.

4.2 Age

In this study bean and bottle gourd farmers were classified into different age groups i.e. as less than 5 and 5 to 14, 15 to 55 and above 55 years.Table 4.2 indicates that in the case of Bean producing household 11 percent members belonged to less than 5 years of age group, 28 percent belonged to 5-14 age groups, 55 percent belonged to 15-55 years group and 6 percent belonged to the age group of above 55 years. Besides, in the case of bottle gourd farmers 9 percent belonged to less than 5 years of age group, 32 percent belonged to 5-14 years of age group, and 54 percent belonged to 15-55 years of age group and 5 percent belonged to above 55 years of age group. It is evident from the Table 4.2 that the age of 15-55 was the highest which was working age and age groups above 55 and less than 5 years were the lowest which considered as dependent class both for the bean and bottle gourd farmers.

Table 4.2: Age distribution of the members of sample farm families

Age groups (years)	Bean farmers	Bottle gourd farmers	All farmers
	n=140	n-134	n=274
0-<5	11	9	10
5-14	28	32	30
15-55	55	54	54
>55	6	5	6
Total	100	100	100

Source: Field survey, 2015

4.3 Education

Education was considered as the key factor for transforming technology. An educated farmer is inclined to take the new technology and motivated towards progress. It is because of the fact that education changes the psychology of the

farmers. The present study has been categorized the respondent family into six categories on the basis of educational qualification.

Table 4.3: Educational status of household members

Level of literacy	Bean farmers	Bottle gourd fanners
	% of family members n=140	% of family members n=134
Illiterate	38	33
Primary (I-V)	31	27
High School (VI-IX)	14	13
Secondary School Certificate	13	19
HigherSecondary Certificate	2	4
Graduate & above	1	4
Total	100	100

Source: Field survey, 2015

Table 4.3 showed that in the case of bean farmers 38 percent were illiterate. The rate of illiteracy was higher in bean producing household members than those of bottle gourd producing household. Primary education is high in bean producing household and secondary education is high in bottle gourd producing household.13percent had completed S.S.C examination, 2 percent completed their higher school secondary certificate course, 1 percent obtained degree in case of bean producing household members. On the other hand, in case of, bottle gourd producing household,19 percent completed SSC level, 4 percent completed HSC level and 4 percent obtained graduation. The overall level of education was to be found relatively better for bottle gourd producing household members. The literacy rate was found to be 62 percent and 67 percent for bean and bottle gourd producing household members,respectively.

4.4 Occupation

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

Table 4.4: Occupational status of the household heads of the sample farmers

types or occupation	Bean farmers		Bottle gourd farmers	
	Main occupation (no.)	Percentage of total	Main occupation (no.)	Percentage of total
Agriculture	23	77	25	83
Business	4	13	3	10
Service	3	10	2	7
Total	30	100	30	100

Source: Field survey, 2015

Table 4.4 showed thatin case of bean producing farmers 77 percent were engaged in agriculture, 13 percent in business and 10 percent in service.Whereas 83 percent were engaged in agriculture, 10 percent in business and 7 percent in service of bottle gourd producing farmers.

4.5 Farm Size

Farm size is measured by the entire land area operated by the operator. It is computed by adding the area of land owned and the rented in from others and subtracting the area rented to others. It includes both homestead area and the area used for woods, pasture and crops. In the present study, the size of farm has been defined as the cultivated land

= (Own + Rented in + Mortgaged in - Rented out- Mortgaged out) during the year of investigation.

Table 4.5 Distribution of sample farmers by farm size

Categories of farmers	Bean farmers		Bottle Gourd farmers		All farmers	
	No.	Percent	No.	Percent	No.	Percent
Small farmers (0.2-1 .0 ha)	19	63	16	53	35	58
Medium farmers (1.01-2.0 ha)	8	27	9	30	17	28
Large farmers (above 2.0 ha)	3	10	5	17	8	13
All farmers	30	100	30	100	60	100

Source: Field Survey, 2015.

Table 4.6: Land ownership pattern of the sample farm households

Land ownership and tenurial arrangement	Amount of land (ha)	
	Bean	Bottle Gourd
a. Own land	0.863	0.673
b. Rented/mortgaged in land	0.149	0.161
c. Rented/mortgaged out land	0.052	0.032
d. Land allocation for bean and bottle gourd (a +b)-c	0.96	0.802
e. Homestead	0.092	0.082
f. Pond	-	0.025
g. Orchard	0.0078	0.0065
Farm size (ha)	1.05	0.916

Source: Field survey, 2015

Table 4.6 shows the land use pattern of bean and bottle gourd farmers. It shows that average farm size of bean and bottle gourd farmers were 0.96 hectares and 0.802 hectares respectively. Table 4.6 also shows the average size of homestead, pond orchard, land of the sample farmers. On an average bean and bottle gourd farmers possessed about 1.05 hectare of and 0.916 hectare of land, respectively.

Chapter V

PROFITABILITY OF BEAN AND BOTTLE GOURD PRODUCTION

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

5.1 Variable Cost

5.1.1Cost of human labour

Human labour was one of the most important and largely used inputs in producing both bottle gourd and bean. It may be noted that in the case of bottle gourd production a total of 300 man-days of human labour were required per hectare .The per hectare total cost of human labour was Tk. 82500 for bottle gourd production. The study revealed that weeding and mulching consumed the largest amount of human labour in producing bottle gourd, which was 30.01 percent of total labour cost. In the case of bean production, total human labour requirement was 296 man-days per hectare. Per hectare total cost of human labour was Tk. 81400 for bean production (Tables 5.2).In the case of bottle gourd production, total human labour requirement was 300 man-days per hectare. Per hectare total cost of human labour was Tk. 82500 for bean production (Tables 5.1).

5.1.2 Cost of land preparation

Power tiller was used by the farmer for land preparation for producing both bottle gourd and bean. The farmers paid the charge for power tiller use at a fixed rate prevailing in the study area. The power tiller cost for bottle gourd and bean was Tk.2000, per hectare which shared 1.27 percent and 1.34 percent of total cost, respectively.

Table 5.1: Per hectare cost of human labour for bottle gourd production

Items of cost	Total labour (Person-days)	Total cost (Tk)	Percentage of total
Land preparation	30	8250	10.00
Sowing/Transplanting	20	5500	6.66
Weeding and mulching	90	24750	30.01
Fertilizer, manure and insecticide applications	50	13750	16.66
Irrigation	18	4950	6.00
Harvesting and carrying	70	19250	23.33
Other (Fencing and Mancha making, guarding, etc.)	22	6050	7.33
Total cost	300	82500	100

Source: Field survey, 2015.

Table 5.2: Per hectare human labour cost of bean production

Items of cost	Total labour (Person-days)	Total cost (Tk)	Percentage of total
Land preparation	40	11000	13.51
Sowing/Transplanting	30	8250	10.13
Weeding and mulching	56	15400	18.91
Fertilizer, manureand insecticide applications	38	10450	12.82
Irrigation	18	4950	6.08
Harvesting and carrying	92	25300	31.08
Other (Fencingand mancha making, guarding, etc.)	22	6050	7.43
Total	296	81400	100

Source: Field survey,2015

5.1.3 Cost of seeds

The cost of seed is the single most important cost item for bottle gourd and bean production. In the study area, it was found that farmers used both home supplied andpurchased seeds. The total amount of seed requirement per hectare for producing bottle gourd and bean were 0.5 kg and 2kg, respectively.The average prices of seeds were Tk.7500, and Tk. 600 per kg for bottle gourd and bean, respectively. Table 5.3 shows that the total cost of seeds for bottle gourd was Tk. 3750, which shared 2.39 percent of total cost. In case of bean cultivation, cost of seeds was Tk. 1200, which shared 0.81percent of total cost (Table 5.5).

5.1.4 Cost of fertilizer

Farmers used urea, TSP, MP and gypsum. All the fertilizers were purchased, cost of fertilizers were estimated according as the cash price paid by farmers.Per hectare fertilizer cost of bottle gourd production was Tk. 19000 which represent 12.14 percent of the total cost(Table 5.3). On the other hand,per hectare fertilizer cost of bean production was Tk. 17500 which represent 11.80 percent of the total cost (Table 5.5)

Table: 5.3: Per hectare costs of bottle gourd production

Items	Unit	Quantity (piece)	Price per unit (Tk.)	Total value/cost (Tk.)	Percent of return/grosscost
Human labour	Man-day	300	275	82500	52.73
Land preparation				2000	1.27
Seed	Kg	0.5	7500	3750	2.39
Fertilizer				19000	12.14
Irrigation charge	Tk.			10000	6.39
Insecticides	Tk.			3000	1.92
Manure	Tk.			1500	0.96
Fence and Mancha	Tk.			13000	8.31
IOC	Tk.			1684	1.01
A.Total Variable Cost				**136434**	
Land used cost	Tk.			20000	12.78
B.Total Fixed Cost				**20000**	
C.Total Cost (A+B)				**156434**	100

Source: Field survey, 2015

5.1.5 Cost of irrigation

Irrigation water is an important input in winter vegetables cultivation. Per hectare cost of irrigation water was Tk. 10000 for bottle gourd, and Tk. 9000 for bean which represented 6.39 percent and 6.07 percent of their respective total cost (Table 5.3 and Table5.5)

Table: 5.4: Per hectare costs and return of bottle gourd production

Items	Unit	Quantity (piece)	Price per unit (Tk.)	Total value/cost (Tk.)
Main product	Piece	12000	25	300000
By product				5000
A.Gross Return				305000
B.Total Variable Cost				136434
C.Total Cost				156434
Gross Margin (A-B)				168564
Net Return (A-C)				148566
BCR(Undiscounted)				1.94

Source: Field survey, (2015)

5.1.5 Cost of insecticides

The cost of insecticides was calculated on the basis of actual money paid. The cost of insecticides amounted to Tk. 3000 per hectare for bottle gourd and Tk. 2500 for bean production, which occupied 1.92 and 1.61 percent of their respective total cost (Table5.3 and Table 5.5).

5.1.6 Cost of manure

It was found that most of the farmers used cowdung as manure in producing vegetables (bottle gourd and bean). The cost of cowdung was Tk. 0.50/kg . Per hectare cost of manure was Tk. 1500 and Tk. 1200 for producing bottle gourd and bean, respectively.

5.1.7 Cost of fence and mancha

Fence andmancha is an important item for bottle gourd and bean production. Cost of fence and mancha amounted to Tk. 13000 and Tk. 12000 per hectare for bottle gourd and bean production, which occupied 8.31 percent and 8.09 percent of their respective total cost (Table 5.3and Table 5.5).

5.1.7 Interest on operating capital (IOC)

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

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

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

5.1.8 Total variable cost

The summation of the costs of variable inputs gave the total variable costs which were Tk. 136434 and Tk. 128183 per hectare for bottle gourd and bean production respectively. In percentage term total variable costs covered 87.21 percent and 86.50 percent of total costs for bottle gourd and bean respectively.

5.2 Fixed Costs:

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

5.2.1 Land use cost

Land use cost was calculated by using per hectare cash rental value of land. Land use cost was estimated for the cropping period of three months for bottle gourd and bean production. The land use cost per hectare was Tk. 20000 for bottle gourd and Tk. 20000 for Bean production. Land use cost covered 12.68 and 13.49 percent of total cost of bottle gourd and bean production respectively (Tables 5.3and Table 5.5).

5.3 Gross Cost

Tables 5.3 and Table 5.5 showed that per hectare gross cost for producing bottle gourd and bean production were Tk. 156434 and Tk. 148183 respectively. Per hectare gross cost of bean was lower than bottle gourd due to higher amount of seed cost incurred in producing bottle gourd.

Table: 5.5: Per hectare costs of bean production

Items	Unit	Quantity	Price per unit (Tk)	Total value/cost (Tk)	Percent of return/gross cost
Human labour	Man-day	296	275	81400	54.8
Land preparation				2000	1.34
Seeds	Kg	2	600	1200	0.81
Fertilizer				17500	11.80
Irrigation	Tk.			9000	6.07
Insecticides	Tk.			2500	1.61
Manure	Tk.			1200	0.70
Fence and Mancha	Tk.			12500	8.45
IOC	Tk.			1583	1.06
A.Total Variable Cost				**128183**	
Land used cost	Tk.			20000	19.07
B.Total Fixed Cost				**20000**	
C.Total Cost (A+B)				**148183**	100

Source:Field survey, 2015

5.4 Gross Return from Bottle Gourd and Bean Production

The average market price of bottle gourd and bean was Tk.25 per piece and Tk. 20 per kg respectively. The per hectare average yield of bottle gourd was 12000 pieces (Table 5.4) and the per hectare average yield of bean was 12000 kg (Table

5.6). The average per hectare gross returns were Tk. 305000 and Tk. 242500 for bottle gourd and bean production respectively.

Table: 5.6: Per hectare costs and return of bean production

Items	Unit	Quantity	Price per unit (Tk.)	Total value/cost (Tk.)
Main product	Kg	12000	20	240000
By product				2500
A.Gross Return				242500
B.Total Variable Cost				128183
C.Total Cost (A+B)				148183
Gross Margin (A-B)				114317
Net Return (A-D)				94317
BCR(Undiscounted)				1.63

Source: Field survey, (2015)

5.5 Net Return

Net return was calculated by subtracting gross cost from its gross return. Per hectare net return from bottle gourd was Tk. 148566, from bean was Tk. 94317 (Table 5.4 and Table 5.6). So it can be concluded from this study that bottle gourd production is more profitable than bean production.

5.6 Benefit-Cost Ratio (Undiscounted)

In this study, BCR (undiscounted) was found 1.94 and 1.63 for bottle gourd and bean production, respectively (Table 5.4 and Table 5.6). It implies that one taka investment in bottle gourd production generated Tk. 1.94 and one taka investment in bean production generated Tk. 1.63.From the above calculation it was found that both production are profitable but bottle gourd production is more profitable than bean production.

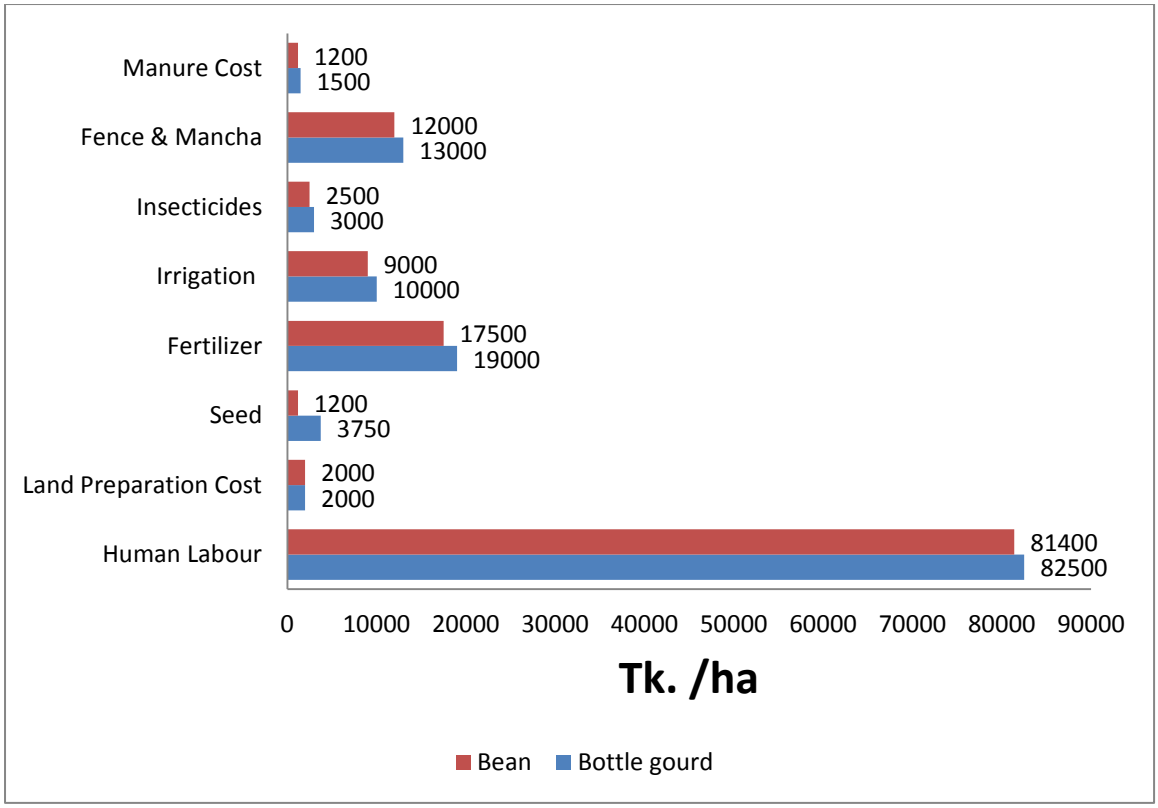

Figure 5.1: Variable cost items of bottle gourd and bean production.

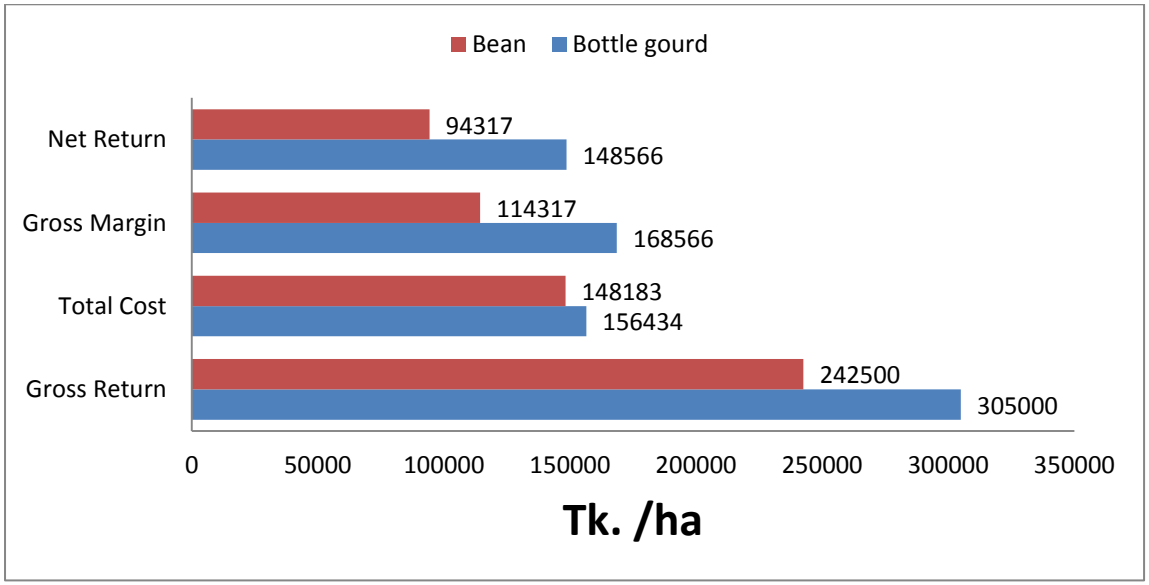

Figure 5.2 Gross return, Total cost, Gross margin and Net return of bottle gourd and bean production.

5.7 Comparative Profitability of Bottle Gourd and Bean Cultivation

In determining the comparative profitability of bottle gourd and bean it was found that per hectare yield, cost and net return of bottle gourd were higher than those of bean.Total variable cost of bottle gourd production per hectare is Tk. 136434 which is higher than the variable cost of bean production, Tk. 128183. Figure 5.2 shows that between bottle gourd and bean cost of production per hectare was higher in producing bottle gourd. The cost of production of bottle gourd per hectare was estimated at Tk. 156434.Theper hectare cost of production of bean was amounted to Tk. 148183 respectively. Table 5.4 and Table 5.6 also shows that per hectare gross return from bottle gourd and bean were Tk. 305000 and Tk. 242500, respectively.Theper hectare yield was highest for bottle gourd as well as the net return per hectare was also the highest for bottle gourd. The per hectare net return of bottle gourd and bean were amounted to Tk. 148566 and Tk. 94317 respectively. Benefit cost ratio(undiscounted) comprised 1.94 and 1.63 was for bottle gourd and bean, respectively.The per hectare cost and return of producing bottle gourd was higher than the per hectare cost and return of producing bean. Due to per hectare gross return of producing bottle gourd is higher than that of producing bean , BCR(undiscounted) was higher in bottle gourd than bean.

From the above discussion it was considered that bottle gourd cultivation is relatively profitable than bean cultivation.

Chapter VI

FACTORS AFFECTING THE PRODUCTION OF BOTTLE GOURD AND BEAN

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

6.1 Factors Contributing to Yield and Economic Return

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

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

$$Y_i = \alpha\ X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta 7} e^{ui}$$

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

$$In\ Y = \ln\alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + u$$

Where,

a = Constant or Intercept

Y = Gross return (Tk./ha)

X_1= Human labour cost (Tk./ha)

X_2 = Land preparation cost (Tk./ha)

X_3 = Seed/ Seedling cost (Tk./ha)

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

X_5 = Irrigation cost (Tk./ha)

X_6 = Insecticides cost (Tk./ha)

X_7 = Fence and Mancha cost (Tk./ha)

$\beta_1, \beta_2, ...\beta_3$ = Coefficient of respective variables:

In = Natural logarithm

e = Base of natural logarithm

u_i = Error term.

6.2 Estimated Values of the Production Function Analysis

The estimated values of the coefficients and related statistics of the Cobb-Douglas production functions for bottle gourd and bean have been presented in Table 6.1.

The major features of the model are:

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

6.3 Interpretation of the Results

6.3.1 Human labour cost (X_1)

The magnitude of the regression coefficient of human labour cost were found to be positive and significant at 1 percent level for both bottle gourd and bean production (Table 6.1). Co-efficient of human labour cost(X_1) was 0.243 for bottle gourd and 0.246 for bean production. It implies that one percent increase of human labour cost, keeping other factors constant, would lead to an increase in the yield of bottle gourd and bean by 0.243 and 0.246 percent, respectively (Table 6.1).

6.3.2 Land preparation cost (X_2)

The regression coefficient of power tiller cost (X_2) were positive and significant at 5 percent level for both bottle gourd and bean production.The regression coefficient of power tiller cost (X_2) were 0.108 and 0.109 for bottle gourd and bean production, respectively, which implies that one percent increase of power tiller cost, keeping other factors constant, would lead to an increase the yield of bottle gourd and bean by 0.108 and 0.109 percent ,respectively (Table 6.1).

6.3.3 Seed cost (X_3)

It can be seen from Table 6.1 that regression coefficient of seed were 0.101(significant at 5 percent level) and 0.125 (significant at 5 percent level) for bottle gourd and bean production, respectively, which implies that one percent increase in amount of seed, keeping other factors constant, would result in an increase the yield of bottle gourd and bean by 0.101 and 0.125 percent, respectively (Table 6.1).

6.3.4 Fertilizer and Manure cost (X_4)

The regression coefficient of fertilizer and manure cost were positive and significant at 5 percent level for bottle gourd production and positive and significant at 1 percent level for bean production. This indicates that an increase in one percent of fertilizer and manure cost, remaining other factors constant, would result in an increase the yield of bottle gourd and bean by 0.209 and 0.235 percent, respectively (Table 6.1).

6.3.5 Irrigation cost (X_5)

The regression coefficient of irrigation cost were positive and significant at 10 percent level for bottle gourd production but positive and insignificant for bean production. This indicates that an increase in one percent of irrigation cost, remaining other factors constant, would result in an increase the yield of bottle gourd by 0.055 percent (Table 6.1).

Table 6.1: Estimated values of the coefficients and related statistics of Cobb-Douglas production function of Bottle Gourd and Bean

Exploratory variables	Bottle Gourd		Bean	
	Values of coefficients	t-value	Values of coefficients	t-value
Intercepts	5.733	6.043	5.466	5.588
	(0.948)		(0.978)	
Human labour (X_1)	0.243***	3.418	0.246***	3.337
	(0.077)		(0.073)	
Land preparation cost (X_2)	0.108**	2.196	0.109**	2.144
	(0.049)		(0.050)	
Seed cost (X_3)	0.101**	2.224	0.125**	2.604
	(0.045)		(0.048)	
Fertilizer and manure cost (X_4)	0.209**	2.582	0.235***	2.823
	(0.080)		(0.083)	
Irrigation cost (X_5)	0.055*	1.761	0.005	1.317
	(0.031)		(0.037)	
Insecticides cost(X_6)	0.003	0.170	0.012	0.578
	(0.017)		(0.020)	
Fence and Mancha cost (X_7)	0.043	0.659	0.023	0.353
	(0.065)		(0.066)	
R^2	0.889		0.882	
F-value	25.087***		23.551***	
Return to scale	0.762		0.755	
Sample size	30		30	

Source: Field survey, 2015

*** Significant at 1 percent level

** Significant at 5 percent level

* Significant at 10 percent level

6.3.6 Insecticides cost (X_6)

It can be seen from Table 6.1 that the magnitude of the regression coefficient of insecticides cost were 0.003 and 0.012 with a positive sign but insignificant for both bottle gourd and bean production.

6.3.7 Fence and Mancha cost (X_7)

The magnitude of the regression coefficient of fence and mancha cost were found positive but insignificant for both bottle gourd and bean production (Table 6.1).

6.4 Performances of the Bottle gourd and Bean Production Model

The Adjusted (R^2) were found to be 0.889 and 0.882 for bottle gourd and bean, respectively. It indicated that about 88.9 percent of the total variations in yield of bottle gourd and 88.2 percent of the total variations in yield of bean could be explained by the explanatory variables included in the model (Table 6.1). Other 11.1 percent and 11.8 percent variation of total yield depend on the factors which were not included in the regression model of bottle gourd and bean, respectively. The F-values of bottle gourd and bean production were 25.087 and 23.551, respectively and both were significant at 1 percent level, which implied good fit of the model. Highly significant F-value implied that the included variables collectively were important for explaining the variations in the yield of bottle gourd and bean production.

6.5 Returns to Scale in Bottle gourd and Bean Production

The summation of all the regression coefficients of the estimated production function of bottle gourd and bean were 0.762 and 0.755, respectively (Table 6.1). This implied that the production function exhibits decreasing returns to scale. That is, the farmers were operating their farming in the second stage of production function. In this case, if all the variables specified in the production function were increased by one percent, the yield of bottle gourd and bean would increase by 0.762 and 0.755 percent, respectively.

Chapter VII

PROBLEMS AND CONSTRAINTS OF BOTTLE GOURD AND BEAN PRODUCTION

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

7.1 Problems and Constraints Faced by the Farmers

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

i) Economic and technical problem

ii) Marketing problem iii) Social and natural problems

7.1.1 Economic and technical problems

It was observed that fanners faced some economic and technical problems and constraints relating to the production of bean and bottle gourd. The major economic and technical problems faced by the farmers in bean and bottle gourd production are discussed below:

Lack of capital or institutional credit

The production of selected vegetables needs proper doses of fertilizers, irrigation water, insecticides in order to special agronomic care and therefore, farmers should have sufficient money to buy the necessary inputs. But in the study area, about 63.33 and 50 percent of total bean and bottle gourd growers respectively reported that they did not have adequate amount of operating capital (Table 7.1). Most of the growers did not get institutional credit and, therefore, they had to borrow money from relatives, neighbors and money lenders at exorbitant rate of interest.

High price of fertilizers and insecticides

Fertilizer and insecticides are vital inputs in the production of bottle gourd and bean. During the cultivation period, the prices of fertilizer and insecticides went up due to profit making motive of both retailers and wholesalers. It was reported that bottle gourd and bean plants were attacked by various types of pests and diseases. About 60 percent of bottle gourd and 53.33 percent of bean growers had to face this problem and they reported that although there were timely supplies of fertilizers, the prices were higher. They complained that they had to purchase fertilizers and insecticides at higher price in the study area (Table 7.1).

Lack of irrigation facilities

For producing winter crops, water was an important input. In the study area, about 36.66 percent bottle gourd growers and 33.33 percent bean growers opined that the lack of irrigation facilities was a major constraint to bottle gourd and bean production.

Scarcity of quality seeds

Seed is one of the most important inputs. Production of crop depends largely upon timely availability of good and healthy seeds. About 56.67 percent of bottle gourd and 56.67 percent of bean growers mentioned that some inferior quality seeds were sold in the market and consequently the germination rate was very low.

Shortage of human labour

Since bottle gourd and bean werelabour intensive crop, non-availability of human labour was one of the major problem for producing bottle gourd and bean in the study areas.It is observed from Table 7.1 that about 53.33 percent of bottle gourd growers and 63.33 percent of bean growers faced acute shortage of human labour in the production of selected vegetables.

Lack of scientific knowledge and technology

Low productivity of bottle gourd and bean is a serious problem. In the study area most farmers are illiterate. About 80 percent of bottle gourd and 73.33 percent of bean growers reported that the productivity of the selected winter vegetables was low due to lack of scientific knowledge about cultural practice.

7.1.2 Marketing problems

According to respondents opinion, one serious problem of bean and bottle gourd was the marketing problems. In the study areas, most of the farmers used to sell their product to the 'Paiker' at home. A few farmers sold the product at the village 'hat'.There were some problems relating to the marketing of bean and bottle gourd which are highlighted below.

Low market price of product at harvesting period

Price of particular product works as an incentive for increasing the production of crops. It was reported that prices of output of the crops were not adequately attractive to the farmers for growing bottle gourd and bean in the study area. About 53.33 percent of bottle gourd and 73.33 percent of bean farmers reported that the prices received from bottle gourd and bean were low, particularly after harvest of the crops.

Storage problem

Lack of proper storage facilities was the most important problem regarding bean and bottle gourd marketing. Seventy six percent of vegetable growers complained about the storage problem (Table 7.1). Storage of bean and bottle gourd is not possible under ordinary condition because these vegetables are perishable.

Therefore, due to lack of proper storage facilities the farmer did not get fair prices of their bean and bottle gourd.

Lack of adequate transportation facilities

Due to transportation problem, the growers used to sell their product to "paiker" at the local markets and a few growers sold their products at home in the study area. Table 7.1 shows that about 40 percent and 43.33 percent of the bottle gourd and bean growers treated lack of transportation facilities as a problem. Farmers also reported that they could not take advantage of the higher prices prevailing at distant market due to lack of transportation facilities. Adequate transport facilities at reasonable cost would improve the efficiency of vegetable marketing.

7.1.3 Social and natural problems

It was found that farmers were facing some social and natural problems in producing bean and bottle gourd. These are discussed below:

Attack by pest and disease

Some incidences of pest and disease attack were noticed in the crops. About 63.33 percent of bottle gourd and 76.67 percent of bean growers identified this as a major problem.

Crop damaged by domestic animal

Crop damage by wild animal was an acute problem in the production of bottle gourd and bean production, all bottle gourd and bean growers reported that damage by rats was a major to them. About 20 and 26.67 percent of bottle gourd and bean growers reported that their crops were damaged by rats.

Table 7.1: Responses on Major problems faced by the farmers in producing bottle gourd and bean

Name of problems	Bottle gourd fanners (n=30)		Bean farmers (n=30)	
	Farmer response(No.)	%	Farmer response(No.)	%
A. Economic and technical problems				
i) Lack of capital or institutional credit	19	63.33	15	50
ii) High price of fertilizers and insecticides	18	60	16	53.33
iii)Lack of irrigation facilities	11	36.66	10	33.33
iv) Scarcity of quality seeds	17	56.67	17	56.67
v) Shortage of human labour	16	53.33	19	63.33
vi) Lack of scientific knowledge and technology	24	80	22	73.33
B. Marketing Problems				
i) Low market price of product at harvesting period	16	53.33	22	73.33
ii) Storage problem	24	80	23	76.67
iii)Lack ofadequate transportation facilities	12	40	13	43.33
C. Social Problems				
i) Attack by pest and disease	19	63.33	23	76.67
ii) Crop damaged by domestic animal	6	20	8	26.67
iii) Affected by wild animal	2	6.67	4	13.33
iv) Loss of production due to theft	2	6.67	1	3.33

Source: Field survey, 2015

Affected by wild animal

Crop damaged by wild animal was one of the major problem for vegetable production. About 12 percent of bean and bottle gourd growers reported that their products were attacked by wild animals like cow, goat etc.

Loss of production due to theft

During harvesting period, stealing of bottle gourd and bean was a common phenomena which discouraged the growers to grow these vegetables. In the study area, about 6.67 percent of bottle gourd and 3.33 percent of bean growers reported their products were stolen.

Chapter VIII

SUMMARY AND CONCLUSION

8.1 Summary

The present study was undertaken with a view to determine and analyse the comparative profitability of bean and bottle gourd production in an area of Gopalgonj district and area selected for the study covered two upazilas namely Muksudpur and Gopalgonjsadar in the district of Gopalgonj. Gopalgonj district had been purposively selected as study area, 60 samples were selected by simple random sampling technique. Among 60 farmers, 30 farmers were bottle gourd producer and the other 30 farmers were bean producer.

Data were collected during the months from July to September 2015. All the collected data were summarized and scrutinized carefully to eliminate all possible errors. Data were presented mostly in the tabular form. Descriptive statistics like average, percentage, etc., were followed to analyze the data to achieve the objectives of the study. Cobb-Douglas production function was used to estimate the factors affecting the yield of bottle gourd and bean.

In studying socioeconomic characteristics, age structure, educational status, farm size and land ownership patterns, family size of the sample farmers were considered. It was found that the age group of 14 to 55 years was the largest group in all the cases. The literacy rate of bottle gourd producers was high. The average farm size of bean and bottle gourd were 0.96 hectare and 0.802 hectare respectively. The average farm size indicated that most of the sample fell in the small size category.

Actual price paid by farmer were used to estimate the cost of purchased inputs, prevailing market price was used for home supplied inputs The bank interest rate of 10 percent per annum was used to determine the opportunity cost of operating capital.In the production process of selected vegetables, human labour 'was the

most important factor. On an average per hectare human labourrequired for bottle gourd and bean were 300 man-days and 296 man-days respectively. The per hectare costs of human labour for bottle gourd and bean were Tk. 82500 and Tk. 81400, respectively.Farmers of the study area used home supplied and purchased seeds. The per hectare seed costs for bottle gourd and bean were Tk. 3750 and Tk. 1200 respectively. The cost of seed constituted 2.39 percent and 0.80 percent of total cost of bottle gourd and bean, respectively.Fertilizer is a major requirement of bottle gourd and bean production. In the study area, farmers mainly used four types of fertilizer namely urea, TSP, MP and gypsum. The per hectare cost of these fertilizers were calculated at Tk. 19000, and Tk. 17500 for bottle gourd and bean ,respectively.The per hectare costs of irrigation was Tk. 10000 for bottle gourd and 6.39 percent the total costs of respective crop and the per hectare costs of irrigation was Tk. 9000 for bean and 6.07 percent of total cost. The cost offence and manchaamounted to Tk. 13000and Tk. 12000 per hectare for bottle gourd and bean production, respectively.

Gross returnsof the production was calculated on the bass of the value of product and by-product. The per hectare total values of product for bottle gourd and bean were Tk. 305000 and Tk. 242500, respectively. Net returns for bottle gourd were calculated at Tk. 148566 and for bean production were Tk. 94317 per hectare, respectively. Undiscounted BCR on total cost bases were 1.94 and 1.63 for bottle gourd and bean production, respectively.

In the present study, Cobb-Douglas production function model was applied on the basis of its superior properties and empirical fit. The explanatory variables were human labour, seed, fertilizer, insecticides and irrigation for bottle gourd production and human labour, seed, fertilizer, manure and insecticides for bean production. The coefficient of multiple determinations, R^2, was 0.889 in case of bottle gourd productionfunction. 0.882 in case of bottle gourd production function. Explanatory variables like human labour, fertilizer, land preparation cost had significant impact on both bottle gourd and bean production.The F-values of bottle

gourd and bean production were 25.087 and 23.551, and both were significant at 1 percent level , which implied good fit of the model.

The present study identified some of the problems and constraints associated with bottle gourd and bean production. The main problems faced by the farmers were: lack of capital, high price of fertilizer and insecticides, low price of the product, lack of scientific knowledge and method, scarcity of quality seeds, poor irrigation system and marketing problems, particularly relating to crop damage by wild animals.

8.2 Conclusion

In determining the comparative profitability of bottle gourd and bean it was found that per hectare yield and gross return of bottle gourd were higher than that of bean. The study revealed that bottle gourd production was relatively more profitable than bean.The summation of all the regression coefficients of the estimated production function of bottle gourd and bean were 0.762 and 0.755, respectively (Table 6.1). This implied that the production function exhibits decreasing returns to scale. That is, the farmers were operating their farming in the second stage of production function. In this case, there is a opportunityto increase the yield of the both vegetables.

8.3 Policy Recommendations

The study revealed that the cultivations of bottle gourd and bean were profitable in the study area. There was a great opportunity to increase the productivity of bottle gourd and bean due to their highly nutritious value and demand in the country. Several policy recommendations emerged from the results of this research which are highlighted below:

- Capital shortage was one of the severe problems faced by the farmers. Without institutional credit support, it is difficult for the farmers to cultivate large area under these crops. It is, therefore, necessary that credit on easy terms should be provided to the farmers for the entire area under bottle gourd and bean production.

- Seeds of good quality, disease resistance and high yielding varieties could be provided directly to the farmers just before the growing season.
- Regular supply of fertilizer should be ensured and fertilizer adulteration should becontrolled strictly.
- Irrigation facilities should be made available to the producers
- Modern technology should be disseminated by the extension workers for improvingthe efficiency in producing these crops.

8.4 Shortcomings of the Study

Almost all the research studies have some common limitations in terms of time, fund and personnel. The present study is not an exception to that. Some of the specific limitations however are as follows:

- The farmers in Bangladesh do not generally keep records of their farm business transactions. As a result, the accuracy of data fully depends upon their memoriesand sincerity. Consequently, the possibility of data errors could not be ruled out.
- The study was conducted on the basis of some collected raw data from some village under Muksudpur and Gopalgonj sadar of Bangladesh. These findings shouldtherefore, be interpreted with considerable caution if any greater generalization was sought for the country as a whole.

In spite of the above limitations some of the findings of the study may be useful in providing important information for farmers and decision makers, but a note of caution should be taken while considering the findings for other areas of the country.

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