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PROFITABILITY OF BITTER GOURD PRODUCTION IN SOME AREAS OF NARSINGDI DISTRICT

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Abstract

The estimation of profitability and to investigate the factors affecting the yield of bitter gourd production at Narsingdi district in 2013 was designed. The study area was selected purposively and a total of 100 farmers were randomly selected. The stochastic Cobb-Douglas production frontier model was used for estimating the factors that affecting bitter gourd production. The study used both descriptive and functional analysis to achieve the objectives of the study. The study divulged that bitter gourd production was profitable in the study areas. Average yield of bitter gourd was found to be 27.5 ton ha^{-1} and average gross return was Tk. 5,50,000 ha^{-1}. Total cost of production was found to be Tk. 3,06,810 ha^{-1}. Net return and BCR was found to be Tk. 2.43,190 ha^{-1} and 1.79, respectively. The functional analyses suggested that human labour, Urea, TSP, cow dung and irrigation had positive and significant effect on the yield of bitter gourd in the study areas. Among different constraints, attacked by insect and diseases, lack of quality seed and high price of input were dominant in the study areas. Necessary steps from the concern authority are essential to solve the problems regarding bitter gourd cultivation and to increase the production as well as the income of the farmers in the study areas.

Keywords: Profitability, Bitter gourd, gross margin, net return, BCR, Cobb-Douglas

Introduction

Agriculture is the single most important sector of the economy in Bangladesh. It is the major source of livelihood in the rural areas. It contributes 20.16% to the gross domestic product (GDP) while 51.33% of households are engaged in this sector (BBS, 2010). Farmers of Bangladesh are producing a lot of vegetable and the minimum recommended dietary allowance of vegetables per capita per day is 300 g but its present availability is 166.1 g (NFPCSP, 2013). Vegetables play an important role in balanced diet for human being as well as it acts as an income generating source of the farmers. Bitter gourd is one of the most popular cucurbitaceous vegetable in Bangladesh for its nutritive and medicinal value. It is grown extensively throughout the country mostly during summer season. The nutritive value of bitter gourd in 100 g of edible portion are carbohydrate 4.2 g, calcium 20 mg, phosphorus 55 mg, protein 2.1 g and iron 1.8 g. It is also rich in Vitamin A 210 IU and Vitamin C 88 mg which plays a vital role in human nutrition (Akroyd, 1983; Singh and Kirtiraj, 2012).

The success of any crop production generally depends on the profitability at farm level. Although several studies (Hoq *et al*, 2012; Asaduzzaman *et al*, 2011; Karim *et al*, 2009; Mohiuddin *et al*, 2009; Hasan, 2005) have been conducted in Bangladesh on different aspect of vegetable production but there is dearth of a comprehensive study on the profitability of bitter gourd production. Keeping all this factors in consideration, the present study has undertaken with the following specific objectives;

Specific objectives

1) To assess the profitability of bitter gourd production at farm level,

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2) To identify the factors affecting bitter gourd production in the study area, and

3) To identify the constraints faced by the farmers of bitter gourd production.

Materials and Methods

The study was conducted at Narsingdi district based on intensity of bitter gourd cultivation. The study area was purposively selected and a total of 100 farmers were selected randomly taking 50 from two villages, namely Kondarpara and Chandpasha under Shibpur upazilla of Narsingdi district during 2013. Necessary data were collected through survey method. Mostly descriptive statistics like average, percentage etc. were used to achieve the objectives of the study.

The following profit equation was used to assess the profitability of bitter gourd production at the farm level:

$$\Pi = P_r Q_r - \sum_{i=1}^{n} (P_{xi}.X_i) - TFC$$

Where,

Π = Profit per hectare of bitter gourd production
P_r = Per unit price of output (Tk kg^{-1})
Q_r = Quantity of output (kg ha^{-1})
P_{xi}= per unit price of the $_i$th (Variable) inputs
X_i = quantity of the $_i$th inputs
i = 1, 2, 3……..n and
TFC = Total fixed cost.

Factors affecting the bitter gourd production

The following type of stochastic Cobb-Douglas production frontier model was used for estimating the factors affecting bitter gourd production in the study areas.

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \ldots\ldots\ldots\ldots\ldots\ldots\ldots + \beta_n \ln X_{ni} + V_i - U_i$$

Where, ln represents the natural logarithm, the subscript i represents the i^{th} farmer in the sample, Y represents the quantity of bitter gourd harvest in Kilogram, X_i represents the variable factors of production, β_i unknown parameters to be estimated, V_i assumed to be independently and identically distributed (iid) random errors, having N (0, σ_v^2) distribution, u_i are non-negative one sided random variables.

The empirical Cobb-Douglas stochastic frontier production function with double log form can be expressed as:

$$\text{Ln } Y_i = \beta_0 + \beta_1 \text{ Ln } X_{1i} + \beta_2 \text{ Ln } X_{2i} + \beta_3 \text{ Ln } X_{3i} + \beta_4 \text{ Ln } X_{4i} + \beta_5 \text{ Ln } X_{5i} + \beta_6 \text{ Ln } X_{6i} + \beta_7 \text{ Ln } X_{7i} + \beta_8 \text{ Ln } X_{8i} + \beta_9 \text{ Ln } X_{9i} + \eta_1 D_{1i} + \eta_2 D_{2i} + v_i - u_i \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where,

Ln = Natural logarithm,
Y = Yield of bitter gourd of the i-th farm (kg ha^{-1})
X_1 = Human labour used by the i-th farm (man-days ha^{-1})
X_2 = Seed cost used by the i-th farm (Tk ha^{-1})
X_3 = Urea used by the i-th farm (Kg ha^{-1})
X_4 = TSP used by the i-th farm (Kg ha^{-1})
X_5 = MoP used by the i-th farm (Kg ha^{-1})
X_6 = Land preparation cost used by the i-th farm (Tk ha^{-1})
X_7 = Irrigation cost used by the i-th farm (Tk ha^{-1})
X_8 = Cow dung cost used by the i-th farm (Kg ha^{-1})

X_9 = Material cost (bamboo, rope etc) used by the i-th farm (Tk ha^{-1})
D_1= Dummy for land type
D_2= Dummy for sowing date (1 = Optimum sowing, 0 = Otherwise)
β's and η's are unknown parameters to be estimated
V_i - U_i = error term, V_i are assumed to be independently and identically distributed random errors, having N (0, σ_v^2) distribution.

Results and Discussion

Input use pattern

The pattern of input use is presented in Table 1. On an average, bitter gourd farmers used 456 man-days of human labour ha^{-1} of which 40% were family supplied and 60% were hired. The farmers of the study areas used 6.7 kg seed ha^{-1}. The sample farmers used cow dung at the rate of 5652 kg ha^{-1}. Chemical fertilizers were also applied by the bitter gourd growers at the rate of 352, 289 and 196 kg ha^{-1} for urea, TSP and MoP, respectively.

Table 1. Level of input use per hectare for bitter gourd production

Item	Quantity
Human labour (man-days ha^{-1})	456
Family	182
Hired	274
Seed (kg ha^{-1})	6.7
Cow dung (Kg ha^{-1})	5652
Urea (Kg ha^{-1})	352
TSP (Kg ha^{-1})	289
MoP (Kg ha^{-1})	196

Source: Field Survey, 2013

Cost of bitter gourd production

Costs are the expenses in organizing and carrying out the production process. The cost of production included different variable cost items like human labour, seed, cow dung, fertilizer, pesticides etc. Human labour was the major cost items incurred for bitter gourd production. Farmers mostly used hired labour which constituted about 60% of the total labour use. The cost of human labour was found to be Tk. 113937 ha^{-1}, which was about 37.13% of the total cost. Seed cost was Tk. 80400 ha^{-1} which was 26.21% of the total cost. Total cost of bitter gourd production was Tk. 3,06,810 ha^{-1} of which 77.51% was variable cost and rest 22.49% was fixed cost (Table 2).

Table 2. Per hectare cost of bitter gourd production

Cost items	Tk ha^{-1}	Percentage (%)
Hired labour	68269	22.25
Land preparation cost	7283	2.37
Seed	80400	26.21
Cowdung	2826	0.92
Fertilizer	17401	5.66
Urea	3262	1.06
TSP	8023	2.61
MoP	6116	1.99
Pesticide	9890	3.22
Trellis making	32515	10.60
Irrigation	12300	4.01
Interest on operating capital	6926	2.26
A. Total variable costs	**237810**	**77.51**
Family labour	45668	14.88
Land use cost	23332	7.60
B. Total fixed cost	**69000**	**22.49**
C. Total cost (A+B)	**306810**	100.00

Source: Field Survey, 2013

Return from bitter gourd cultivation

Return was calculated by multiplying yield with its price per kilogram. Return per hectare of bitter gourd is shown in Table 3. It is evident that the average yield of bitter gourd was found to be 27.5 ton ha^{-1} and gross return was Tk. 5,50,000 ha^{-1}. Gross margin was calculated by deducting variable costs from gross return. The average gross margin was found Tk. 3,12,190 ha^{-1} for bitter gourd production. On the other hand, net return was found to be Tk. 2,43,190 ha^{-1} in the study areas. Average return to each taka spent on production is an important criterion for measuring profitability of a crop. On an average, benefit cost ratio was found to be 1.79 over total cost indicates overall performance of bitter gourd cultivation in the study areas is encouraging in terms of profitability (Table 3).

Table 3. Return per hectare of bitter gourd production

Particulars	Tk ha^{-1}
Yield (Ton ha^{-1})	27.50
Gross return (Tk ha^{-1})	5,50,000
Total cost	306810
Variable cost	237810
Fixed cost	69000
Gross margin	3,12,190
Net return	2,43.190
Benefit cost ratio (undiscounted)	
Over total cost	1.79
Over variable cost	2.13

Maximum likelihood estimates of farm specific stochastic frontier function

The maximum likelihood estimates for parameter of the Cobb-Douglas stochastic production function frontier of bitter gourd is presented in Table 4. The empirical result indicated that the co-efficient of human labour and cow dung which are the important yield determining factors for bitter gourd, co-efficient for both of these variables were statistically significant at 1% level and showed positive values of 0.267 and 0.144, reflecting that increment of these inputs by one percent would increase the yield of bitter gourd by 0.266 and 0.144 percent. Similarly the coefficient of urea, TSP and irrigation were also found positive and significant. The co-efficient of seed was found negative and significant at 10% indicates 1% increase in the use of seed would decrease the yield of bitter gourd by 0.43%.

Table 4. Maximum likelihood estimates of the stochastic Cobb-Douglas frontier production function (n=100)

Items	Parameters	Co-efficient	Std. error	t-ratio
Constant	β_0	2.950***	0.998	2.96
Ln Human labour (m-d ha^{-1})	β_1	0.260***	0.094	2.85
Ln Seed(Tk ha^{-1})	β_2	-0.430*	0.309	-1.61
Ln Urea(Kg ha^{-1})	β_3	0.070*	0.041	1.94
Ln TSP(Kg ha^{-1})	β_4	0.900*	0.540	1.68
Ln MoP(Kg ha^{-1})	β_5	0.390	0.381	1.03
Ln Land preparation (Tk ha^{-1})	β_6	0.240	0.167	1.48
Ln irrigation(Tk ha^{-1})	β_7	0.180**	0.091	2.08
Ln cowdung(Kg ha^{-1})	β_8	0.140***	0.048	3.02
Ln material cost (Tk ha^{-1})	β_9	0.060	0.062	1.01
Dummy for land type	β_{10}	0.780	0.641	1.23
Dummy sowing	β_{11}	0.010	0.018	1.07
Log likelihood function	-		261.43	

Note: ***, ** and * indicates significant at 1%, 5%, and 10% level of significance respectively

Constraints of bitter gourd Production

Despite being highly profitable, it has some draw back as well which could not be over looked. An indication about the obstacles faced by the sample farmers in cultivating bitter gourd production is given in Table 5. It is revealed

from the table that the highest percent (75%) of the farmers reported attack by insect and disease were their main problem for bitter gourd production. Among the other problems lack of quality seed was ranked 2nd followed by high price of input and high wage rate of labour.

Table 5. Constraints of bitter gourd cultivation in the study areas

Problems	No. of farmers	Rank
High wage rate	36	4th
Lack of quality seed	65	2nd
Attacked by insect and diseases	75	1st
High price of input	40	3rd
Lack of irrigation facilities	6	5th

Source: Field Survey, 2013

Based on the findings of the study, it may be concluded that bitter gourd cultivation in the study areas is very much profitable. Use of human labour, cowdung, Urea, TSP and irrigation had positive impact on the yield of bitter gourd while the farmers in the study areas using higher amount of seed. Bitter gourd growers also facing some constraints like insect and disease infestation, high price of inputs, lack of quality seed etc. The concern authority need to take appropriate steps to ensure fair price of seed, fertilizers and other inputs for getting higher return from bitter gourd production. The scientist of agricultural research should take initiative to develop more varieties of better yield potential and tolerant to insect and diseases. If modern variety of seed and production technology are made available to the farmers, then the production might be increased further which may help to intensify the income of the farmers.

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