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RESEARCH ARTICLE

FINANCIAL PROFITABILITY, RESOURCE USE EFFICIENCY AND FACTORS AFFECTING EGGPLANT (*SOLANUM MELONGENA* L.) CULTIVATION IN BANGLADESH

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ABSTRACT

The study was conducted in the upazilla namely Keraniganj of Dhaka, Bangladesh during 2015 to assess the profitability, resource use efficiency and factors affecting eggplant cultivation. Primary data collection was carried out at Keraniganj upazilla of Bangladesh.Cobb-Douglas production function was applied to determine the effects of inputs on eggplant production. Human labour, seeds, murate of potash (MoP), urea, power tiller, pesticides and irrigation had significant impact on eggplant production. The most important factors for variation in costs as identified were human labour and chemical fertilizers cost. Net return and cash margin of eggplant production were USD4780.9 and USD4968.8 ha^{-1}, respectively, while the rate of return was 2.60. Thus, eggplant cultivation is a highly profitable enterprise. In all cases, resources are underutilized, so there is more scope to utilize the resources more efficiently in case of eggplant production.

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INTRODUCTION

When vegetables are dearth in supply in the market, eggplant (*Solanum melongena* L.) is one of the three most popular and economically significant vegetables among small-scale farmers and low-income consumers of South Asia, especially in summer (Alam et al., 2003). The crop is one of the most important, popular and nutritious vegetables growing all over the world. More than 1600 thousand ha are engaged with the cultivation of eggplant in the world. China is the top producer (58.6 % of world output) and India is second (25.2%), followed by Egypt, Iran and Turkey (FAOSTAT 2012). In Bangladesh, over 46710 hectare of total cultivable land is devoted to eggplant cultivation (BBS, 2011). Eggplant is consumed throughout the year. The crop isclassified into two categories in respect of their production period. Though it is more or less available throughout the year, its peak supply comes during December to April in South Asia (Mollika, 2015). Eggplant is a good source of vitamins and minerals (mostly vitamin A, B, C and iron). An edible portion of 100 gram (g) egg plant contains 1.4 g protein, 18 mg calcium and 24 kcal of food energy. In addition, eggplant consists of almost 92.7 percent of water and it is superior in terms of fiber, folic acid, manganese, thiamin, vitamin B6, magnesium and potassium to that of most other vegetables (Chadha and Kalloo, 1993). Plenty of eggplant is also produced in Bangladesh and in 2015-2016; the total production of eggplant was 475 thousand metric tons (BBS, 2016) withper acre yield is 7909 kg (BBS, 2016). The present study is duly required for increasing eggplant production. The study not only emphasizes on the profitability of eggplant production but also establish the relationship between socioeconomic characteristics and problems faced by the eggplant growers. It also identifies crucial problems of eggplant production and ranks those problems which make this research identical. The results of the study will be helpful to the policy maker to formulate future policy considering farmers production problem and the researcher for further study about eggplant.

Objectives

The study was conducted

- to estimate the profitability of eggplant cultivation at farm level.
- to find out the factors affecting the eggplant production.

METHODOLOGY

In the district name Keranigonj upazila, a total of 50 farmers were randomly selected for the interview.

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A pre-tested interview schedule was used for collecting data and information from the egg plant farmers during May to July, 2015.

Analytical Techniques

Descriptive statistics using different statistical tools like averages, percentages along with Cobb-Douglass production function was need to achieve the objectives of the study.

Profitability analysis: Profitability of eggplant was estimated using the following formula proposed by Dillon and Hardker (1980).

$\Pi = PQ — TC = PQ — (TVC + TFC)$

Where,

Π = Profit from eggplant
Q = Quantity of the eggplant (kg),
P= Averageprice of eggplant
TC = Total cost Tk ha^{-1},
TVC = Total variable cost
TFC = Total Fixed cost,

Functional analysis

Cobb-Douglas type production function model was used to estimate the contribution of factors to vegetables production. The functional form of the Cobb-Douglas production function model (Gujarati, 2003) is given below:

Y = aX1^b1 X2^ b2 ....Xn^bn e^ui

The production function was converted to logarithmic form so that it could be solved by least square method i.e.

ln Y = lna + b1lnX1 +b2lnX2+ ..... + bnlnXn + Ui
The empirical production function model was the following:
ln Y = a + b1 ln X1 + b2 ln X2 + b3 ln X3 + b4 ln X4 + b5 ln X5 + b6 ln X6 + b7 ln X7 + b8 ln X8 + b9 ln X9+ Ui

Where

Y = Total yield) (kg ha^{-1})
X1 =Human labour (man-daysha^{-1})
X2 =Seed (Tk ha^{-1})
X3 = Power tiller (Tk ha^{-1})
X4 = Urea (kg ha^{-1})
X5 =TSP (kg/ha)
X6 = MoP (kg/ha)
X7 = Pesticide (Tk ha^{-1})
X8 = Irrigation (Tk ha^{-1})
X9= Land use
a = Intercept
b1, b2..... b9 = Coefficients of the respective variables to be estimated

Ui = Error term.

The efficiency of inputs used in production was measured by the following equation:

MVPx⁄MFCx

Where, MVPx is the marginal value product of 'X input and MFCx is the marginal factor cost of 'X' input. When the ratio of MVP and MFC is equal to unity, it indicates that the resource is efficiently used. When the ratio is more than unity, it implies that the resource is underutilized. In that case, there is an ample opportunity to increase total production by increasing the use of specific input in the production process. Again, it is possible to reduce production cost or to decrease the use of specific input by keeping the total production unchanged. According to Dhawan and Banal (1977), the useful estimate of MVP is obtained by taking the geometric mean of the resources (Xi) as well as the gross return. The marginal value product (MVP) is computed by multiplying the coefficient of a given resource with the ratio of the geometric mean of theresource. Thus, MVP (Xi) = bi Yi⁄Xi

Where Y = Mean value of gross return in Tk.
Xi = Mean value of different resources in Tk.
i = (1, 2 ...4) and

bi =dy/dxi= Slope of the production function

Since all the inputs and outputs were expressed in monetary terms, the acquisition cost of the inputs was taken as one taka. The criteria used here to assess the resource allocation efficiency are to test the MVPs against unit (Heady and Dhillon, 1988). All the values in Tk. were then converted into USD for reporting.

RESULTS AND DISCUSSION

Input use pattern for eggplant production

The survey data showed that the quantity of inputs like seeds, fertilizers and pesticides used by the farmers were some cases less and some cases higher than the recommended level. Eggplant seeds for nursery use were 7650 g ha^{-1}, while the recommendation is 700-750 gha^{-1}. The application of urea, TSP and MoP uses were slightly higher than the recommended dose for the area. The use of pesticide costed 326.5 USD ha^{-1}, while irrigation accounted for 246.3 USD ha^{-1} (Table 1).

Table 1. Per hectare level of input use for eggplant cultivation

Items	Eggplant
Human Labor (Man-days ha^{-1})	371
Seed (g ha^{-1})	650
Power Tiller	11095
Urea (kg ha^{-1})	340
TSP (kg ha^{-1})	211
MoP (kg ha^{-1})	179
Pesticide (USD ha^{-1})	326.9
Irrigation (USD ha^{-1})	246.3

Source: Field survey 2015

Table 2. Cost of eggplant cultivation in the study areas

Items	Amount (USD ha^{-1})
A.Variable cost	
Human labour	1780.7
Seed	144.5
Power Tiller	133.2
Urea	81.6
TSP	55.9
MOP	34.4
Pesticide	326.9
Irrigation	246.3
B. Fixed cost	
Land use	187.9
Total	2991.3

Source: Field survey (2015)

Table 3. Profitability of eggplant cultivation in the study areas

Items	Amount
A.Total cost (USD ha^{-1})	2991.34
Variable cost	2803.42
Fixed cost	187.92
B.Gross return	7772.26
C.Gross margin	4968.83
D.Net return	4780.90
E.Rate of return (BCR)	
BCR on full cost	2.60
BCR on variable cost	2.77

Source: Field survey 2015

Cost of eggplant production

Costs are the expenses for organizing and carrying out the production process. The cost of production included different variable cost items like land preparation, human labour, seed, manure, fertilizer, insecticides etc. Both cash expenditure and imputed value of family supplied inputs were included in the analysis. Table 2 represents the cost of eggplant production in the study areas. Per hectare total cost of eggplant production was found USD 2991.3 of which 92.72% were variablecost and 6.28% were fixed cost. In case of eggplant higher cost was incurred for human labour (56%) followed by pesticide (11%).

Profitability of eggplant cultivation

The average return of eggplant production is shown in Table 3. Per hectare gross return was found for eggplant (USD7772.3). Similarly, per hectare net return found for eggplant was USD4780.9. Benefit cost ratio (BCR) was found for eggplant which was 2.58 and 2.77 on full cost and variable cost

Factor Affecting Eggplant Production

The estimated values of co-efficient and related statistics of Cobb-Douglas production function is presented in Table 4.

Table 4. Estimated co-efficient and their related statistics of production function for eggplant

Regression variable	Regression coefficient	t-value
Intercept a	3.408*** (.935)	3.644
Human labor X1	0.3550*** (0.054)	6.6192
Seed X2	0.0478 (0.032)	1.504
PT X3	-0.0826* (0.045)	-1.808
Urea X4	0.2916*** (0.104)	2.814
TSP X5	0.0384 (0.048)	0.8077
MOP X6	0.1189* (0.071)	1.6840
Pesticide X7	0.07202 (0.060)	1.1975
Irrigation X8	0.11534** (0.051)	2.2340
Land use X9	0.0589 (.049)	1.2112
Adjusted R -square	0.874	
F- value	38.08	

'***', '**' and '*' indicates 1%, 5%, and 10% level of significance

Table 5. Estimation of resource use efficiency for eggplant production

Items	Resource use efficiency
Human labor	1.55
Seed	2.57
Power Tiller	-4.82
Urea	27.8
TSP	5.35
MoP	26.87
Pesticide	1.71
Irrigation	3.64
Land use	2.43

It is clear from table that the variables like human labour, urea, irrigation, MOP insecticides were positively significant at 1%, 5% and 10% level which indicate that 1% increase in human labour, urea, irrigation, MoP,cost would increase the return of eggplant by 0.355%, 0.292%, 0.115% and 0.1188%, respectively, keeping other factors constant.The co-efficient of power tiller was negatively significant at 10% level indicating that 1% increase in PT cost would decrease the return of eggplant by 0.0826% by keeping other factors constant. The multiple co-efficient of determination (R^2) is a summary measure which tells how the sample regression line fits with the data (Gujarati, 1995). In this table, the value of R^2 was 0.87, which means the variables considered in the models can explain 87 percent of the variation in yield explained by independent variables include in the model. And the F value of eggplant cultivation was estimated at 38.81 which was highly significant at 1% level of significance implying that the variation of yield mainly depends on the explanatory variables included in the model.

Resource Use Efficiency of eggplant Production

Resource use efficiency of eggplant production is presented in Table 5. If the MVP (Xi) is divided by MFC (Xi) the result will be equivalent to the value of MVP (Xi) because MFC in all cases is equal to 1. All the ratios obtained as can be seen from the table are different from 1 which indicates inefficient use of resources. In case of eggplant, the ratio of MVP and MFC was found to be higher than unity for all the inputs except manure implies that there was scope of increasing the production of these inputs. The ratio of MVP and MFC was higher than unity for human labour, seed, urea, TSP, MoP, pesticide, irrigation and land use for eggplant production.

Conclusion and Recommendations

The study revealed that the benefit cost ratios of eggplant found to be more than unity which implied that the production of the eggplant was profitable in the study areas. Eggplant production required highest costs and received highest net returns as well as highest benefit cost ratios. Although eggplant farmers received higher return on its investment but it was not reached to the optimum level due to inefficient use of inputs. The major problem of eggplant production was insect infestation. The coefficients of inputs which were significant imply that farmers have more scope of utilizing these inputs to increase higher production. Based on the findings of the study, the following recommendations were put forward to increase the production of eggplant cultivation:

- Since eggplant is a profitable vegetable to grow, farmer should cultivate it throughout the year with large acres of the land.
- Government should give subsidy to the farmer for more cultivation of eggplant.
- Pest and disease control management program should be introduced by the extension officer in field level.
- In all cases resource are underutilized, so there is more scope to utilize the resources more efficiently in case of eggplant production.

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