Reprint ISSN 1923-7766 (Web Version)

International Journal of Experimental Agriculture

(Int. J. Expt. Agric.)

Volume: 6 **Issue: 1** **January 2016**

Int. J. Expt. Agric. 6(1): 10-14 (January 2016)

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ISSN-1923-7766 (Online)
Int. J. Expt. Agric. 6(1):10-14(January 2016)

A COMPARATIVE ECONOMIC ANALYSIS OF OKRA AND BITTER GOURD PRODUCTION IN MYMENSINGH DISTRICT OF BANGLADESH

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Accepted for publication on 25 December 2015

ABSTRACT

Jahan H, Asaduzzaman M, Matin S (2016) A comparative economic analysis of okra and bitter gourd production in Mymensingh district of Bangladesh. *Int. J. Expt. Agric*. 6(1), 10-14.

The present study was designed to assess the relative economic performance of two summer vegetables, namely okra and bitter gourd. In total, 60 farmers (30 from each of the okra and bitter gourd growing farmers) were randomly selected from the villages, namely Baira and Ujankashiar char under Sadar upazila of Mymensingh district in Bangladesh. Descriptive statistics, profitability analysis and Cobb-Douglas production function were employed to achieve the specific objectives of the study. The major findings of the study revealed that production of the two selected vegetables were profitable. However, okra production was found to be more profitable than that of bitter gourd. Per hectare gross costs of production of okra and bitter gourd were Taka 1,24,992 and Tk. 1,47,126, respectively and the corresponding gross returns were Tk. 2,15,010 and Tk. 2,32,000, respectively. Per hectare net returns of producing okra and bitter gourd were found to be Tk. 90,018 and Tk. 84,874, respectively. The results of Cobb-Douglas production function indicated that per hectare gross returns of okra and bitter gourd were significantly influenced by the use of human labour, tillage operation, seed, fertilizers, irrigation and insecticides. Based on the findings of the study, it was suggested to improve cultural and management practices of the selected vegetables farming with a view to increasing income and employment opportunity of the farmers. Thus, the rural farmers can improve their economic livelihood by cultivating both okra and bitter gourd.

Key words*: *vegetables, profitability, cobb-douglas

INTRODUCTION

Bangladesh is an agro-based developing country. Environment in Bangladesh is quite favourable for the production of a large variety of fruits and vegetables. Vegetables constitute an important component of a balanced diet for human. Vegetables are usually considered as protective food and high value crops so are fruits and spices. The potentiality of this sector, generally known as horticultural sector, is immense, although it has never been exploited fully. Out of the total 13.3 million hectares of arable land in the country only 6.73 percent is under horticultural crops. If potato and spices are excluded, the area comes down to 3.22 percent only (Hossain 2004). Since vegetables are rich in various nutrients which are needed for a balanced diet, increased production of vegetables can help to solve the problem of malnutrition to a great extent. In recent years, the government of Bangladesh has given emphasis on vegetable production in the year round to meet the nutritional and caloric need for the growing population and for increasing employment opportunities and income of farmers.

Around 70 Percent of the total vegetables productions take place in winter season. Consequently, consumption of vegetables is very less in the summer season than the winter season (Banglapedia 2015). So, production of summer vegetables needs to be increased. Okra (*Abelmoscus esculentus*) and Bitter Gourd (*Momordica charantia*) are grown in summer season may provide nutritional food as well as income opportunities for farmers. Okra is valued for its edible green fruits, said to be shaped like lady's fingers-one of its common names in British English. Okra is an herbaceous annual plant in the family *malvaceae* which is grown for its edible seed pods. Conversely, Bitter gourd is a tropical and subtropical vine of the family *cucurbitaceae*, widely grown in Asia, Africa, and the Caribbean for its edible fruit which is extremely bitter and rich in phosphorus (Agriculture Information, 2015). There are little systematic economic investigations on these vegetables have been undertaken either by the government or private organizations. Therefore, the present study aims to assess the relative profitability of okra and bitter gourd production. Thus, the results of the analysis are likely to be helpful to farmers as well as extension workers and policy makers in providing information for taking appropriate production decisions of these vegetables.

MATERIALS AND METHODS

According to Yang (1962), the area in which a farm business survey is to make depends on the purpose of the survey and possible cooperation from the farmers. Keeping these objectives, two villages namely Baira and Ujankashiar char under Sadar upazila of Mymensingh district were purposively selected for the present study. In total 60 farmers, 30 farmers for okra and 30 for bitter gourd were randomly selected from these two villages to achieve the objectives of the study. A set of interview schedules was prepared for eliciting desired information from the farmers. The present study covered the whole summer vegetables season (March to May) of 2015. Data were collected for this period from June to August, 2015. The collected data were summarized and scrutinized carefully. Data entry was made in computer and analyses were done using the relevant software i.e., Microsoft Excel and Statistical Package for Social Sciences (SPSS).

Data analysis technique

To determine per hectare profitability for each of the selected okra and bitter gourd farming from the view point of individual farmers, the following algebraic equation was followed, where TR and TC represent Total Return and Total Cost, respectively.

π= TR-TC

$\pi_{1=} \Sigma Q_y P_y - \Sigma (X_i.P_{xi}) - TFC$

Where,

π_1= Net return from okra/bitter gourd (Tk/ha);
Q_y= Total quantity of (okra/bitter gourd) outputs (Kg/ha);
P_y= Per unit price of okra (Tk/Kg);
X_i= Quantity of the concerned i^{th} inputs;
P_{xi}= Per unit price of the relevant i^{th} inputs;
TFC= Total fixed cost involved in production;
i= 1,2,3,...., n (number of inputs).

Factors affecting production of okra and bitter gourd

Cobb-Douglas production function was chosen to estimate the affects of key variables on production processes of okra and bitter gourd. The double log form of the Cobb-Douglas production function proved to be a superior alternative on theoretical and econometric grounds (Rubin and Erickson, 1980). Thus, Cobb-Douglas function was selected for this study.

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

$Y= aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} X_8^{b8} U_i$

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.

$LnY= lna + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4 + b_5 lnX_5 + ... + b_8 lnX_8 + U_i$

Where,

Y= Return per hectare (Tk/ha);
lna= Intercept of the function;
X_1= Human labour cost (Tk/ha);
X_2= Tillage cost (Tk/ha);
X_3= Seed cost (Tk/ha);
X_4= Urea cost (Tk/ha);
X_5= MOP cost (Tk/ha);
X_6= TSP cost (Tk/ha);
X_7= Irrigation cost (Tk/ha);
X_8= Insecticide cost (Tk/ha);
$b_1, b_2, ..., b_8$= Coefficients of the respective inputs to be estimated;
and U_i= Error term.

RESULTS AND DISCUSSION

Profitability analysis has been conducted to investigate the net return of the concerned activities of the selected farmers. To obtain the net return, at first the cost of production and then the value of output (gross return) have been calculated. The net return can be obtained by deducting the gross costs from its gross return.

Cost and return of producing okra

Human labour was considered as the most important and largely used input in production. It shared a large portion of total costs of okra. Human labour is required for various activities and management such as: land preparation, weeding, fertilizing, irrigating, using insecticides and herbicides, harvesting and cleaning. Okra growers used on an average 310 man-days/ha human labour. In the study area, the average wage rate was Tk. 300 per man-day. So, total cost of human labour was calculated at Tk. 93,000 per hectare. In the study, power tiller has widely been used for land preparation. For okra production, the average per hectare power tiller cost was estimated at Tk. 5000, considering Tk. 7/decimal and three times tillage operation. In the study area, it was found that farmers used only purchased seeds. The total amount of seed requirement for producing okra is 5 Kg/ha. The average price of seed of okra was Tk. 400/Kg. Farmers used different kinds of fertilizer in producing their vegetables. Commonly used fertilizers were urea, DAP and MOP. The per hectare use of urea, DAP and MOP were 300 Kg, 75 Kg and 65 Kg, respectively. All the fertilizers were purchased at market prices. Prices of urea, DAP and MOP were Tk. 17, 32 and 16 per Kg, respectively. Therefore, total cost of fertilizers was estimated at Tk. 8540. Irrigation water is an important input in selected vegetables cultivation. In the study area, farmers paid a fixed rate for irrigation water which was Tk. 100 per hour. Per hectare cost of irrigation water was estimated at Tk. 5000. In the study area, farmers applied insecticides to protect their vegetables from the

attack of pests and diseases. Cost of insecticides amounted to Tk. 5500 per hectare for okra production. Summation of the costs of variable inputs gave the result of total variable costs, which was Tk. 1,19,040 for okra production. In the study area interest on operating cost for okra was calculated at Tk. 5952 per hectare considering 10 percent interest rate. Summation of the costs of fixed inputs gave the result of total fixed costs, which was Tk. 5952 per hectare for okra production. Per hectare total cost of okra production was estimated at Tk. 1,24,992 (Table 1).

Per hectare total returns were calculated by multiplying the total amount of main products (output) with the farm-gate price. Per hectare yield of okra was found to be 14,334 Kg. The price of okra per Kg was Tk. 15. The gross return was thus calculated at Tk. 2,15,010 per hectare (Table 1). Gross margin has given an estimate of the difference between gross return and total variable costs. The argument for using the gross margin analysis is that the farmers of Bangladesh are more interested to know their return over variable cost. Per hectare gross margin of okra was Tk. 95,970 (Table 1). Per hectare net return was obtained by deducting gross costs from gross return. Per hectare net returns of okra was found to be Tk. 90,018. Benefit-cost ratio (BCR) is a relative measure which is used to compare benefits per unit of cost. It helps analyze the financial efficiency of the farmers. BCR was calculated as a ratio of gross returns and gross costs. The overall BCR (undiscounted) of okra production was 1.72, indicating that production of okra is profitable from the viewpoint of individual farmer's investment in the study area. Similar results were found by Begum *et al*. (2011) and Suraiya (2008).

Table 1. Profitability analysis of per hectare okra production

Items of return/cost	Total quantity/ha	Per unit price (Tk.)	Return/cost (Tk.)
A. Gross return			
Main product	14334 Kg	15	215010
Total return			215010
B. Variable costs			
Human labour	310 Man-day	300/Man-day	93000
Power tiller	3 times		5000
Seed	5 Kg	400/Kg	2000
Urea	300 Kg	17/Kg	5100
DAP	75 Kg	32/Kg	2400
MOP	65 Kg	16/Kg	1040
Insecticides			5500
Irrigation charge			5000
C. Total variable cost			119040
D. Fixed Cost			
Interest on operating costs			5952
E. Total fixed cost			5952
F. Total cost (C+E)			124992
G. Gross margin (A-C)			95970
H. Net return (A-F)			90018
I. Undiscounted BCR			1.72

Cost and return of producing bitter gourd

Profitability of bitter gourd was examined in terms of net return. Net return from bitter gourd production was obtained by deducting total cost from gross return. The results of the estimation of the costs and returns of bitter gourd have been presented in Table 2. It was observed that bitter gourd growers used on an average 373 man-days/ha total human labour. In the study area, the average wage rate was Tk. 300 per man-days. So, total cost of human labour estimated at Tk. 1,11,900 per hectare. For bitter gourd production, the average per hectare power tiller cost was calculated at Tk. 5000, considering Tk. 7/decimal and three times tillage operation. In the study area, it was found that farmers used only purchased seeds. The total amount of seed requirement for producing bitter gourd was 4 Kg/ha. The average price of seed was Tk. 700/Kg. Thus the total cost of seeds for bitter gourd was Tk. 2800. It was found that farmers used different kinds of fertilizer in producing bitter gourd. Commonly used fertilizers were urea, DAP and MOP. The amount of urea, DAP and MOP used per hectare for bitter gourd production were 200 Kg, 150 Kg and 170 Kg, respectively. Thus for bitter gourd cultivation the total cost of fertilizers was calculated at Tk. 10,920. In the study area, farmers paid a fixed rate for irrigation water which was Tk. 100 per hour. Per hectare cost of irrigation water was found to be Tk. 4500. Cost of insecticides was amounted to Tk. 5000. Summation of the costs of variable inputs gave the result of total variable costs, which was Tk. 1,40,120 for bitter gourd production. In the study area interest on operating cost for bitter gourd was estimated at Tk. 7006 per hectare considering 10 percent interest rate. Per hectare total cost of bitter gourd production was estimated at Tk. 1,47,126.

Per hectare yield of bitter gourd was found to be 11600 Kg/hectare. Per Kg price of bitter gourd was Tk. 20. The gross return of bitter gourd was thus calculated at Tk. 2,32,000 per hectare. Gross margin calculation was done

from the difference between total return and variable cost. Per hectare gross margin of bitter gourd was calculated at Tk. 91,880. Per hectare net return for bitter gourd production was obtained by deducting gross costs from gross return. Per hectare net return of bitter gourd was estimated at Tk. 84,874 (Table 2). The similar results were found by Chowdhury (2011) and Hoq *et al*. (2012). The overall BCR (undiscounted) of bitter gourd production was 1.58, indicating that production of bitter gourd was profitable from the viewpoint of individual farmer's investment in the study area.

Table 2. Profitability analysis of per hectare bitter gourd production

Items of return/cost	Total quantity/ha	Per unit price (Tk.)	Return/cost (Tk.)
A. Gross return			
Main product	11600 Kg	20	232000
Total return			232000
B. Variable costs			
Human labour	373 Man-day	300/Man-day	111900
Power tiller	3 times		5000
Seed	4 Kg	700/Kg	2800
Urea	200 Kg	17/Kg	3400
DAP	150 Kg	32/Kg	4800
MOP	170 Kg	16/Kg	2720
Insecticides			5000
Irrigation charge			4500
C. Total variable cost			140120
D. Fixed Cost			
Interest on operating costs			7006
E. Total fixed cost			7006
F. Total cost (C+E)			147126
G. Gross margin (A-C)			91880
H. Net return (A-F)			84874
I. Undiscounted BCR			1.58

A comparison has been made to assess per hectare relative economic performance of growing okra and bitter gourd. The summary results of per hectare yield, gross return, gross cost, net return and BCR (undiscounted) of okra and bitter gourd are presented in Table 3. The table shows that per hectare yield and net return of okra was higher than bitter gourd, whereas cost of production per hectare was higher for bitter gourd than okra. Benefit cost ratio was higher in okra than in bitter gourd. Therefore, it can be concluded that okra production was more profitable than bitter gourd production in the study area.

Table 3. Relative economic performance of growing per hectare okra and bitter gourd production

Particulars	Okra	Bitter gourd
Yield (Kg/ha)	14334	11600
Gross return (Tk/ha)	215010	232000
Gross cost (Tk/ha)	124992	147126
Net return (Tk/ha)	90018	84874

Estimated values of okra efficient and related statistics of the Cobb-Douglas production function for okra and bitter gourd are presented in Table 4.

Table 4. Estimated values of Cobb-Douglas production function for okra and bitter gourd production

Explanatory variables	Okra		Bitter gourd	
	Values of coefficients	Standard error	Values of coefficients	Standard error
Intercept	5.884	0.885	2.865	1.278
Human labour (X_1)	0.281*	0.159	0.292*	0.128
Tillage cost (X_2)	0.147**	0.047	0.152**	0.055
Seed cost (X_3)	0.176**	0.063	0.167*	0.085
Urea cost (X_4)	0.162*	0.082	0.172**	0.062
MOP cost (X_5)	-0.020	0.028	0.178	0.770
DAP cost (X_6)	0.172**	0.062	0.264***	0.077
Irrigation cost (X_7)	0.164*	0.086	0.053	0.129
Insecticide cost (X_8)	0.043	0.186	-0.015	0.024
F-value	16.391		12.875	
R^2	0.78		0.72	
Returns to scale (Σb_i)	1.12		1.26	

Note: ***= Significant at 1% level; **= Significant at 5% level;*= Significant at 10% level

For okra, the highest magnitude of the regression coefficient was found for human labour cost, i.e. s 0.281 with a positive sign. It implies that one percent increase of human labour cost, keeping other factors constant, would lead to an increase in the gross return by 0.281 percent for okra. For bitter gourd also, the highest magnitude of the regression coefficient was found for human labour cost, which was 0.292. The coefficient was found negative for MOP in case of okra and for insecticides in case of bitter gourd. The value of the coefficient of multiple determination (R^2) was estimated at 0.78 for okra, indicates that about 78 percent of the variations of the gross returns were explained by the explanatory variables. The sum of all the production coefficients of the equations for okra production was 1.12 (Table 4). This indicates that the production function exhibited increasing returns to scale for the okra production. The value of the coefficient of multiple determination (R^2) was 0.72 for bitter gourd, indicates that about 72 percent of the variations of the gross returns are explained by the explanatory variables. Similar to okra, the bitter gourd production showed increasing returns to scale (1.26). However, the value was higher for bitter gourd production. For both vegetables, the F value confirmed the good fit of the model. Cobb-Douglas production function revealed that the key variables included were individually or jointly responsible for variation in gross return or output of okra and bitter gourd production. It also indicated that okra and bitter gourd growers allocated their resources in the zone of increasing returns, which indicates that they were operating okra and bitter gourd farming in the first stage of production function.

CONCLUSION

Overall the results showed that both okra and bitter gourd cultivation were profitable but the okra cultivation was more profitable than the cultivation of bitter gourd. The cultivation of okra and bitter gourd would help farmers to earn more household income and to attain better livelihood. The management practices of selected vegetables production in the study area were not found efficient enough. Farmers were not aware of the application of inputs in right time with right doses. Consequently, they made over or under use of some inputs. Thus, well planned management training in accordance with their problems, needs, goals and resource base can lead to viable production practices and sustainable income from okra and bitter gourd cultivation. The extension service must be able to render the needed advice, management and technical support to the okra and bitter gourd growers at the appropriate time. At the end, it can be said that the present study provides some useful information for researchers, policy makers as well as farmers for promoting the production of okra and bitter gourd in Bangladesh.

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