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An Economic Analysis of Cauliflower Production in Selected Areas of Mymensingh District of Bangladesh

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ABSTRACT: The study is an attempt to examine the economic analysis of cauliflower production in selected areas of Mymensingh district. A total of 100 farmers were randomly selected from three villages TrishalUpazilaof Mymensingh district. The major findings of this study revealed that production of the cauliflower was profitable. Benefit cost ratios of cauliflower was 2.44. The farmers earned the highest profit from cauliflower production. The results of Cobb-Douglas production function indicated that three major input factors namely labor cost, seed cost and fertilizer cost were significantly influenced the production of cauliflower. This study also identified some problems faced by farmers for producing cauliflower like insects affect, lack of capital, lack of quality seeds, lack of storage facilities, marking problems. Thus, more research and extension service can be adopted to solve the problems in order to increase production and ensure the nutritional food value in Bangladesh.

Keywords: *Profitability, cauliflower farming, Cobb-Douglas production function, Mymensingh*.

Introduction

Bangladesh, a country of 16.1 million people and covers an area of 147,570 square kilometer, is one of the predominantly agro-based developing countries in the world (WB, 2019). Since her independence in 1971, agriculture has been the core sector of Bangladesh economy, which is still contributing around 13.60 percent of the GDP and also providing employment to 40.6 percent labor force (MoF, 2019, BBS, 2018). Around 84 percent of the rural people of the country depend on agriculture for their livelihood directly or indirectly (LFS, 2016-17). Agriculture has been playing a pioneering role in the growth and stability of the national economy of Bangladesh (Sharminet al., 2018). The main agricultural commodities of our country are rice, wheat, pulse, jute and different vegetables. Vegetables are considered as one of the most important food crops due to their high nutritive value, relatively higher yield and higher return (Sharmin, 2015). Apart from nutritional importance, it helps to employment generation, increase income and reduce poverty in developing

countries like Bangladesh (Mitra &Yonus, 2018; SOFA team *et al*., 2011; Weinberger & Genova, 2005). Vegetable production has experienced tremendous growth in last 40 years in Bangladesh. Winter vegetables of Bangladesh are tomato, water gourd, cauliflower, cabbage, rabi brinjal, rabi pumpkin, radish, bean, green spinach etc. Supply of vegetables increases in a large extent in the winter season. Surplus vegetables in winter reduce the market price and farmer's faces economic loss. Government may decide to export surplus vegetables after meeting domestic requirements or they can store surplus vegetables to reduce economic loss. Government or policy makers can take these decisions based on the growth and trend of winter vegetables production in Bangladesh. Vegetable contributes an important share of the total agricultural export in Bangladesh. Vegetables and crops sub-sector also contribute an important share to the agricultural GDP which is near about 9.71 % (MoF, 2018).

Vegetables are generally labor-intensive crops and thus offer a considerable promise for generating increased rural employment opportunities. Homestead crop production systems especially production of horticultural crops can, to a considerable extent, help to ensure food and nutrition security in addition to self-employment, poverty alleviation and income generation of the farmers. Vegetables can be identified as a significant one for this economy for its noteworthy contribution in raising the foreign exchange earnings and occupies an important position among the items exported from Bangladesh.

Among more than 90 types of vegetables, Cauliflower (*Brassica oleracea* L. var. *botrytis*) is grown mainly as Rabi crop during winter. The production of vegetables including cauliflower is increasing day by day in Bangladesh. Among all the vegetables produced in the country, cauliflower dominates a major share in terms of total cropping area and production. It grows in all the districts of Bangladesh but plenty of cauliflower is produced in the region of Dhaka, Jessore, Rajshahi, Rangpur, Tangail and Kustia (BBS, 2016). It occupied 47749 acres of land with the total production of 268484 metric tons in Bangladesh (BBS, 2016).

The above discussion reveals that a good number of studies were also being conducted which are related to costs and returns of different vegetables including tomato, cauliflower and cabbage. That means a few researches have been conducted on homestead vegetables production, specifically cauliflower in Jamalpur district. The present study aims to examine the profitability of cauliflower production in Jamalpur district. It is expected to bring into focus important information regarding homestead vegetables production. The specific objectives are: i) to measure the profitability of cauliflower production; and ii) to determine the factors which influence cauliflower production.

Location of study, sampling technique and sample size

Mymensingh is one of the most cauliflower producing districts in Bangladesh where TrishalUpazila is most famous for its production and fulfil the demand within country and abroad. Trishal is a place of surplus cauliflower producing areas in Bangladesh. The research on profitability and factor influence on the gross return on cauliflower production in these places have not been conducted. Total 100 number of samples were selected from three villages of TrishalUpazila under Mymensingh district. Random sampling technique was applied for

return on cauliflower production, the Cobb-Douglas production function has used:
$InY=Inb_o+ b_1InX_1+ b_2InX_2+b_3InX_3+b_4InX_4+b_5InX_5+b_6InX_6+ b_7InX_7$

Where, Y = Gross return (US$/acre); X_1 = Human labor cost (Tk/acre); X_2 = Tillage cost (Tk acre); X_3 = Seeds/seedlings cost (Tk/acre); X_4 = Fertilizers cost (Tk/Acre); X_5 = Manure cost (Tk/acre); X_6 = Irrigation cost (Tk/acre); X_7 = Insecticides cost (Tk/acre);

And b_o=intercept and b_1…. b_7 = Coefficient/parameters of respective variables.

Cost and Return Analysis

Cost and return analysis considered variable cost and fixed cost. To achieve the objectives of the study, simple tabular analysis was used to determine the profitability of cauliflower growers. Flowing profit equation was used to access the profitability of production.
Net return of cauliflower producer,

□=Prc.Qc-(TVC+TFC)

]Where,
□= Profit of cauliflower producer per hectare per year
Prc=Per unit price of cauliflower. Qc= Quantity of cauliflower, TVC=Total variable cost and
TFC= Total fixed cost

Gross Return

Gross return was calculated by multiplying the total volume of output of an enterprise by the average price in the harvesting period. Gross return was calculated simply by multiplying the total volume of output by its per unit price in Tk in the harvesting period. The following equation was used to estimate gross return (GR):

GR=Pc.Qc

Where, GR= gross return from output. Pc=Price of cauliflower (Tk.), Qc=Quantity of cauliflower produce.

Gross margin

Gross margin calculation was done to have an estimate of the difference between total return and variable costs. The analysis is also easily understandable because of its simplicity. The Following equation used to assess gross margin:

GM = TR-VC

Where, GM = Gross margin; TR = Total return; and VC = Variable cost.

Net return

Net return analysis was considered as the differences between Gross returns and Total costs.

NR=GR-TC

Where, NR= Net return, GR=Gross returns and TC=Total cost

Benefit-Cost Ratio (BCR)

The BCR is estimated as a ratio of gross returns and gross costs. The formula of calculating BCR (undiscounted) is shown below:

BCR=(GR/TC)
Where, GR= Gross return, TC=Total cost

Results and Discussion Socioeconomic characteristics of the selected farmers

Table 1 represents the basic information of the selected farmers in the study areas. It was found that average household and farm size of small, medium and large farmers was 6.0, 5.0 and 6.0; and 0.83, 2.11 and 3.09 ha, respectively. Average dependency ratio of large farmers (2.6) was comparatively lower than small and medium farmers (1.2 and 1.9, respectively) which indicated that large farmers were more self-sufficient and self-employed.

Table 1. Basic information about the selected farmers

Average household size (no.)		6.0	5.0	6.0
Average farm size (ha)		0.83	2.11	3.09
Average dependency ratio (no.)		1.2	1.9	2.6
Average sex distribution (% of farmers)	Male	62.0	72.1	67.5
	Female	38.0	27.9	32.5
Average age (years)		31	38	35
Literacy rate (% of farmers)	Illiterate	32.0	56.5	55.6
	Sign only	42.0	27.5	22.4
	Primary and above	26.0	16.0	22.0
Occupational status (% of	Agriculture only	26.0	22.0	29.0
	Agriculture and others	74.0	78.0	71.0

Source: Field Survey, 2019

The percentages of male and female respondents were 62.0, 72.1 and 67.5; and 38.0, 27.9 and 32.5 for small, medium and large farmers, respectively. Average age of small, medium and large farmers was 31, 38 and 35 years, respectively. Though 42.0% small farmers could put sign only, majority of the medium and large farmers (56.5 and 55.6%, respectively) were illiterate in the study areas. Most of the farmers were engaged in agriculture as well as other income generating activities like labor selling, service, small business, etc. (74.0, 78.0 and 71.0% small, medium and large farmers, respectively) (Table 1).

Profitability of cauliflower production estimation of production cost

For calculating total production cost, variable and fixed costs were taken into consideration. The

components of variable cost were land preparation, sowing, weeding, harvesting, power tiller, seed/seedlings, fertilizer, manure, irrigation, insecticides, wastage and miscellaneous. Fixed cost items for crop production were agricultural equipment, land use cost and interest on operating capital.

It is evident from Tables 2 that total cost of human labor for land preparation amounted to Tk. 3433.33 and which covered 3.66% of the total cost (TC) of production. TC of human labor for sowing amounted to Tk. 3117.78 per acrein cauliflower production; that covered 3.32% of the respective TC of production. TC of human labor for weeding amounted to Tk. 3273.33 per acrein cauliflower production; that covered 3.48% of the TC of production. Total cost of human labor for harvesting amounted to Tk. 4493.33 per acrein cauliflower production; that covered 4.79% of the total cost of production. For cauliflower production, the average per acrepower tiller cost was Tk. 6085.19. In percentage terms it shared 6.48% of total cost (Tables 2).

The farmers used different kinds of fertilizers for higher yield of vegetables. Commonly used fertilizers were Urea, TSP, MP, Gypsum, etc. All the fertilizers were purchased. Costs of fertilizers were estimated according to the cash price paid. Market prices of Urea, TSP, and MOP were Tk. 20, Tk. 25, and Tk. 18, respectively. Most of the farmers used cowdung as manure in producing cauliflower. The cost of cowdung acre^{-1} was Tk. 5863.03. The total amount of seeds requirement acre^{-1}for producing cauliflower production was 0.064 kg and its respective cost was Tk. 3105.83 which shared 3.31% of total cost of production. The cost of insecticides amounted to Tk. 6640 acre^{-1} for cauliflower production, which occupied 7.08% of its respective total costs. Per acre cost of irrigation water in cauliflower was Tk. 6242.72 which represented 6.65% of their respective total costs. Per acre miscellaneous cost in cauliflower was Tk. 2554.44 which represented 2.72% of its respective total costs. Summation of the costs of variable inputs gave the total variable costs nwhich was Tk. 61591.06 per acre for cauliflower production. In percentage, total variable costs covered 65.62% of the total costs for cauliflower production (Table 2).

Table 2. Cost and return of cauliflower production acre^{-1}

Items	Unit	Quantity	Price unit^{-1} (Tk.)	Total value (Tk.)	% of Total
A. Gross returns					
Main Product	No.	11470.37	20	229407.4	
By Product	Tk.	-	-		
Total gross return	Tk.	-	-	229407.4	
B. Variable cost					
Human Labor					
Land preparation	Man-days	11.44	300	3433.33	3.66
Sowing	Man-	10.39	300	3117.78	3.32

	days				
Weeding	Man-days	10.91	300	3273.33	3.48
Harvesting	Man-days	14.98	300	4493.33	4.79

Per acre cost of agricultural equipment in cauliflower was Tk. 2664.117 which represented 2.84% of its total costs. The land use cost acre^{-1} was Tk. 20000 for cauliflower production; which covered 21.31% of TC of cauliflower production. In production practice, per acreinterest on operating cost was Tk. 9605.37 cauliflower production. In percentage term, this cost covered 10.23% of TC for cauliflower production. Summation of the costs of fixed inputs made total fixed costs. Total fixed costs were Tk. 32269.49 per acre for cauliflower production. In percentage term total fixed costs covered 34.38% of TC for cauliflower and production. In order to estimate gross costs acre^{-1}, all the resources used in cauliflower production have been recaptured together. Per acre gross costs of cauliflower production were Tk. 93860.55 (Table 2).

Estimated returns

It was seen from Tables 2 that acre^{-1} average yield of cauliflower was estimated to be 11470.37 kg acre^{-1}. Per acre gross returns of cauliflower was Tk. 229407.4. Per acre gross margins were estimated at Tk.167816.35 for cauliflower. Per acre net returns of cauliflower was Tk. 135546.85.Benefitcostratiosofcauliflowerproductionacre^{-1}was2.44, which implies that Tk. 2.44 will be achieved for corresponding crop by investing Tk. 1.00 in cauliflower production.

Factors affecting cauliflower production

To identify and measure the effects of relevant variables of production on gross returns of cauliflower, Cobb-Douglas production function model was used. Estimated values of the production function analysis, estimated values of the coefficients and related statistics of the

Cobb-Douglas production functions of cauliflower are presented in Tables 3.

Factors affecting production of cauliflower

Human labor cost(X1)

The magnitude of the regression coefficient of human labor costs was 0.142 with a positive sign. This coefficient was statistically significant at 5% probability level it implies that, 1% increase in human labor costs, keeping other factors constant, would lead to an increase in the gross return by 0.14% (Table 3).

Tillage cost (X2)

The magnitude of the regression coefficient of tillage cost was 0.043 with a negative sign. This coefficient was insignificant. This indicates that an increase in 1% of tillage cost, remaining other factors constant, would result in decrease in the gross return by 0.04% (Table 3).

Seeds cost (X3)

It can be seen from Table 4 that regression coefficient of seeds cost was 0.406 with a positive sign. This coefficient was statistically significant at 1% probability level it implies that, 1% increase in seed costs, keeping other factors constant, would lead to an increase in the gross return by 0.41%.

Fertilizers cost (X4)

It can be seen from Table 4 that regression coefficient of fertilizer (Urea, TSP, MOP, etc.) cost was 0.274 with a positive sign. This coefficient was statistically significant at 1% probability level it implies that, 1% increase in fertilizer costs, keeping other factors constant, would lead to an increase in the gross return by 0.27%.

Manure cost (X5)

It can be seen from Table 4 that the magnitude of the regression coefficient of manure cost was 0.36 with a positive sign. This coefficient was insignificant. This indicates that an increase in 1% of manure cost, remaining other factors constant, would lead to an increase in the gross return by 0.36%.

Irrigation water cost (X6)

It can be seen from Table 4 that the magnitude of the regression coefficient of irrigation water cost was 0.032 with a positive sign. This coefficient was insignificant. This indicates that an increase in 1% of irrigation water cost, remaining other factors constant, would lead to an increase in the gross return by 0.03%.

Insecticides cost (X7)

It can be seen from Table 4 that regression coefficient of insecticides cost was 0.020 with a positive sign. This coefficient was statistically insignificant. This indicates that an increase in 1% of insecticides cost, remaining other factors constant, would result in an increase in the gross return by 0.02%.

Coefficient of multiple determinations (R^2)

It is evident from Table 4 that the value of the coefficient of multiple determinations (R^2) was 0.632. It indicated that about 63% of the variations of the gross return are explained by the explanatory variable included in the model.

Goodness of fit (F-value)

The F-value (11.797) of the estimated production function was significant at 1% probability level (Table 4), which implies good fit of the model. That is, all the explanatory variables included in the model were important for explaining the variation of cauliflower production.

Returns to scale ($\sum\beta i$)

The summation of all the regression coefficient of the estimated production function of cauliflower was 1.19. This implies that the production function exhibited increasing returns to scale. In this case, if all the variables specified in the production function were increased by 1%,

gross return on an average would increase by 1.19% (Table 3).

Conclusion and Recommendations

The study concludes that cauliflower production is highly profitable in the study areas. It is experienced that involvement with cauliflower production created ample scope to increase income, employment and nutritional status of farmers; ameliorate the problem of gender issue by enabling the women to participate in the household decision-making in rural areas. The study reveals that human labor, seed cost and fertilizers cost had significant impact on cauliflower production. Considering the findings of the study, some essential policy recommendations have been arisen which are: input and price support, and motivation and training programs should be arranged by different government and non-government organizations; and public-private partnership should be emphasized for creating scope to improve the overall economic condition of the farmers through homestead vegetable farming.

Conflicts of Interest

There are no conflicts to declare.

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