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Economic Study on Winter Vegetables Produced by Different Categories of Farms

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Abstract: The study was designed to assess the comparative profitability of selected winter vegetables like potato, cauliflower and tomato. To achieve this objective, total of 75 farmers, 25 producing potato, 25 producing cauliflower and 25 producing tomato were selected. For this purpose, Cobb-douglas production function model was used. Per hectare total cost of production of potato, cauliflower and tomato were 51396.79, 64406.06 and 61663.87 TK., respectively and the corresponding gross incomes were 99401.44, 119165.12 and 93442.24 TK., respectively. The estimated net return of producing potato, cauliflower and tomato were 48004.65, 54759.06 and 31778.37 TK., respectively. For producing the three alternate winter vegetables net return was the highest for cauliflower followed by potato and tomato. It was also found that there was a large variation of yield in producing these winter vegetables among different categories of farms. In the case producing potato and cauliflower, per hectare yield was the highest for small farms followed by medium and large farms. On the other hand in the case of tomato per hectare yield was the highest (48164.50 kg) for large farms followed by medium (47444.10 kg) and small farms (46143.00 kg). It is concluded that production of cauliflower is more profitable than that of others.

Key words: Economic study, winter vegetables, production, profitable, Cobb-douglas

INTRODUCTION

Agriculture plays a vital role in the economy of Bangladesh. It accounted for about 37%^[1] of GDP and nearly 63% of the total employment in 1995-96^[1]. Bangladesh has about 13.80 million ha of total cropped area of which 2.91 million ha are single cropped, 3.94 million ha are double cropped and 1.01 million ha are triple cropped area. In total net sown areas is about 7.85 million ha having a cropping intensity of 175.71^[2]. Rice, wheat, pulses, vegetables, oil seeds, sugarcane and potato are the major crops grown in Bangladesh. Vegetables are a major and efficient source of micronutrients considering both per unit area of land and per unit cost of production^[3]. Since the mid sixties, all the government programs have been aimed at achieving self-sufficiency in food grain production. This illusive chasing towards self-sufficiency in food grain production led to adverse effect on the acreage and production of winter vegetables. As a result, the people of Bangladesh are suffering from severe malnutrition. 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. Potato, cauliflower and tomato are grown in winter season may provide such opportunities. Farmers would be benefited from this study for effective operation and management of their farms. The results of the analysis will be helpful to the farmers as well as policy makers in providing a basis for taking appropriate decision in respect of production of these vegetable crops. The study may also help extension workers to learn the various problems of the selected winter vegetable grower. Therefore, they will be equipped with adequate knowledge for giving various suggestions to the farmers. Thus, the present study makes an attempt to analyze and compare the relative profitability of potato, cauliflower and tomato production.

MATERIALS AND METHODS

Selection of the study area: Five villages namely, Khairabad, Kongshonagor, Porchimsing, Singherikhola and Behermondal under Devidwar and Burichong Upazila in the district of Comilla were selected for collecting data.

Selection of sample and sampling technique: Sampling was done by selecting representative farms to minimize time and cost of the study. Achieving the ultimate objectives of the study, 75 farmers were selected randomly.

Method of data collection: Data were collected in 2000 through interview method using survey schedule. Before taking actual interview, the whole academic purpose of the study was clearly explained to the sample farmers. At the time of interview, the researcher asked questions systemically and explain 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 checked so as to ensure that information to each of the items had been properly recorded.

Analytical technique: To explore the relationship between production and input used, Cobb-douglas production function was used because of the log linear (Cobb-douglas) model proved superior on theoretical and econometrics grounds. Finally, double log functional form was chosen on the basis of better results obtained from it. Multiple regression analysis was conducted to understand the possible relationship between the production of winter vegetables and inputs used. In order to determine the effect of variable inputs Cobb-douglas production function was initially estimated. The functional form of the multiple regression is as follows:

$$Y = a X_{11}^b X_{22}^b X_{33}^b X_{44}^b X_{55}^b X_{66}^b X_{77}^b \mu_i$$

$$\text{Or, } \log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + \mu_i$$

Where:

- Y = Gross return (TK. ha⁻¹)
- a = Constant or intercept value
- X₁ = Human labor (TK. ha⁻¹)
- X₂ = Seedlings (TK. ha⁻¹)
- X₃ = Inorganic manure (TK. ha⁻¹)
- X₄ = Organic manure (TK. ha⁻¹)
- X₅ = Irrigation (TK. ha⁻¹)
- X₆ = Insecticides (TK. ha⁻¹)
- X₇ = Tillage (TK. ha⁻¹)
- b₁, b₂,....., b₇ = Coefficient of respective variables
- μ_i = Error term

RESULTS AND DISCUSSION

Estimation of variable cost of potato, cauliflower and tomato production: In the case of potato, human labour

used was 296 man-days per hector of which 95 mandays were farm family and 201 man-days were hired labour (Table 1). Total cost of human labour amounted to TK. 14800 ha⁻¹. In the case of cauliflower, the total human labour requirement was 364 man-days per hector of which 150 man-days were family supplied and 214 man-days were hired and the total cost of human labour amounted to 18200 TK. ha⁻¹. In the case of tomato, the total human labour requirement was 533 man-days per hector of which 231 man-days were family supplied and 302 man-days were hired. Total cost of human labour amounted to 26650 TK. ha⁻¹. Animal labour and power tiller were mainly used for land preparation. The hiring rate of pair-day of animal labour was TK. 50. The animal labour/power tiller cost of potato, cauliflower and tomato were 3590.84, 2470.00 and 2970.00 TK. ha⁻¹ respectively, for land preparation. The average price of potato seeds was estimated at 12 TK. kg⁻¹. The average price of cauliflower seedlings was estimated at TK. 0.40 per number and the average price of tomato seedlings was estimated at 0.10 TK. per number. The total costs of seeds/seedlings of potato, cauliflower and tomato were 10143.84, 13842.87 and 4006.20 TK. ha⁻¹. The cost of cowdung, ash and oil cake were TK. 1.00, 2.00 and 8.00 kg⁻¹, respectively. Per hectare costs of cowdung, ash and oil cake were 2551.80, 600.00 and 00.00 TK. for producing potato, 3548.98, 1309.84 and 1020.16 TK. for producing cauliflower and 6446.07, 1523.76 and 659.52 TK. for producing tomato. Costs of fertilizers were estimated according as the cash price paid. Market prices of urea, T.S.P., M.P., gypsum and S.S.P. were 6, 13, 8, 3 and 4 kg⁻¹, respectively. Per hectare costs of urea, TSP, MP, SSP and gypsum were 2639.28, 2617.60, 2841.60, 747.80 and 00.00 for producing potato, 1901.28, 4792.32, 2535.04, 950.64 and 250.72 TK. for producing cauliflower and 1658.40, 4619.68, 2211.20, 00.00 and 242.46 TK. for producing tomato. The cost of insecticides was calculated on the basis of actual money paid (Table 1). Irrigation cost was calculated according to hiring rate in the study area.

Estimation of fixed cost of potato, cauliflower and tomato production: Interest on operating capital was charged at the rate of 8% for 3 months in consulting the local bank manager. Interest on operating capital was charged on cash cost only. Land use cost was calculated by using per hector cash rental value of land. Land use cost per hector varied from 4000 to 6000 TK. for the cropping period covering three months. Tools and equipment cost was less than 1% of the total cost. Considering the each costs per kg/piece of potato, cauliflower and tomato were calculated at 4.00, 4.00 and 2.00 TK., respectively.

Table 1: Per hectare variable cost of potato, cauliflower and tomato production

Inputs used	Unit	Potato		Cauliflower		Tomato	
		Quantity	Cost (TK.)	Quantity	Cost (TK.)	Quantity	Cost (TK.)
Human labour	Man-day	296	14800.00 (32.59)	364.00	18200.00 (31.28)	533.00	26650.00 (47.73)
Animal labour/	TK.	-	3590.84 (7.91)	-	2470.00 (4.25)	-	2970.00 (5.32)
Seed/Seedling	kg	845.32	10143.84 (22.34)	34607.24	13842.87 (23.79)	40062.00	4006.20 (7.17)
Fertilizer							
Urea	kg	439.88	2639.28 (5.81)	316.88	1901.28 (3.27)	276.40	1658.40 (2.97)
TSP	kg	355.20	2617.60 (5.76)	368.64	4792.32 (8.24)	355.36	4619.68 (8.27)
MP	kg	355.20	2841.60 (6.26)	316.88	2535.04 (4.36)	276.40	2211.20 (3.96)
SSP	kg	149.56	747.80 (1.65)	316.88	950.64 (1.63)	-	-
Gypsum	kg	-	-	62.68	250.72 (0.43)	80.82	242.46 (0.43)
Manure							
Compost/Cowdung	kg	2551.80	2551.80 (5.62)	3548.98	3548.98 (6.10)	6446.07	6446.07 (11.54)
Ash	kg	300.00	600.00 (1.32)	654.92	1309.84 (2.25)	761.88	1523.76 (2.73)
Oil Cake	kg	-	-	127.52	1020.16 (1.75)	82.44	659.52 (1.18)
Irrigation	TK.	-	3602.92 (7.93)	-	5550.00 (4.54)	-	2346.28 (4.20)
Insecticides	TK.	-	1270.44 (2.80)	-	1810.32 (3.11)	-	2505.72 (4.49)
Total variable cost	TK.	-	45406.12 (100.00)	-	58182.17 (100.00)	-	55839.49 (100.00)

Source: Field Survey 2000, Figures within the parentheses indicate the percentages of the total

Table 2: Per hectare yield and economic return of potato, cauliflower and tomato

Categories of farm	Unit	Potato	Cauliflower	Tomato
Small farm	Yield (kg)	30333.90	40822.22	46143.00
	Gross income (TK.)	121335.60	163288.88	92286.00
Medium farm	Yield (kg)	25330.90	30771.60	47444.10
	Gross income (TK.)	101323.60	123086.40	9488.20
Large farm	Yield (kg)	21537.00	28843.80	48164.50
	Gross income (TK.)	86148.00	115375.12	96329.00
Average farm size	Yield (kg)	24850.36	29791.28	46721.12
	Gross income (TK.)	99401.44	119165.12	93442.24

Source: Field Survey 2000

Table 3: Per hectare cost and return of potato, cauliflower and tomato

Items	Unit	Total value of potato (TK.)	Total value of cauliflower (TK.)	Total value of tomato (TK.)
Total variable cost (TVC)	TK.	45406.12 (88.72)	58182.17 (90.33)	55839.49 (90.55)
Fixed cost				
Interest on operating capital	TK.	800.17 (1.56)	1003.46 (1.56)	824.38 (1.49)
Rental value of land	TK.	5000.00 (9.73)	5000.00 (7.76)	5000.00 (9.06)
Tools and equipment	TK.	190.50 (0.37)	220.25 (0.34)	-
Total fixed cost	TK.	5990.67 (11.28)	6223.89 (9.67)	5824.38 (9.45)
Total cost (A+B)	TK.	51396.79 (100.00)	64406.06 (100.00)	61663.87 (100.00)
Gross income	TK.	99401.44	119165.12	93442.24
Gross margin (D-A)	TK.	53995.32	60982.95	37602.75
Net return (D-C)	TK.	48004.65	54759.06	31778.37

Source: Field Survey 2000, Figures within the parentheses indicated the percentages of the total

Table 4: Estimated value of coefficient and related statistics of Cobb-douglas production function model of potato, cauliflower and tomato production

Explanatory variables	Coefficients		
	Potato	Cauliflower	Tomato
intercept	0.645	-3.020	1.086
Human labor (X ₁)	0.769* (0.169)	0.596** (0.240)	0.299** (0.139)
Seedlings (X ₂)	0.114** (0.051)	0.445* (0.119)	0.693* (0.214)
Inorganic manure (X ₃)	0.080 (0.129)	0.417 (0.173)	-0.360 (0.185)
Organic manure (X ₄)	0.081 (0.077)	0.114 (0.106)	0.031 (0.142)
Irrigation (X ₅)	0.067 (0.301)	0.266** (0.106)	0.331** (0.126)
Insecticides (X ₆)	-0.141** (0.055)	-0.080 (0.128)	0.155** (0.057)
Tillage (X ₇)	0.222** (0.083)	0.186** (0.079)	0.250** (0.094)
R ²	0.787	0.841	0.772
F	8.983*	12.983*	8.213*
Return to scale	1.192	1.944	1.399

*Significant at 1 % level, ** Significant at 5 % level, Figures within the parentheses indicate the standard error

Yield and economic return: Per hectare average yields of potato were 30333.90, 25330.90 and 21537.00 kg for small, medium and large farmers, respectively (Table 2). The results indicate that the yield of small farmers was the highest. Per hectare average yields of cauliflower were 40822.22, 30771.60 and 28843.80 piece for small, medium and large farmers, respectively. The results indicate that the yield of small farmers was higher than that of others. Per hectare average yields of tomato were 46143.0, 47444.10 and 48164.50 kg for small, medium and large farmers, respectively. The findings show that the yield of large farmers was the highest. Gross income of potato and cauliflower was the highest in small farmers than that of others. On the other hand gross income of tomato was higher in large farmers than that of others. On average farm size per hector yield of tomato (46721.12 kg) and gross income (TK. 119165.12) of cauliflower was higher than that of others. Per total variable cost (58182.17 TK.) of cauliflower was higher than other vegetables production. It was also found that per hector total fixed cost (6223.89 TK.) of cauliflower was higher than other vegetables production. It was shown that per hector total cost (64406.06 TK.) of cauliflower was higher than other vegetables production. Finally it was observed that per hector gross income (119165.12 TK.), gross margin (60982.95 TK.) and net return (54759.06 TK.) of cauliflower was higher than that of other vegetables production (Table 3).

Estimated values of the coefficient and related statistics of the Cobb-douglas production: The results indicate that the Cobb-douglas production function fitted well considering R^2 and F value. The coefficients of multiple determination R^2 were 0.787, 0.841 and 0.772 for potato, cauliflower and tomato, respectively which indicate that about 79, 84 and 77% of variation in returns are explained by the independent variables used in the model. The F value of the equation is also satisfactory as it was significant at 1% level implying that the variation of potato, cauliflower and tomato production significantly dependent on the factors of the model. F value of potato, cauliflower and tomato were significant at 1% level indicating that the model specified gave a reasonably good fit. For potato production, human labor cost was significant at 1% level and seed, insecticides, tillage cost were significant at 5% level and inorganic manure, organic manure, irrigation cost were insignificant. Results indicated that 1% increase the cost of using human labor, seed, power would increase the gross return of potato production by 0.769, 0.114 and 0.222%, respectively but insecticides cost would decrease the gross return by

0.141%, assuming the other inputs were held constant. For cauliflower production, seedlings cost was significant at 1% level and human labor, irrigation and tillage cost were significant at 5% level and inorganic manure cost, organic manure cost and insecticides cost were insignificant. Results indicate that 1% increase the cost of seedling, human labor, irrigation and tillage would increase the gross return of cauliflower production by 0.445, 0.596, 0.266 and 0.186%, respectively but insecticides cost would decrease the gross return by 0.080%, assuming that other inputs were held constant. For tomato production, seedlings cost was significant at 1% level and human labor cost, irrigation cost, insecticides cost and tillage cost were significant at 5% level and organic manure cost and inorganic manure cost were insignificant (Table 4).

Results indicate that 1% increase in seedlings cost, human labor cost, irrigation cost and tillage cost would increase the gross return by 0.693, 0.299, 0.331 and 0.250, respectively and inorganic manure cost would decrease the gross return by 0.360% assuming that other inputs were held constant. The summation of all the production coefficients of the equations for potato, cauliflower and tomato were 1.192, 1.944 and 1.399, respectively which indicates that production function exhibited increasing returns to scale. That is, if all the inputs specified in the function were increased by 1%, output would have increased by 1.192, 1.944 and 1.399%, respectively for potato, cauliflower and tomato.

In determining the comparative profitability of potato, cauliflower and tomato it was found that per hector yield of tomato (46721.12 kg) and gross income (119165.12 TK.), gross margin (60982.95 TK.) and net return (54759.06 TK.) of cauliflower was higher than those of others. From this study, it can be concluded that cauliflower is more profitable than other vegetables.

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