Profitability of Summer BARI Hybrid Tomato Cultivation in Jessore District of Bangladesh

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ABSTRACT

The present study was conducted at Bagherpara thana under Jessore district to assess the profitability, contribution of factors to production and changes in socio-economic status of the farmers. About 42% and 21% of total variable cost was incurred for tunnel preparation and using human labour, respectively. The average yield of BARI hybrid tomato was found 32.78 t/ha. The average return per hectare over variable cost is observed to be Tk 11,44,387 on full cost basis and Tk 12,07,481 on cash cost basis. On an average benefit cost ratio was found to be 4.19 on full cost basis and 5.09 on cash cost basis. The cost per kilogram of hybrid tomato cultivation was Tk 10.94 and return from one kilogram of tomato production was Tk 45.83. The functional analysis shows that MP and TSP had positive significant contribution to yield while human labour, hormone, irrigation and seed had negative significant impact on yield of hybrid tomato. The overall socio-economic status of the sample farmers was found increased by 20.33 percent. High price of tunnel materials, timely non availability of hormone, insect and diseases attack were reportedly the major problems for tomato production.

Key words: Hybrid tomato, profitability, socio-economic status.

INTRODUCTION

Bangladesh is an agro-based country where agriculture is considered as backbone of her economy. About 80 percent of its population lives in rural areas and 62 percent of total labor force are engaged in agriculture (BBS, 2005). Agriculture plays a vital role through employment generation, poverty alleviation, food security, enhance standard of living by increasing income level of rural population.

Many developing countries like Bangladesh benefited from the green revolution in cereal production in the past but were not able to substantially reduce poverty and malnutrition. Vegetable production can help farmers to generate income which eventually alleviate poverty. Among the vegetables tomato is one of the most important vegetables in terms of acreage, production, yield, commercial use and consumption. At present 6.10% (BBS, 2005) area is under tomato cultivation both in winter and summer. It is the most consumable vegetable crop after potato and sweet potato occupying the top of the list of canned vegetable (Chowdhury, 1979). It is cultivated all over the

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country due to its adaptability to wide range of soil and climate (Ahmed, 1976). However, the yield of the crop is very low compared to those obtained in some advanced country (Sharfuddin and Siddique, 1985). In Bangladesh congenial atmosphere remains for tomato production during low temperature winter season that is early November is the best time for tomato planting in our country (Hossain et al., 1986). It is a good source of vitamin C (31 mg per 100g), vitamin A, calcium, iron etc. (Matin et al., 1996). Although tomato plants can grow under a wide range of climatic conditions, they are extremely sensitive to hot and wet growing conditions, the weather which prevails in the summer to rainy season in Bangladesh. But limited efforts have been given so far to overcome the high temperature barrier preventing fruit set in summer-rainy (hot-humid) season. Its demand for both domestic and foreign markets has increased manifold due to its excellent nutritional and processing qualities (Hossain et. al, 1999). Considering the growing demand and importance of tomato, Bangladesh Agricultural Research Institute (BARI) has taken initiative to develop off-season summer and rainy season tomatoes. So far BARI has developed and released 2 hybrid tomato varieties i.e. BARI hybrid tomato-3 and 4 which can be grown during summer and rainy season under polytunnel. But very little information has been generated about the profitability and adoption of hybrid tomato cultivation technologies by the farmers in the country. Generalization from studies conducted by home and abroad (Mohiuddin et al., 2007; Zaman et al., 2006; Islam, 2005; Rahman et al., 1998; Ali and Gupta, 1978; Gupta and Rao, 1978) regarding the tomato production may not be always applicable due to considerable variation in attributes of the technologies and for various others factors. Fortunately, the farmers of Bagherpara thana under Jessore district started to adopt this technology as a pioneer farmer since 2005. It is recognized that in order to expand the area of this crop as well as to fit this crop in the farmers cropping system, studies are needed to ascertain its cost and return situation in relation to profitability, input use and farmer's resource use efficiency. Keeping all these factors in consideration the present study was undertaken to provide information through fulfillment of the following objectives.

OBJECTIVES

1. To ascertain the cost and return of hybrid tomato cultivation;
2. To study interrelationship between inputs and outputs of hybrid tomato cultivation;
3. To assess the changes in socio economic status of the growers due to hybrid tomato cultivation.

METHODOLOGY

The present study was conducted at Bagherpara thana of Jessore district. The study area was purposively selected considering the higher concentration of BARI hybrid tomato-3 and 4 cultivation during summer season. The study was carried out by using formal survey method. At first a complete list of the tomato growers was prepared and a total of 42 farmers were chosen randomly from the list to collect the information regarding tomato cultivation. The sample farmers were classified as small and medium classes on the basis of their total land holdings. Large category of farm was not considered because of non availability of large farmers in the list. Data were collected through pre-designed interview schedule during the period of summer 2007. The unit of data collection was a single hybrid tomato plot of each selected farmers where detailed information regarding this crop cultivation were taken and analysis was done on per hectare basis. Although some of the selected farmers continued to harvest the crop upto December but yield data and other information were taken upto last week of October considering summer period. Conventional statistical analysis using average, percentages, ratio etc. were applied to derive meaningful findings in this study. Perceived Impact Score (PIS) technique (Rahman, 2006) was used to elicit the impact of hybrid tomato cultivation on the socio-economic status of the farmers. Each farmer indicated the extent of change that has been occurred for tomato cultivation by checking any one of the four responses, i.e. excellent, moderate, average and no change. The weights assigned were 3, 2, 1 and 0 for excellent, moderate, average and no change respectively. The PIS for a particular change item was standardized by using the following formula:

$$\text{Standardized PIS (SPIS)} = \frac{\text{Observed perceived impact score}}{\text{Possible perceived impact score}} \times 100$$

A production function analysis was carried out to explore the contribution and productivity of individual inputs. Cobb-Douglas production model was used because of the best fit of the sample data. The functional form of the Cobb-Douglas multiple regression equation was as follows:

$$Y = a\, X_1^{b1}\, X_2^{b2} \text{----------} X_6^{b6} + U_i$$

For the purpose of the present empirical exercise the Cobb-Douglas production function was converted into the following logarithmic (Double log) form with variables specific as under:

$$L_nY = Ln\, a + b_i\, Ln\, X_1 + b_2\, Ln\, X_2 + b_3\, Ln\, X_3 + b4\, Ln\, X_4 + b_5\, Ln\, X_5 + b_6\, Ln\, X_6 + U_i$$

Where,

$Y =$		Gross return (Tk/ha)
$X_1 =$		Human Labour (Tk/ha)
$X_2 =$		Cost of TSP (Tk/ha)
$X_3 =$		Cost of MP (Tk/ha)
$X_4 =$		Cost of Hormone (Tk/ha)
$X_5 =$		Irrigation cost (Tk/ha)
$X_6 =$		Cost of Seed (Tk/ha)
$a =$		Constant of intercept
b_i, b_2 ---------- $b_6 =$		Coefficient of the respective variable
$U_i =$		Error term.

RESULTS AND DISCUSSION

Cost of hybrid tomato cultivation

In this study cost of production was calculated on the basis of variable inputs like seed, fertilizer, manure, human labour, hormone, pesticide, irrigation etc. A perusal of Table 1 revealed that total variable cost of hybrid tomato cultivation was Tk 3,58,577 per hectare. When only cash costs was considered the cost per hectare was Tk 2,95,182 which is about 82 percent of the total cost. Among the different cost items tunnel preparation cost was the major cost items which accounted for about 42% of the total cost. The second highest (20.57%) cost item was human labour followed by insecticide (12.70%). There is no wide variation among different categories of farms in the cost of tomato cultivation. However, higher manure cost implies higher use of manure by small farmers over medium farmers. On the contrary, medium farmers appear to use more fertilizer and irrigation water.

Table 1.   Structure of cost of hybrid tomato cultivation

(Tk./hec.)

Cost items	Small	Medium	All	Percentage
Human labour:				
Family	64641	62149	63395	17.68
Hired	8461	12290	10375	2.89
Total	73101	74439	73770	20.57
Land preparation cost	6526	6662	6594	1.84
Seed cost	8188	8114	8151	2.27
Fertilizer	26795	28175	27485	7.66
Manure	4362	2361	3362	0.94
Tunnel cost	146380	155941	151160	42.16
Irrigation cost	6476	6827	6652	1.86
Hormone	35504	36037	35771	9.98
Insecticide cost	45003	46263	45633	12.73
Total variable cost:				
Full cost basis	352335	364820	358577	100.00
Cash cost basis	287694	302671	295182	

Source: Field survey, 2008

Profitability of hybrid tomato cultivation

Return was calculated by multiplying yield with its price. Return per hectare of tomato cultivation is shown in Table 2. The average yield of summer tomato was 32.78 t/ha which was found a bit higher for the medium farmers. The average gross return was calculated as Tk 15,02,664 per hectare. The average price of hybrid tomato upto last week of October was Tk 45.83 per kilogram. The average return over variable cost was observed to be Tk 11,44,387 on full cost basis and Tk 12,07,481 on cash cost basis. The return over variable cost was found higher for the medium farmers compared to small farmers. On the average, benefit cost ratio was found to be 4.19 on full cost basis and 5.09 on cash cost basis.

Table 2.   Return from hybrid tomato cultivation (Tk. /hec.)

Particulars	Small	Medium	All
Yield (t/ha)	32.45	33.12	32.78
Gross return	1487645	1517682	1502664
Total variable cost			
Full cost basis	352335	364820	358577
Cash cost basis	287694	302671	295182
Return over variable cost			
Full cost basis	1135311	1152862	1144087
Cash cost basis	1199951	1215011	1207481
Benefit cost ratio			
Full cost basis	4.22	4.16	4.19
Cash cost basis	5.17	5.01	5.09
Cost per kilogram	10.86	11.01	10.94
Return per kilogram	45.84	45.82	45.83

Source: Field survey, 2008

Contribution of different inputs to hybrid tomato production

For producing hybrid tomato different types of variable inputs were employed. Initially 10 variables were included but to improve the result, some of the independent variables were omitted to allow the selection of the best set of explanatory variables. Estimated values of coefficients and related statistics of Cobb-Douglas production function are presented in Table 3. The coefficient of determination (R^2) tells how well the sample regression line fits the data (Gujarati, 1995). The coefficient of determination (R^2) was 0.59, which indicates that around 59 percent of the variations in gross return were explained by the independent variables included in the model. The F-value of the equation is significant at 1% level implying that the variation in return from summer tomato production mainly depends upon the independent variables included in the model.

Table 3. Estimated values of coefficients and related statistics of Cobb-Douglas production function

Variables	Co-efficient	t-value
Intercept	45.31***	2.89
Human labour (X_1)	-0.23**	-2.10
TSP (X_2)	0.53*	1.79
MP (X_3)	0.17**	2.32
Hormone (X_4)	-1.12*	-1.84
Irrigation (X_5)	-0.009	0.48
Seed (X_6)	-0.94**	-2.01
R^2	0.59	
F-value	3.03**	

Note: * ,** and *** indicate significant at 10%, 5% and 1% level

Input-output relationship

The negative and significant regression coefficient of human labour (X_1) and seed (X_6) indicated the inefficient use of these input. It implies that 1% increase in human labour and seed cost, keeping other factors constant, would decrease the gross return by 0.23 and 0.94 percent respectively. The regression coefficient of hormone (X_4) was also negative and significant at 10% level. The regression coefficient of MP (X_3) was positive and significant at 5% level while the regression coefficient of TSP (X_2) was positive and significant at 10% level. The positive coefficient of MP and TSP imply that 1% increase in the cost of these inputs keeping other factors constant would increase the gross returns by 0.17 and 0.53 percent respectively. The coefficient of irrigation (X_5) was found negative and insignificant.

Changes in socio-economic status of the farmers

Percentage distribution of the respondent according to their perception on different change items has been shown in Table 4. It is observed that the highest 7 percent excellent change has been occurred on income for growing hybrid tomato based on the perception of the respondents. The change occured 3 to 7% for excellent change, 9 to 24% for moderate change, 21 to 52% for average change and 19 to 70% for no change. From percentage distribution, it is clear that BARI hybrid tomato-3 and 4 cultivation has brought changes in socio-economic status of the sample farmers.

Table 4. Socio-economic changes of the farmers

Items	Nature of changes (%)				Total
	Excellent	Moderate	Average	No	
Food and nutrition	5	19	40	36	100
Housing condition	-	09	21	70	100
Using sanitary latrine	-	11	31	58	100
Clothing	5	15	38	43	100
Household furniture	-	12	23	65	100
Knowledge about summer tomato production	3	21	52	24	100
Income	7	24	50	19	

Source: Field survey, 2008

Changes in socio-economic status on the basis of PIS

The impact has been measured on the basis of farmer's perception about the extent of change that has been occurred due to tomato cultivation. Perceived impact score (PIS) was computed for each change item by summing the weights for responses of the respondents against that change item. PIS of a selected change item indicates how much change occurs due to hybrid tomato cultivation during summer season. The higher the PIS of a change item, the more is the impact of tomato cultivation. The possible PIS of any change item ranged from a minimum of zero to a maximum of 126 (42 x 3). The overall SPIS of 7 change items was found to be 20.33 percent which reflects that the overall change in socio-economic status of the farmers increased by 20.33 percent for cultivating hybrid tomato (Table 5).

Table 5. Impact of perceived items on the basis of PIS

Impact	PIS	Standardized	%	Rank order
Food and nutrition	39	30.95	17.26	3
Housing condition	17	13.49	7.52	7
Using sanitary latrine	23	18.25	10.18	5
Clothing	34	26.98	15.04	4
Household furniture	20	15.87	8.85	6
Knowledge about summer tomato production	43	34.13	19.03	2
Income	50	39.68	22.12	1
Overall change			20.33	

Source: Field survey, 2008

For calculating the impact of hybrid tomato cultivation, 7 selected change items have been arranged in rank order according to their SPIS values. Data contained in Table 5 indicates that the 7 change items were not equally important in terms of extent of change occurred. The highest SPIS was found 39.68 (22.12 %) on income while the lowest was 13.49 (7.52 %) for housing condition. So the impact on income was found to be the most important item among the selected items.

Constraints of hybrid tomato cultivation

Although hybrid tomato cultivation was observed to be a profitable crop, there were several constraints to its higher production. Constraints were identified based on the questions asked to the respondents and then they were edited and summarized to arrive at only few problems. It is observed from Table 6 that about one half of the farmers reported high price of tunnel materials was the problem. Timely non-availability of hormone and insect and diseases attack were the problems reported by each 40 per cent of the respondents. Timely non-availability of seed as a problem mentioned by 36 per cent of respondent in the study area.

Table 6.   Constraints to hybrid tomato cultivation

Items	Percent of response		
	Small	Medium	All farms
1. Timely non-availability of seed	38	31	36
2. Attack of insect & diseases	41	38	40
3. High price of fertilizer	10	8	10
4. High price of insecticide	17	15	17
5. Timely non-availability of hormone	41	38	40
6. High price of tunnel materials	48	46	48

Source: Field survey, 2008

Conclusion

BARI hybrid tomato-3 and 4 is a profitable crop on the basis of its return to investment. Farmers are highly pleased and encouraged with these technologies as they have the bright scope to increase their income by cultivating this crop. For upgrading the knowledge of the farmers, it is necessary to disseminate the latest information of the improved technological package of tomato cultivation which will enhance the farmers to increase production. From the analysis it is clear that BARI hybrid tomato-3 and 4 cultivation has brought changes in socio-economic status of the sample farmers. The overall socio economic status of the farmers increased by about 20 percent. As this crop is very labour intensive crop, there is an ample scope for increasing employment in the rural areas of Bangladesh.

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