ADOPTION AND PROFITABILITY OF IMPROVED TOMATO VARIETY IN THE CHITTAGONG REGION OF BANGLADESH

M. MOHIUDDIN[1], M. S. UDDIN[2], M. H. RASHID[1], K. M. F. HOSSAIN[1] AND M. A. MATIN[3]

[1]Scientific Officer, [2]Chief Scientific Officer, Regrional Agricultural Research Station, Hathazari, Chittagong, [3]Senior Scientific Officer, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur, Bangladesh

Accepted for publication: October 08, 2007

ABSTRACT

Mohiuddin, M., Uddin, M. S., Rashid, M. H., Hossain, K. M. F. and Matin, M. A. 2007. *Adoption and Profitability of Improved Tomato Variety in the Chittagong Region of Bangladesh.* **J .Soil .Nature .1(3): 52-58**

The study was conducted in Patiya and Satkania upazila of Chittagong district during 2005-2006 to assess the adoption status, agronomic practices and profitability of improved tomato variety among the farmers. Data were analyzed through tabular methods and Cobb- Douglas production model. The adoption status of improved tomato variety was found very low. Considering all the improved varieties that are cultivated in the study area Surokka (Indian variety) are ranked first followed by Ratan (BARI variety) and Ruma VF (Indian variety). Farmers' consciousness about improved tomato cultivation was found increasing. Gross margin was Tk 101566/ha and Tk 140015/ha on the basis of variable cost and cash cost respectively. Per hectare net return from tomato cultivation was Tk 100338 on the basis of full cost. On the basis of variable cost, returns to labour and returns to irrigation were Tk 483 and Tk 13.33 respectively. Major reasons in favour of improved tomato cultivation were higher yields, thick fruit skin, large size, long durability and high price due to attractive colour and size. The farmers of improved tomato adopters facing several problems like non-availability of quality seed, unfavorable weather, good quality fertilizer and insecticide for tomato cultivation. High price of inputs was recorded as one of the major problem to the tomato farmers.

Key Words: Adoption, Profitability, Improved Tomato Variety

INTRODUCTION

Tomato (*Lycopersicon esculentum*) is well-produced and most popular vegetables in all over the Bangladesh. It has well nutritional value. It contains vitamin A, B, C and calcium, iron etc. It's vitamin C contents is 31 mg per 100 g of tomato. It contains a number of nutritive elements almost double compared to fruit apple and shows superiority with regard to food values. It is consumed as a raw salad, cooked or as processed food item such as sauce, ketchup, jam, jelly, pickles soup etc. Tomato has originated in Peruvian and Mexican regions and come from tropical America and spread to other parts in the world in 16th century. It was perhaps introduced into Indian subcontinent by the Portuguese (Das, 1993).

Due to its palatability and vitamin content its demand in general increasing day by day, while its production is far from the requirements. During 1992-93 to 2003-04, the compound growth rate of tomato consumption was 7% per annum and the coefficient of variation was 11 percent. In 2003-04, the country production was 120 thousand metric tons of tomato. To meet up local demand Bangladesh govt. have also been imported 9395.14 metric tons of tomato in exchange of taka 1503 millions from foreign countries in the year 2000-2001 (BBS, 2004). Farmers are cultivating local tomato variety, which are low yielded and has less contribution to mitigate the malnutrition problem. Improved variety of tomato can play a vital role in future to mitigate the malnutrition problem (Rashid and Anwar, 2001). Farmers grow fifty tomato varieties in our country. Usually they were adopted the local and Indian varieties because seed availability in the nearly market. BARI has also developed 13 modern varieties of tomato having a good yield characters. They are getting potential profitable image by cultivating those varieties. It grows mainly in the winter season in Bangladesh because the optimum climatic conditions specially the night temperature (15-20^{o}c) prevails during that period (Islam, 2005). But these varieties are not adopted commercially or largely by the farmers in the country due to some constraints. Chittagong is one of the tomato growing areas in Bangladesh. The area and production of tomato in Chittagong region are increasing day by day. Demand and high price of tomato encourage farmers to bring more land under plough for this vegetable. Adequate seed availability increased improved tomato sowing in Chittagong region also. Many researches have already been done on profitability of producing tomato. Per hectare gross margin of Ratan variety tomato cultivation on total variable cost basis and cash cost basis was Tk 61206 and Tk 102879 for demonstration and non demonstration plot respectively (Matin et al., 1996). Another study revealed that net return per hectare from tomato cultivation was Tk 94821 and benefit cost ratio were 3.24 and 5.79 on total cost basis and cash cost basis respectively (Barman, 2005). Islam (2005) reported that per hectare gross margin of off season tomato cultivation was Tk 144832 and return to labour, return to irrigation and benefit cost ratio were 397, 14.96 and 5.54 respectively. These studies have used a variety of species such as Ratan, off season variety of tomato but very little is known of the farmers attitude and their constraints to adoption. Therefore, the study was taken in order to determine the adoption status and yield performance of improved tomato varieties in the farmers' field.

The study was undertaken with the following objectives: to find out the adoption status of improved tomato variety in the farmers field at the Chittagong region, to measure the profitability of the improved tomato variety and to identify the potentials and constraints to higher production of tomato.

MATERIALS AND METHODS

The study was based on primary data collected through farm household survey. The study was conducted in Patiya and Satkania upazila of Chittagong district during 2005-2006 to assess the adoption status, agronomic practices and profitability of improved tomato variety among the farmers. These study locations were purposively selected for the study where improved tomato was cultivated intensively. A complete list of improved tomato growers were prepared and total of 60 farmers selected using simple random sampling technique taking 30 from each location. However, the selected households were interviewed with a structured questionnaire for generating data on the demographic characteristics of households, the use of all parcels of land owned and operated by the households, cost and returns on cultivation of improved tomato. Data were analyzed through tabular methods and Cobb- Douglas production model.

To determine the contribution of some important inputs to the production process of improved tomato, the Cobb-Douglas production model was estimated because of the best fit of the sample data. The functional form of the Cob-Douglas multiple regression equation was as follows:

$Y = aX_1b_1X_2b_2.....X_{10}b_{10} + U_i$

Or, $\text{Log } y = \text{Log } a + b_1 \text{ Log } x_1 + b_2 \text{ Log } x_2 .....+ b_{10} \text{ Log } x_{10} + U$

Where,

Y= per hectare gross return (tk/ha), X_1= Cost of plough (tk/ha), X_2= Cost of irrigation (tk/ha), X_3= Cost of seed (tk/ha), X_4= Cost of Manures (tk/ha), X_5= Cost of Urea (tk/ha), X_6=Cost of TSP (tk/ha), X_7= Cost of MP (tk/ha), X_8=Cost of insecticides (tk/ha), X_9=Cost of bamboo (tk/ha), X_{10}=Cost of labour (tk/ha), a = intercept value, Ui= disturbance term/error term, b_1 b_2 b_3..... b_{10}= Co-efficient of the relevant variables.

RESULTS AND DISCUSSION

Socio-economic profile of farmers

Socioeconomic characteristics of the farmers affected their production patterns. In Patiya, there had a larger family size than Satkania. The average family size of the respondents was 5.28 (Table 1) which was smaller than the national average (5.48). Literacy had its own merits and contribution towards the process
of progress or modernization. On an average 86% and 81% sampled farmer were literate in Patiya and Satkania respectively in which primary education was highest (52%) in Patiya followed by secondary education (26%) in Satkania and 14% & 19% farmers were illiterate in Patiya and Satkania respectively. It might favour them to involve in service and business along with agriculture. Agriculture was the main occupation of the selected farmers and 15% & 17% farmers have no secondary occupation in Patiya and Satkania respectively i.e. they are fully engaged in agriculture (Table1). Considering only owned cultivated area most of the sampled farmers belonged to the small and medium size groups in Satkania and Patiya respectively (Table 1). About 11% & 15% tomato growers received agriculture related training in Patiya and Satkania respectively. It may be indicated that agriculture related training can help to increase technology adoption and increased farmers income from crop production.

Table1 Socio-economic characteristics of the sample farmers

Item	Patiya	Satkania	All
Education Level (%)			
Illiterate	14	19	16.5
Primary (i-v)	52	50	51
Secondary (vi-x)	25	26	25.5
SSC & above	9	5	7
Occupation (%)			
Primary (Agriculture)	64	60	62
Secondary (Business/service)	21	23	22
None	15	17	16
Farming experience (years)	3	3	3
No. training received (No.)	11	15	13
Average Family Size (No.)	5.43	5.13	5.28
Average cultivated land	1.06	.89	0.975
Average farm size	1.24	1.18	1.21

Source: Field Survey

Adoption status

Among the total respondents 71 farmers (21%) were found to be involved in improved tomato cultivation practice which was very low. However, there is a considerable overlap among the different variety of tomato cultivation i. e. same farmers produces more than one or two varieties of tomato in his different plots. Among the improved tomato growers 72% were cultivating Indian tomato variety named 'Surokka', 18% farmers were cultivating BARI variety "Ratan", 6.7% were cultivating 'Ruma VF', and 3.3% cultivating Indian variety 'Udoyan' in the study area (Table 2). Considering all the improved varieties that were cultivated in the study area Surokka was first, Ratan was second and Ruma VF was third. Higher adoption of surokka variety was caused by high price, regular size of the fruit, thick fruit skin, long durability, seed availability in the nearly market, and attractive color.

Table 2 Location- wise adoption of improved tomato variety by the surveyed farms

Variety adoption	Study locations					
	Patiya		Satkania		All	
	N	%	N	%	N	%
Surokka	20	67	23	77	43	72
Ratan	6	20	5	17	11	18
Ruma VF	3	10	1	3	4	6.7
Udoyan	1	3	1	3	2	3.3
All	30	100	30	100	60	100

Source: Field Survey

About 58% of the respondents reported that they have got information about improved variety from their neighbors followed by dealer or agents, extension contact and BADC respectively (Table 3).

Table 3 Area wise sources of information about improved tomato variety

Characteristics	Respondents						Rank
	Patiya		Satkania		All		
	N	%	N	%	N	%	
Extension contact	5	17	3	10	8	13.3	3
Neighbors	16	53	19	63.3	35	58.3	1
Dealer/Agent	8	27	7	23.3	15	25	2
BADC	1	3	1	3.3	2	3.3	4
All	30	100	30	100	60	100	

Source: Field Survey

Major reasons in favour of improved tomato cultivation were higher yields, thick fruit skin, large size, long durability and high price due to attractive colour and size (Table 4). Most of the farmers (52%) reported that they cultivate improved variety because of higher yield, 20% and 18% of the farmers told that because of higher demand and regular fruit size respectively.

Table 4 Reasons for adopting improved tomato variety

Reasons	Percentage of respondents					
	Patiya		Satkania		All	
	N	%	N	%	N	%
Higher yield	15	50	16	53	31	52
Regular fruit size	6	20	5	17	11	18
Higher demand (attractive color and size)	7	23	5	17	12	20
Thick fruit skin & long durability	2	7	4	13	6	10
All locations	30	100	30	100	60	100

Source: Field Survey

Agronomic practices

Farmers generally used ploughing, laddering, weeding, top dressing, irrigation and spraying in the cultivation of improved tomato. More number of spraying (14), ploughing (4), laddering (3), weeding (3) and irrigation (3) were done in the study area. Cultivation practices followed by the farmers are stated in Table 5. All of the respondents farmers reported that they sown their seeds in the bed within first week of November to second week of November and planted 3-4 weeks age of seedlings in their field within last week of November to first week of December. They started harvesting tomato from 3rd week of February to 2nd week of March and ended last week of March. The name of the variety which they grow in their field called improved variety but maximum seeds of those varieties coming from neighboring country (India).

Table 5 Level of technology employed in improved tomato cultivation in different locations

Particular	Location		All
	Patiya (No. /ha.)	Satkania (No. /ha.)	No. /ha.
No. of ploughings	4	4	4
No. of ladderings	2	4	3
No. of weedings	3	3	3
No. of irrigations	4	2	3
No. of top dressings	2	2	2
No. of insecticide application	17	11	14
No. of harvesting	19	15	17
Planting range (month & week)	4 November - 1 December		
Harvesting range (month & week)	3 February - 4 March		

Source: Field Survey

Cost and returns

The cost of production included all technological and non technological variable cost items such as human labour, power tiller, organic and chemical fertilizers, tomato seed or seedlings, fence and plant supporting materials, irrigation and pesticides. But cost expenses and imputed value of the family owned inputs and interest on cash cost for four months period were included in calculating the cost of tomato production. Human labour irrespective of home supplied and hired performed many physical operations such as land preparation, laddering, weeding, insecticide spraying and harvesting etc. Study found that the average number of human labour requirement per hectare was 288 for the cultivation of improvement tomato. The study also found that the wage rate of the human labour was ranged between Tk 120 to Tk 150 per day with or without meal respectively. The farmers in the study area used different types of inputs to produce improved tomato. The farmers in the study area used 19512 kg/ha of cow dung, 383 kg/ha of urea, 516 Kg/ha of TSP and 133 Kg/ha of MP. But the recommended dose of fertilizer for growing winter tomato were 8000-12000 kg of cow dung, 500-600 kg of urea, 400-500 kg of TSP and 200-300 kg of Mp per hectare respectively. Comparing to recommended doses farmers' applied lower doses of fertilizers. The average total variable cost, cash cost and total cost of producing improved tomato was found Tk 99861, Tk 61412 and Tk 101089 per hectare respectively in the study area. Among the cost items, human labour cost was the highest that contributed 37% of the total cost but it shared only 14% in cash cost basis (Table 6). Different types of manures and fertilizers combindly contributed 21% of the total cost. The next major cost items in tomato production were found to be irrigation, pesticides and fence and plant supporting materials & in most of the cases farmers had to purchase all these items spending cash out of their pocket. On the cash cost basis these cost items shared 18% of the total cost. Study found that yield of improved tomato was 34.48 ton/ha (Table 6). Hence average gross margin was estimated Tk 101566 and Tk 140015 on variable cost and cash cost basis respectively.

Table 6. Cost and return from improved tomato cultivation per hectare

Items	Quantity	Costs/Returns (Tk/ha)	% of total
Human labour (Man-days):	288	37663	37
Family	180	23539	23
Hired	108	14124	14
Power tiller	-	6101	6
Seeds/Seedlings	-	8520	8
Cow dung (Kg):		9756	9
Own	15130	7565	7
Purchase	4382	2191	2
Fertilizer (Kg):		12044	12
Urea	383	2681	3
TSP	516	7229	7
MP	133	2134	2
Irrigation	-	7176	7
Insecticides	-	9086	9
Bamboo & net	-	9515	9
Own	-	7345	7
purchase	-	2170	2
Interest on operating capital		1228	1
Total Variable cost (TVC)		99861	
Total cash cost		61412	
Total cost of production		101089	100
Yield (ton/ha)	34.48		
Gross return (Tk/ha)		201427	
Gross Margin (Tk/ha):			
Total variable cost basis		101566	
Total cash cost basis		140015	

Source: Field Survey

Net return per hectare on the basis of full cost was estimated at Tk 100338. On the basis of full cost, cash cost and variable cost net return per ton were Tk 2910.03, Tk 4060.76 and Tk 2945.65 respectively. Net return per kilogram was Tk 2.91, Tk 4.61 and Tk 2.95 on the basis of full cost, cash cost and variable cost respectively (Table 7). To measure the efficiency of labour returns to labour was calculated. It was found that the average returns to labour was Tk 479.17/ man-day on full cost basis, Tk 535/man-day on cash cost basis and Tk 483/ man-day on variable cost basis. Average return to each spent on production is an important criterion for measuring profitability for producing tomato. Study found that the average benefit cost ratio was 1.99 on full cost basis, 3.28 on cash cost basis and 2.01 on variable cost basis (Table 7).

Table 7 Profitability of improved tomato cultivation in the study area

Parameters	Economic indicators
Net return (Tk/ha):	
Full cost basis	100338
Cash cost basis	140015
Variable cost basis	101566
Net return (Tk/ton):	369.72
Full cost basis	2910.03
Cash cost basis	4060.76
Variable cost basis	2945.65
Net return (Tk/kg):	
Full cost basis	2.91
Cash cost basis	4.61
Variable cost basis	2.95
Returns to labour:	
Full cost basis	479.17
Cash cost basis	535
Variable cost basis	483
Return to irrigation	13.33
Benefit cost ratio:	
Full cost basis	1.99
Cash cost basis	3.28
Variable cost basis	2.01

Source: Field Survey

Factors affecting tomato yield

Estimated value and related statistics of Cobb-Douglas production function for the sampled farmers are presented in Table 8. The figures were judged by the value of R^2 (0.686) and F value. The coefficient of R^2 indicated that the explanatory variables included in the model explained 69% of the variation in tomato production. The F value of the equation is significant at 1% level of confidence implying that the variation in tomato production depends mainly upon the explanatory variables included in the model. The results showed that the coefficients of the cost of Plough, Manures, Urea, Mp, Insecticides and Human labour had considerable effect on gross return. Where as the coefficients of the expenditures on Seeds and Bamboo used were neither significant nor negative. These insignificant production coefficients implied that either the data failed to pick-up the actual impact of the inputs or these were used most inefficiently. However the production coefficient for TSP and irrigation were found to be negative but TSP was highly significant at 1% level indicating that excessive and irrational use of TSP in the study area for improved tomato cultivation.

Table 8 Estimated co-efficient and related statistics of tomato cultivation under Cob-Douglas model

Parameters	Co-efficient	Standard error	T- value
Intercept	8.226	.723	11.382
Cost of Plough (X_1)	.039*	.012	3.155
Cost of Irrigation (X_2)	-.021	.037	-.567
Cost of Seed (X_3)	.002	.048	.050
Cost of Manures (X_4)	.049***	.012	4.023
Cost of Urea (X_5)	.100***	.037	2.672
Cost of TSP (X_6)	-.088***	.030	-2.901
Cost of Mp (X_7)	.021**	.009	2.276
Cost of Insecticides (X_8)	.088**	.040	2.161
Cost of Bamboo (X_9)	.001	.004	.227
Cost of Labour (X_{10})	.257***	.086	3.002
R^2	0.686		
F-Value	7.854		

*= Significant at 10% level, ** = Significant at 5% level, *** = Significant at 1% level

The major constraints in producing improved tomato were lack of improved seeds reported by maximum farmers. Lack of extension service to the farmers was mentioned as the second important problem to the farmers followed by high price of fertilizers, lack of storage facility, lack of cash money and high wage rate (Table 9).

Table 9 Constraints to improved tomato variety adopters

Constraints	percentage of responses		
	Patiya	Satkania	All
Lack of improved seeds	48	42	45
Higher price of fertilizers	17	12	14.5
Lack of extension services	26	39	32.5
Lack of storage facility	5	2	3.5
High wage rate	1	3	2
Lack of cash money	3	2	2.5

Source: Field Survey

It can be concluded from the discussion that the adoption of improved tomato varieties was not found to be satisfactory in the study area. Indian variety 'Surokka' was very popular in the farmers' field due to its seeds availability, large size, thick fruit skin, attractive colour and long durability. Most of the farmers were influenced by themselves, neighbors/ sub-assistant agricultural officer of agriculture extension department. Adoption level of improved tomato should be increased by increasing extension contact with the organizational participants. Motivation about high yielding varieties of BARI is needed for bringing more land under tomato cultivation.

REFERENCES

BBS. 2004. Statistical Year Book of Bangladesh 2004. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the Peoples Republic of Bangladesh, Dhaka, Bangladesh.

Barman, S. C. 2005. Real Adoption Impact of Tomato Technologies on Production at Farmer's Level

Das, P.C. 1993. Vegetable Crops of India, Kalyani publishers, 1/1 Rajinder Nagar, ludhiana 41008, India, 1st edition, pp. 1-219

Islam, M.N. 2005. Economics of off-season tomato cultivation in a selected area of Panchagorh districts

Matin M. A., A. S. M. Anwarul Huq, M. S. Hussain, Md. Rezaul Karim, Elahi Baksh. 1996. Farm Level Yield Analysis of Tomato Cultivation in Selected Areas of Bangladesh: An Economic Profile. Bangladesh Journal of Agricultural Research. Volume 21(1), pp. 50-57

Rashid, M.A and M. M. Anwar. 2001. Crop cultivation practices, Input output relationship of major crops in Bangladesh.

Joint Determination of Improved Variety Adoption, Productivity and Efficiency of Pulse Production in Bangladesh: A Sample-Selection Stochastic Frontier Approach. by Sanzidur Rahman 1,* , Md.Â Pulses fit well in the existing cropping systems of Bangladesh due to their short duration, low input, minimum care requirement and drought tolerant nature [10]. India is the largest producer of pulses, producing 67.4% of the global pulse production with an average yield of 920 kg/ha in 2013, followed by Australia, producing only 6.2% of global production with a higher average yield of 1418 kg/ha [11].Â A limited number of studies exist on the adoption of improved varieties, profitability and/or production performance of pulses in Bangladesh with varied conclusions. For example, Miah et al. View Chittagong Research Papers on Academia.edu for free.Â This paper analyzes the dynamics of the conflict in the Chittagong Hill Tracts region of Bangladesh. This study argues that violations of human rights by law enforcement agencies and Bengali settlers against indigenous people continue even after the signing of the 1997 peace accord.Â This book shows how multilingual literacy fostered a variety of literary experiments in the remote kingdom of Arakan, which lay between present-day southeastern Bangladesh and Myanmar, in the mid-17th century.Â The increased amount of waste generation resulting from urbanization, population growth and improved lifestyle is a major concern for many developing countries like Bangladesh.