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GROWTH AND YIELD EVALUATION OF TOMATO HYBRIDS DURING SUMMER IN SYLHET REGION

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Abstract

A field experiment was conducted at the experimental field of Horticulture Department, Sylhet Agricultural University, Sylhet, Bangladesh to find out the suitability of tomato production during summer season of May to October, 2014. Five tomato hybrids viz., BARI hybrid tomato-3, BARI hybrid tomato-4, NHC-1, NHC-2 and NHC-3 were evaluated for tomato production during summer season under Sylhet condition. Different parameters like number of fruits plant^{-1}, individual fruit weight, fruit length, fruit width, total soluble solids, fruit yield plant^{-1}, etc. were significantly differed among the tomato hybrids. Significant variation in respect to fruit yield was also observed among the hybrids. The highest number of fruits plant^{-1} was counted from the BARI hybrid tomato-3 (25.30) followed by BARI hybrid tomato-4 (24.33). The heaviest individual fruit was observed for the NHC-2 (43.23 g) while it was the lowest for BARI hybrid tomato-3 (35.70 g). The NHC-2 hybrid had the highest fruit length (4.50 cm) and fruit width (3.40 cm). Among the hybrids maximum 5.3% total soluble solid was observed in BARI hybrid tomato-3. The hybrid, BARI hybrid tomato-4 produced the highest fruit yield (0.97 kg plant^{-1}) followed by NHC-1 (0.91 kg plant^{-1}). Benefit cost ratio revealed that one can earn more than four thousand taka decimal^{-1} by growing tomato during summer season in Sylhet region. This indicates that there is a bright scope of tomato production during summer in Sylhet region.

***Keywords**:* Tomato hybrids, summer season and Sylhet region.

Introduction

Tomato (*Lycopersicon esculentum* Mill.) is a winter crop belongs to the genus *Lycopersicon* of the family of Solanaceae. Its food value is very rich because of higher contents of vitamins A, B and C and minerals like calcium (Bose and Som, 1990). Tomato is grown in winter months of Bangladesh as the temperature is congenial at that period of time for optimum growth and yield. But it has great potentiality to grow in summer also. Due to its palatability and vitamin content its demand in general is growing day by day throughout the year, while its production is far from the requirements especially in summer season. In summer availability of vegetable is less due to agro-ecological constraints. Cultivation of summer vegetables is affected due to excessive rainfall, wind storm, etc. during the monsoon season. Tomato needs cool and dry weather for better growth and development (Rashid, 1999). Poor fruit set and bacterial wilt are the major problems for tomato production during rainy season. Tomatoes are extremely sensitive to hot and wet growing conditions, the weather which prevails in the summer and rainy seasons of Bangladesh (Ahmad, 2002). Fruit setting in tomato is reportedly hindered at temperature above 26/20°C day/night, respectively and is often completely stopped above 38/27°C day/night (Kuo *et al*., 1979; Villareal *et al*., 1978; Villareal and Lai, 1979). The Optimum night temperature required for fruit setting of tomato is from 15 to 20^0C (Charles and Harris, 1972). Tomato can be grown during high temperature and rainy summer in Bangladesh using heat tolerant tomato varieties under poly-tunnel production system (Ahmad e*t al*., 2008). Production of some heat tolerant tomato hybrids is very popular among the growers around the country. Very few research works in relation to summer tomato cultivation were made for Sylhet region (Biswas *et al.,* 2016). Growers are often requested a variety with bigger size and quality. Hence, development of new tomato variety for summer season cultivation with higher growth and yield is very important for the researchers. Keeping this point in mind the Department of Horticulture, Sylhet Agricultural University has developed some hybrid combinations for summer

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season cultivation in the country. Evaluation of these newly developed hybrids is needed for their growth, yield and suitability for cultivation in Sylhet region. Therefore, the present study was under taken to evaluate the performance of selected hybrid tomato under Sylhet condition.

Materials and Methods

The experiment was carried out at the experimental field of Horticulture Department, Sylhet Agricultural University, Sylhet, Bangladesh during May 2014 to October 2014. The climate of the experimental area is subtropical in nature from May 2014 to October 2014 which is characterized by high temperature, heavy rainfall, and high humidity. It belongs to the Khadimnagar soil series of Eastern Surma-Kushiara Floodplain under the Agro ecological Zone-20 (FAO, 1988). The pH of the soil was around 4.98, soil organic matter 1.79% and soil EC was 0.47 dS m^{-1}. The experiment was conducted with 3 hybrid tomato lines viz., NHC-1, NHC-2, NHC-3 and along with BARI hybrid tomato-3 and BARI hybrid tomato-4. Seeds of five tomato hybrids were sown in raised seed bed on 14 May 2014. Seedlings were transplanted in the main field on 10 June 2014. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 2.3 m × 2.4 m having 4 rows bed^{-1} and 6 plants row^{-1} and 24 plants bed^{-1}. Plants were spaced at 60 cm × 40 cm between row to row and plant to plant, respectively. The unit plots and blocks were separated by 50 cm and 75 cm, respectively. The land was acidic in nature hence, lime (Dolomite) was applied in the field @ 4 kg $decimal^{-1}$. Each plot was fertilized with well decomposed cowdung 15 ton, urea 300 kg, TSP 200 kg and MoP 150 kg ha^{-1}, respectively (Rashid and Singh, 2000). Half quantity of cowdung and the entire quantity of TSP were applied during final land preparation. The remaining cow dung and half of MoP were applied 5 days before planting. The whole of urea and remaining half of MoP were applied in 3 equal splits as top dressing at 15, 30 and 50 days after transplanting. The crop was protected from rain providing polythene tunnel (Plate 1). Irrigation, pruning, mulching, weeding and other intercultural operations were done as and when necessary. Data were recorded for yield and yield attributing characters and statistically analyzed using MSTAT software.

Plate 1. Bamboo made polythene structure

Results and Discussion

It was observed that the hybrids NHC-2 and NHC-3 required the maximum days to first flowering (53.33 days) while it was minimum in BARI hybrid tomato-4 (47.3 days) (Table 1). Maximum days required to first harvest (89.00 days) were recorded in NHC-3 whereas it was the minimum in NHC-1 (87.00 days). BARI hybrid tomato-4 produced the highest fruit yield (0.97 kg $plant^{-1)}$ and number of fruit (24.33 $plant^{-1}$) with an average individual fruit weight of 40.27 g. The second highest fruit yield $plant^{-1}$ (0.91 kg) with highest number of fruits $plant^{-1}$ (25.30) and average individual fruit weight 38.10 g was obtained from the hybrid NHC-1. The other three hybrids BARI hybrid tomato-3, NHC-2 and NHC-3 produced fruit yield $plant^{-1}$ were 0.89 kg, 0.80 kg and 0.78 kg, respectively. Similar yield variation with regard to number of fruits $plant^{-1}$, individual fruit weight and yield among different summer tomato lines was reported by Patwary (2009). Significant variation was observed among the hybrids in respect of fruit length and fruit width, while maximum fruit length (4.39 cm) and maximum fruit width (3.40 cm) both are recorded from BARI hybrid tomato-3. Total soluble solid among the hybrids varied from 4.73% to 5.30%. Biswas *et al.* (2016) observed similar results in the heterosis study among 10 hybrid combinations of heat tolerant tomato

under Sylhet condition. From the study it was observed that BARI hybrid tomato-4 produced the highest fruit yield decimal^{-1} (172 kg) closely followed by the hybrids NHC-1 (160 kg) while, the lowest was recorded from NHC-3 (135 kg). So, calculated yield ranged 17.5 to 28.5 t ha^{-1}, while the national average yield of tomato was 6.64 t ha^{-1} (Anonymous, 2003). Ahmad *et al.,* (2011) reported yield variation 25.5 ton to 48.5 ton ha^{-1} when evaluated 12 tomato hybrids under Gazipur condition. So there is a bright scope to increase tomato yield in summer season incorporating promising hybrid lines in the production system.

Table 1. Yield and yield components of tomato hybrids in summer season

Hybrids	Days to first flower	Days to first harvest	Number of fruit plant^{-1}	Individual fruit weight (g)	Fruit length (cm)	Fruit width (cm)	TSS (%)	Fruit yield plant^{-1} (kg)	Fruit yield decimal^{-1} (kg)
BARI hybrid tomato-4	47.33	87.33	24.33ab	40.27b	4.17b	3.10b	5.10b	0.97a	172
BARI hybrid tomato-3	50.67	88.00	25.30a	35.70d	4.39a	3.40a	5.30a	0.89b	156
NHC-1	49.67	87.00	25.30a	38.10c	4.03b	3.56a	4.73c	0.91b	160
NHC-2	53.33	88.33	18.66d	43.23a	4.50a	3.40a	5.20ab	0.80b	140
NHC-3	53.33	89.00	22.30c	35.8d	3.83c	3.40a	5.10b	0.78c	135
F-test	NS	NS	*	*	**	**	**	**	NA
CV (%)	2.37	1.77	3.51	1.83	2.00	3.68	1.19	4.46	-

**= Significant at 1% level, *= Significant at 5% level, NS = Non-Significant and NA = Not Analyzed. Mean followed by common letter(s) in a column do not differ significantly by DMRT

Cost of production

Cultivation of tomato during summer season required some protective measures to protect plants from heavy rainfall. Olericulture division of Horticulture Research Centre, BARI has standardized a bamboo made poly-tunnel structure which is very effective for summer tomato cultivation. The height at the middle part of tunnel was 6.0 feet as well as 4.5 feet at both sides of the tunnel. The main structure of the tunnel was made of bamboo pole and bamboo sticks bending over the pole. This structure was covered by transparent polythene sheet to protect the crops. The present study was conducted under a poly-tunnel structure (Plate 1). Total variable cost required for preparation of the structure is presented in Table 2. Estimation revealed that almost Tk. 5000 decimal^{-1} was required for cultivation of summer tomato. The highest cost Tk. 1800 for labour followed by Tk. 1250 required for supportive materials like two types of bamboo used. Third highest cost Tk. 750 was incurred for Polyethylene sheets. However, this estimated cost may vary from location to location and farmer to farmer. Providing human labour from family, production cost may reduce substantially. Again, some material like bamboo can be used in the next year; hence, production cost in the second year is to be much less than that of first year. Zaman *et al.* (2006) reported by using home supplied family labor, they can reduce cash cost Tk. 43350 ha^{-1} and thereby increase gross margin from Tk. 695464 to Tk. 739742.

Table 2. Economic analysis of input cost of tomato production in one decimal land during summer

Serial No.	Items	No. or Weight	Tk (Piece^{-1} or kg^{-1})	Total cost (Tk)
1.	Bamboo (Makhal)			
	a. Long clamp	5 no.		
	b. Bending	4 no	50	750
	c. Ara	6 no.		
	Bamboo (Barak)			
	a. Side and middle poles	2 no		
	b. Staking		100	600
		4 no.		
2.	Polythene	7.5 kg	100	750
3.	Nylon rope	2 kg	90	180
4.	Sutoli (Rope)	5 kg	30	150
5.	Fertilizer			
	Cowdung	50 kg	-	140
	TSP	1.8 kg	-	
	MOP	1.1 kg	-	
	Urea	2.25 kg	-	
6.	Seed and seedling	-	-	80
7.	Pesticide			
	Maladan	-	-	100
8.	Labour	6	300	1800
9.	Miscellaneous			450
Total cost for each hybrid tomato production (Tk decimal^{-1})				**5000**

Return from summer tomato

In the Table 3 it was observed that total yield of BARI hybrid tomato-4 for summer was 172 kg decimal^{-1} and gross return was Tk 12040 which was closely followed by NHC-1. By cultivating each summer hybrid tomato in one decimal land, gross margin decimal^{-1} was maximum in BARI hybrid tomato-4 and it was Tk 7040 and followed by Tk 6200 for NHC-1. The benefit cost ratio (BCR) was highest in BARI hybrid-4 (2.41) which was closely followed by NHC-1 (2.24). Cultivating tomato during summer in one decimal of land, gross margin was Tk 2816 and net return or profit was Tk 2795. The benefit cost ratio (BCR) was 3.32 and ratio of benefit to total variable cost was 3.37 (Zaman *et al*., 2006).

Table 3. Per decimal cost and return from summer tomato cultivation at experimental plot

Hybrids	Gross return @70 Tk kg^{-1}	Gross margin decimal^{-1}	Benefit cost ratio
BARI Hybrids tomato-4	12040	7040	2.41
BARI Hybrids Tomato-3	10920	5920	2.18
NHC-1	11200	6200	2.24
NHC-2	9800	4800	1.96
NHC-3	9450	4450	1.86
Mean	10682	5682	
Range	9450-12040	4450-7040	
Stdev	1056.5	1056.5	

It is apparent from the above discussion that cultivation of summer tomato is suitable for Sylhet region and one can earn more than Tk 5000 decimal^{-1} which is appreciable. Therefore, the hybrid BARI hybrid tomato-4 and NHC-1

promising line can be taken for adaptive trials in the farmer's field in Sylhet region. The major constraint is the initial cost for bed and polyethylene shed preparation. In order to overcome this constraint, it is necessary to provide credit with easy terms and conditions.

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