

EFFECT OF STEM PRUNING PRACTICES ON VEGETATIVE GROWTH AND FRUIT YIELD OF CHERRY TOMATO UNDER HYDROPONIC CULTURE

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ABSTRACT

A field experiment was conducted in the semi-green house at the Horticulture Farm of Sher-e- Bangla Agricultural University, Dhaka 1207, Bangladesh, during October 2019 to March 2020 to improve yield and quality of cherry tomato cultivation through stem pruning in hydroponic culture. The experiment consisted of three level of pruning viz. P0= No pruning; P1 = One time stem pruning and P2 = Two times stem pruning and four different cherry tomato varieties viz. V1= BARI Tomato-11; V2= BARI Tomato-20; V3= Red Star F1 and V4 = SAU Tomato-2. There were 12 treatment combinations and experiment were setup in Completely Randomized Design (CRD) with three replications. In case of pruning, the highest plant height and branches number per plant were obtained from P2 treatment at 60 DAT, which enhanced the tomato yield. Similarly, the highest plant height and maximum branches number per plant were obtained from V2 treatment at 60 DAT, which also enhanced the tomato yield. The study noted that the maximum chlorophyll content was observed from P2 and V2, respectively. Considering combined effect, the maximum plant height, branches number per plant, chlorophyll content and yield per plant (2.98 kg) were obtained from V2P2 treatment. Among the treatment combination, V2P2 (BARI Tomato-20 variety with two stem pruning) treatment seemed to be more promising for obtaining higher growth and yield of cherry tomato.

Key words: Cherry tomato, pruning, growth, yield, hydroponic

Introduction

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is a popular type of table tomato with small fruits (1.5-8.5 cm in diameter) on long panicles and the demand for cherry tomato has increased in the market, chiefly due to the recognition of their high quality and good taste (Kobryn and Hallmann, 2005). However, it is now very popular in the whole world for its nutritive value, taste and attractive color. Furthermore, it is a great source of vitamin-C (13mg/100g), dietary fiber (2.0g), vitamin-A (25%) and vitamin-K and also a good source of vitamin-E (Alpha Tocopherol), thiamine, niacin, vitamin B6, foliate, phosphorus, copper, potassium and manganese (Anon, 2009). In Bangladesh, cherry tomato is new type for tomato production and still infancy for farmer field and as well as for consumer market (Uddin *et al.*, 2015). The growing demand for increased productivity and quality of agricultural products is a catalyst for agricultural development, thus, there is a constant need to adapt products and the means of production. This aspect is particularly relevant to horticulture because most producers have a small growing area in which they seek to obtain the maximum possible income (Rinaldi *et al.*, 2008). Amongst the mechanisms liable to increase horticultural products, pruning is so important. Aung (1999) reported that greater marketable yield/area was obtained by pruning in determinate tomato plants to two stems rather than one stem. Bennewitz *et al.* (2011) reported that yield of pruned tomato plants was significantly lower than un-pruned plants, in a determinate variety, but significantly higher in indeterminate and semi-indeterminate varieties. So, the requirements of stem pruning are variable for different variety and growing conditions. Moreover, in Bangladesh, majority of the grower's don not get higher growth of tomato because of their very little knowledge about suitable varieties and proper pruning practices. Considering the above facts, the experiment has been undertaken to find out a suitable pruning practice for maximum growth and yield of cherry tomato to meet up the nutrition demand for the people of Bangladesh.

Materials and Methods

A field experiment was conducted in the semi-greenhouse at the Horticulture Farm of Sher-e- Bangla Agricultural University, Dhaka 1207, Bangladesh, during October 2019 to March 2020 to improve yield and quality of cherry tomato cultivation through stem pruning in hydroponic culture. The experiment consisted of three level of pruning viz. P0= No pruning; P1 = One time stem pruning and P2 = Two times stem pruning and four different cherry tomato varieties viz. V1= BARI Tomato-11; V2= BARI Tomato-20; V3= Red Star F1 and V4 = SAU Tomato-2. There were 12 treatment combinations and experiment were setup in Completely Randomized Design (CRD) with three replications.

Experimental environment: Round eight-inch 36 plastic pots were prepared for culturing the plants. Polythene sheet was placed in the surface of the soil. Pots were filled with different substrates of coco peat, brick broken and rice husk at the ratio of 6:2:2 (v/v). Two-week-old seedlings were transferred in to the 250mL plastic pots. The experiment was conducted in a white net house under intensive care. The room was kept clean and tidy during the time of the experiment. Daily supervise on was maintained to protect plants. The plants were cultivating and it continued until March 2020.

Growing media preparation for seedling raising: The mixture of coco peat, broken bricks (khoa) and rice husk at the ratio of 50:30:20 (v/v). Coconut block was soaked in a big bowl for 24hours. Then they are mixed with khoa and rice husk properly. This mixture was placed in a styro foam sheet box for using seedbed (Fig. 1).

Seed sowing: The seeds were soaked in water for 24 hours and then wrapped with piece of thin cloth. The soaked seed were then spread over polythene sheet for 2 hours to dry out the surface water. After that seeds were sown in styro foam sheet box and covered with newspaper under room temperature for raising seedling.

Transplanting of cherry tomato seedling: 15 days old cherry tomato seedlings were transferred to 250 ml earthen pot. After four weeks the seedlings were transplanted to the main 12-inch plastic pot. The plants were transplanted carefully so that the roots were not damaged. After transplanting of tomato plant in the earthen pot light watering was done with sprayer so that the plant was got proper moisture.

Intercultural operations: Different intercultural operations were done in proper time. Among them staking was done using Dhaincha (*Sesbania* sp.) sticks to keep the plants erect. Within a few days of taking, as the plants grew up, the plants were pruned as per the treatments.

Data collection and analysis: Data on the growth and yield parameters such as plant height, number of branches per plant, leaf chlorophyll content and tomato yield were recorded from the net experiment. The data obtained from the experiment were analyzed statistically using MSTAT computer package program to find out the significance of the difference among the treatments. The significance of the differences among the pairs of treatment means was estimated by the Duncan Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984) for the interpretation of results.

Results and Discussion

Plant height: Plant height is one of the most important parameters, which is positively correlated with the yield of cherry tomato. The tomato plants responded significantly to different level of pruning and varieties. A marked variation in plant height was observed due to influence of different pruning levels of cherry tomato, At 20 and 40 DAT, the tallest plant was recorded from P2 (Double stem pruning) and the shortest plant was recorded from P0 (No pruning). At 60 DAT, the maximum plant height (176.360 cm) was also obtained from P2, which was statistically similar with P1 (170.24 cm). The minimum plant height (123.00 cm) was observed in P0. The results are in harmony with the findings of Razzak *et al.* (2013) on cherry tomato. They reported that two-branch pruning produced the tallest (195.3cm) cherry tomato plants. The maximum plant height was recorded from V2 (BARI Tomato-20) and the minimum plant height was obtained from V1 (BARI Tomato-11) at 20 and 40 DAT. Similarly, at 60 DAT, the maximum plant height

(178.33cm) was recorded from V2, while the minimum plant height (145.42 cm) was found from V1, which was statistically similar with V3 and V4. Combination of variety and level of pruning showed significant variation for plant height throughout the growing season (Table 1). The plant height gradually increased at later DAT and the study noted that at 60 DAT, the tallest plant (189.03 cm) was recorded from V2P2 treatment combination and the shortest plant (93.33 cm) was obtained from V1P0 treatment combination which was statistically similar with V1P1(100.33 cm).

Table 1. Combined effect of pruning and variety on plant height of cheery tomato at different days after transplanting

Interactions	Plant height (cm) at different days after transplanting (DAT)		
	20 DAT	40 DAT	60 DAT
V0P0	32.33 g	71.33 d	93.33 d
V1P1	53.00 d	89.67 c	100.33 d
V1P2	60.67 ab	131.72 a	170.76 ab
V2P0	55.33 cd	83.00 c	127.73 c
V2P1	57.33 bc	115.74 b	171.36 ab
V2P2	63.33 a	136.00 a	189.03 a
V3P0	43.33 f	93.67 c	167.72 b
V3P1	55.33 cd	115.33 b	171.73 ab
V3P2	62.00 a	131.36 a	177.00 ab
V4P0	41.00 f	106.74 b	165.00 b
V4P1	46.67 e	108.00 b	168.72 ab
V4P2	60.00 ab	113.33 b	175.33 ab
LSD(0.05)	3.28	10.46	17.82

In a column means having similar letter (s) are statistically identical and those having dissimilar letter (s) differ significantly as per 0.05 level of probability.

Number of branches per plant: The effects of pruning and variety in alone or jointly significantly differed the numbers of branches of cherry tomato (Table 2). The number of branches recorded at 20, 40 and 60 DAT. The study noted the maximum number of branches per plant (3.25, 3.50 and 5.50) was recorded from P2 (Double stem pruning) while, the minimum number of branches per plant (2.18, 2.80 and 3.90) was recorded from P0 (No pruning). The study also revealed that the maximum branches were recorded from V2 (3.33, 3.367 and 5.67) at 20, 40 and 60 DAT. On the other hand at same DAT, V1 produced the lowest branches per plant of cherry tomato. Due to combined effect of variety and different level of pruning also showed significant differences of the branch number per plant of cherry tomato at 20, 40 and 60 DAT (Table 2). Numerically, at different days after transplanting (DAT), the maximum number of branches per plant (4.33, 4.67 and 6.33) was recorded from V2P2 (BARI Tomato-20 variety with two stem pruning) treatment combination at 20, 40 and 60 DAT, respectively. At the same DAT the minimum number of branches per plant (2.33, 3.00 and 4.33) was recorded from V1P0 (BARI Tomato-11 variety with no pruning) treatment combination, respectively (Fig. 2).

Chlorophyll percentage of cherry tomato: The chlorophyll content (%) was also significantly influenced by pruning practices at different days after transplanting (DAT) in cherry tomato (Table 2). At 25 and 50 DAT, the maximum chlorophyll content was recorded from P2 treatment and the minimum chlorophyll content was obtained from P0 treatment. At 75 DAT, the maximum chlorophyll content (84.91 %) was recorded from P2 treatment while, the minimum chlorophyll content (63.07 %) was found from P0. The chlorophyll content (%) at different days after transplanting (DAT) was also significantly influenced by different varieties of cherry tomato. At last DAT (75 DAT), the maximum chlorophyll content (83.94%) was recorded from V2 treatment, while the minimum chlorophyll content (66.84%) was found in V1.

Combine effect of varieties and pruning showed significant differences of the chlorophyll content (%) of cherry tomato at 25, 50 and 75 DAT. At 75 DAT, the highest chlorophyll content (75.71%) was recorded from V2P2 treatment combination and the lowest chlorophyll content (61.17 %) was obtained from V1P0 treatment combination.

Table 2. Single as well as combined effect of pruning and variety on branches per plant and the chlorophyll content (%) of cheery tomato at different days after planting

Treatment	Branches per plant at different DAT			Cchlorophyll content (%) at different DAT		
	20 DAT	40 DAT	60 DAT	25 DAT	50 DAT	75 DAT
Effect of pruning						
P0	2.18 b	2.80 b	3.90 a	43.85 c	64.03 c	63.07 c
P1	2.92 a	3.67 a	5.25 a	51.41 b	67.22 b	73.82 b
P2	3.25 a	3.50 a	5.50 a	54.75 a	74.57 a	84.91 a
LSD(0.05)	1.06	0.86	1.59	0.40	0.50	0.38
Effect of variety						
V1	2.56 a	3.33 a	4.78 a	47.42 c	55.99 d	66.84 c
V2	3.33 a	3.67 a	5.67 a	52.11 a	84.79 a	83.94 a
V3	3.11 a	3.56 a	5.22 a	52.11 a	75.89 b	72.52 b
V4	2.78 a	3.56 a	5.00 a	48.37 b	57.74 c	72.41 b
LSD(0.05)	1.06	0.86	1.59	0.40	0.50	0.38
Interaction effect						
V0P0	2.33 c	3.00 a	4.33 b	34.67 e	61.33 i	61.17 g
V1P1	2.67 bc	3.67 a	5.33 ab	49.00 bc	82.77 d	69.97 c
V1P2	3.33 abc	3.67 a	5.67 ab	51.00 b	71.27 f	71.78 b
V2P0	2.67 bc	3.33 a	5.33 ab	40.33 de	75.27 e	55.89 j
V2P1	2.67 bc	3.67 a	5.67 ab	48.00 bc	91.63 b	58.39 h
V2P2	4.33 a	4.67 a	6.33 a	58.33 a	101.53 a	75.71 a
V3P0	2.33 c	3.33 a	5.00 ab	43.67 cd	67.73 g	63.57 f
V3P1	3.00 bc	3.67 a	4.67 ab	48.33 bc	83.43 c	67.34 d
V3P2	3.33 abc	3.67 a	5.33 ab	45.67 bcd	64.60 h	71.90 b
V4P0	2.33 c	3.33 a	4.67 ab	35.00 e	61.53 i	52.79 k
V4P1	2.67 bc	3.33 a	4.33 b	49.67 bc	67.60 g	57.19 i
V4P2	3.67 ab	3.67 a	5.33 ab	51.67 b	58.53 j	64.45 e
LSD(0.05)	1.06	0.86	1.59	3.48	0.50	0.38

In a column means having similar letter (s) are statistically identical and those having dissimilar letter (s) differ significantly as per 0.05 level of probability.

Yield of cherry tomato: The highest yield per plant was observed in P2 (double stem pruning), which was statistically identical with P1 and the lowest was found in P0 (unpruned plants). Thakur *et al.* (2005) reported yield per plant was greatest in double leader pruning. In case of variety, the maximum yield per plant was recorded from V2 (BARITomato-20) treatment, which was statistically similar with V3 and the minimum yield per plant was obtained from V1 (BARI Tomato-11) treatment. Combined effect of varieties and pruning had a significant variation in terms of yield of fruit (Table 3). The maximum yield per plant (2.97 kg) was recorded from V2P2 (BARI Tomato-20 variety with two stem pruning) treatment combination (as shown in Figs. 3), while the V1P0 (BARI Tomato-11 variety with no pruning) treatment combination gave the minimum yield of cherry tomato (1.27 kg).

Table 3. Combined effect of varieties and pruning on yield per plant in cherry tomato

Interactions	Yield per plant (kg)
V0P0	1.27 g
V1P1	1.87 def
V1P2	2.22 cde
V2P0	1.64 efg
V2P1	2.35 bcd
V2P2	2.98 a
V3P0	1.43 fg
V3P1	1.95 def
V3P2	2.74 abc
V4P0	2.14 cde
V4P1	2.83 ab
V4P2	2.93 ab
LSD(0.05)	0.55

In a column means having similar letter (s) are statistically identical and those having dissimilar letter (s) differ significantly as per 0.05 level of probability.



Fig. 1. Growing media in net house



Fig. 2. Growing of cherry tomato



Fig. 3. Harvested cluster of cherry tomato

Conclusion

The overall result of this experiment showed that growth and yield parameters of cherry tomato were significantly influenced by the different pruning. Among the varieties, BARI Tomato-20 seemed to be more promising according to morphological character for getting higher yield. Considering the levels of pruning, when two times were pruned the plants performed highest growth and yield. The combined effect of varieties and different pruning had a positive effect on morphological characters, yield contributing characters and yield of cherry tomato. BARI Tomato-20 variety with two times stem pruning of cherry tomato seemed to be more suitable for getting higher yield.

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