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Effect of Tomatotone on Growth and Yield of Summer Tomato

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ABSTRACT

A field experiment was conducted in the Horticulture farm of Sher-e-Bangla Agricultural University, Dhaka, during the period from April 2012 to October 2012 to quantify the effect of Tomatone on yield of summer tomato. The experiment consisted of four level of Tomatotone, viz. H_0: no Tomatotone (control), H_1: 1% Tomatotone, H_2: 2% Tomatotone and H_3: 3% Tomatotone. The experiment was laid out in Randomized Complete Block Design with three replications. Results revealed that the significant variation was observed for the different growth contributing characters of summer tomato due to Tomatotone. The longest plant (86.6cm), maximum number of leaves (50.2), maximum number of flowers per plant (63.4), highest number of fruits per plant (41.0), highest length of fruit (5.2 cm), highest weight of individual fruit (41.9 g), highest yield per plant (4.4 kg) and highest yield (22.7 t/ha) was found form H_2. On the other hand, lowest plant height, lowest yield, lowest number of leaves, flower and fruits was found form H_0 (control).

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I. Introduction

Tomato (*Lycopersicon esculentum* Mill.) is one of most important vegetable crops in Bangladesh. It belongs to the Solanaceae family. Tomato is grown in winter season due to favourable temperature for its optimum growth. When tomatoes are grown during summer in tropical countries like Bangladesh, the usual problem is low fruit set due to high night temperature (above 22^0C) and high humidity which result in poor pollination followed by poor fertilization. Although the problem is solved with the use of heat tolerant varieties, these are inadequate under extreme conditions. Application of plant growth regulators has been shown to improve fruit setting (AVRDC, 1990). Sprays of hormone especially Tomatotone (4-chlorophenoxy acetic acid; 4-CPA) on flower cluster effectively increase the fruit set as well as fruit production. Tomatotone has been found to be effective in improving tomato fruit set under

higher temperature conditions (Kuo *et al.,* 1978). Tomatotone now used commercially in Korea, Japan and China to increase fruit set in tomatoes. The growth regulator has an important effect on the fruit retention of tomato as well as other horticultural crops and thus increasing the yield substantially (Younis and Tigani, 1977). Tomatotone is also used in reducing pre-harvest fruit drop and resulting in increased number of fruits and yield in tomato crop. Therefore, an attempt was made to study the effects of tomatotone on fruit set and fruit size of tomato and ultimately yield.

II. Materials and Method

The experiment was conducted during the period from April 2012 to October 2012 in the Horticultural Farm, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh. The seedlings (30 days age) of tomato (BARI Tomato-4) were collected from the nursery of Sher-e-Bangla Agricultural University horticultural farm. The experiment consisted of four doses of tomatotone solution viz. control or without tomatotone (H_0), 1% tomatotone (H_1), 2% tomatotone (H_2) and 3% tomatotone (H_3). Here, 1% tomatotone solution was prepared by mixing 10 ml tomatotone with 1 liter of water. Accordingly, 2% and 3% tomatotone solution were prepared. The two factors of experiment were laid out in Randomized Complete Block Design (RCBD) with three replications. The size of the plot was 1.6m × 1.2m and spacing was maintained with row to row and plant to plant 60 cm and 40 cm respectively. Manures and fertilizers were used which was recommended by BARI (2005). Five plants were randomly selected from each unit plot for the collection of data. Data were collected on different growth and yield contributing characters. The data obtained for different characters were statistically analyzed to find out the significance of the difference for level of tomatotone on yield and yield contributing characters of tomato. The mean values of all the recorded characters were evaluated and analysis of variance was performed by the 'F' (variance ratio) test. The significance of the difference among the treatment combinations of means was estimated by Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

III. Results and Discussion

Plant height

Different levels of tomatotone at 20, 30, 40, 50 and 60 DAT (Days After Transplanting) represent significant source of variation on plant height (Figure 1a). The longest plant (28.0 cm, 38.2 cm, 54.0 cm, 71.0 cm and 86.6 cm) was obtained from H_2 (2% tomatotone) which was followed(24.09 cm, 34.49 cm, 49.6 cm, 66.2 cm and 77.4 cm) by H_1 (1% tomatotone) and (25.8 cm, 35.4 cm, 50.3 cm 68.2 cm, 81.7 cm) by H_3 (3% tomatotone) respectively. However, the shortest plant (21.6 cm, 30.6 cm, 45.4 cm, 60.9 cm and 69.3 cm) was recorded from H_0 (control) at 20, 30, 40, 50 and 60 DAT, respectively.

Number of leaves per plant

Significant variation was recorded in terms of number of leaves per plant of tomato at 20, 30, 40, 50 and 60 DAT for different levels of tomatotone (Figure 1b). At 60 DAT, the maximum number of leaves per plant was recorded from H_2 (50.2) which was statistically identical with H_1 (46.0) and H_3 (45.7), while the minimum number from H_0 (41.8). Similar result was observed in tomato and okra where highest number of leaves was produced at 75% PAR (Miah, 2001 and Rahman, 2002).

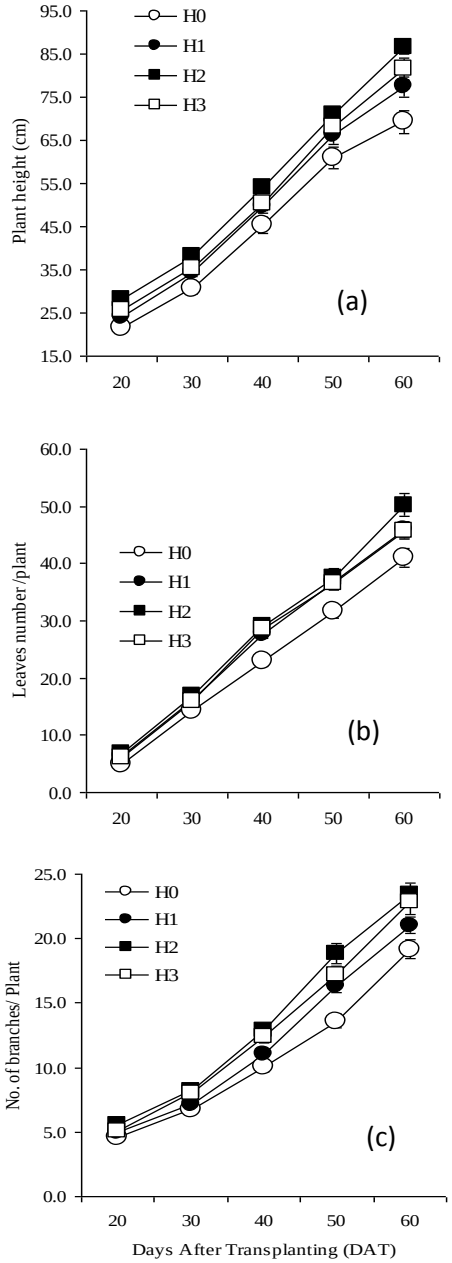

Figure 1. Effect of different levels of Tomatotone on (a) plant height, (b) leaves number and (c) number of branches

Number of branches per plant

Different levels of tomatotone showed significant source of variation on number of branches per plant of tomato at 20, 30, 40, 50 and 60 DAT (Figure 1c). At 60 DAT, the maximum number of branches per plant (23.4) was attained from H_2 (2% tomatotone) which was statistically identical (22.8) with H_3 (3% tomatotone) and closely followed (21.0) with H_1 (1% tomatotone). The minimum number (19.2) was observed from H_0 (no tomatotone).

Number of flower cluster per plant

Significant variation was observed for number of flower cluster per plant of tomato for different levels of tomatotone (Table 2). The highest number of flower cluster per plant (10.2) was found from H_2 (2% tomatotone) which was closely followed (9.6 and 9.8) by H_1 (1% tomatotone) and H_3 (3% tomatotone) respectively whereas the lowest number (8.0) was obtained from H_0 (no tomatotone).

Number of flowers per cluster

Application of different levels of hormone varied significantly for number of flowers per cluster of tomato (Table 2). The highest number of flowers per cluster (6.2) was observed from H_2 (2% tomatotone) which was statistically similar (5.7 and 5.8) with H_1 (1% tomatotone) and H_3 (3% tomatotone) respectively again, the lowest number (4.8) was recorded from H0 (no tomatotone).

Number of flowers per plant

Number of flowers per plant of tomato differed significantly for the application of different concentration of tomatotone hormone (Table 2). The highest number of flowers per plant (63.4) was found from H_2 (2% tomatotone) which was statistically identical (57.2) with H_3 (3% tomatotone) and closely followed (55.2) by H_1 (1% tomatotone) again, the lowest number (39.7) was attained from H_0 (no hormone).

Number of fruits per cluster

Application of different levels of hormone significantly affects the number of fruits per cluster of tomato (Table 2). The highest number of fruits per cluster (4.0) was found from H_2 (2% tomatotone) which was statistically similar (3.9 and 3.8) with H_3 (3% tomatotone) and H_0 (no tomatotone). Again, the lowest number (3.4) was observed from H_1 (1% tomatotone). Fruit set percent increased by application of plant growth regulator. Increasing fruit set by using the plant growth regulator "Tomatotone" was reported by AVRDC (1990).

Number of fruits per plant

Significant variation was recorded for number of fruits per plant at different levels of tomatotone (Table 2). The highest number of fruits per plant (41.0) was obtained from H_2 (2% tomatotone) which was closely followed (37.7 and 32.7) with H_3 (3% tomatotone) and H_1 (1% tomatotone) respectively while the lowest number (30.0) was found from H_0 (no tomatotone). It has been reported that, in an experiment with 20 F_1 crosses, the tomatotone treatment observed to have an appreciable effect on the number and weight of fruits of all lines (AVRDC, 1982).

Table 1. Effect of tomatotone on flower and fruit number of tomato[X]

Treatments[Y]	Number of									
	flower clusters /plant		flowers/Cluster		flower/plant		fruits/cluster		fruits/plant	
H_0	8.0	c	4.8	b	39.7	c	3.8	ab	30.0	d
H_1	9.6	b	5.7	a	55.2	b	3.4	b	32.7	c
H_2	10.2	a	6.1	a	63.4	a	4.0	a	41.0	a
H_3	9.7	b	5.8	a	57.2	b	3.9	a	37.7	b
$LSD_{(0.05)}$	0.4		0.5		5.6		0.4		2.3	
CV (%)	5.6		9.5		7.2		10.6		12.1	

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

[Y]H_0: Control (no tomatotone), H_1: 1% tomatotone, H_2: 2% tomatotone, H_3: 3% tomatotone

Length of fruit

Statistically significant variation was found for length of fruit of tomato at different levels of tomatotone (Table 2). The highest length of fruit (5.2 cm) was observed from H_2 (2% tomatotone) which was closely followed (4.3 and 4.8 cm) by H_0 (no hormone) and H_3 (3% tomatotone), respectively. The lowest length (4.3 cm) was observed from H_1 (1% tomatotone). Cell division and cell elongation enhanced by

hormone application. So, fruit length may be increased due to plant growth regulator (4-CPA) can be considered for increasing fruit size under high temperature conditions (AVRDC, 1982).

Diameter of fruit

Application of different levels of tomatotone showed statistically significant differences for weight of individual fruit (Table 2). The highest weight of individual fruit (41.9 g) was found from H_2 (2% tomatotone) which was closely followed (39.6 g and 39.0 g) with H_3 (3% tomatotone) and H_1 (1% tomatotone) respectively. On the other hand, the lowest weight (36.9 g) was obtained from H_0 (no tomatotone). As fruit size increased by plant growth regulator, consequently individual fruit weight increased. Generally average fruit weight increased 10 to 40% by the plant growth regulator treatment (AVRDC, 1982).

Yield per plot

Statistically significant variation was recorded for different levels of tomatotone application in terms of yield per plot (Table 2). The highest yield per plant (4.4 kg) was found from H_2 (2% tomatotone) which was statistically similar (4.2 kg) with H_3 (3% tomatotone) and closely followed (4.2) with H_1 (1% tomatotone) again, the lowest yield (3.8 kg) from H_0 (no tomatotone). As fruit size was enlarged by plant growth regulator, consequently individual fruit size, fruit yield per plant and fruit yield per plot increased. Generally fruit yield per plot increased 10 to 40% by the plant growth regulator treatment (AVRDC, 1982).

Yield per hectare

Yield per hectare of tomato varied considerably for the application of different levels of tomatotone (Table 2). The highest yield (22.7 t/ha) was recorded from H_2 (2% tomatotone) which was statistically identical (22.1 t/ha) with H_3 (3% tomatotone) and closely followed (21.6) with H_1 (1% tomatotone) respectively, while the lowest yield (19.5 t/ha) from H_0 (full sunlight). The findings of AVRDC (1997) also demand that fruit yield increased under polytunnel conditions with plant growth regulator treatment.

Table 2. Effect of tomatotone on yield contributing character of tomato[X]

Treatments[Y]	Length of fruit (cm)	Diameter of fruit (cm)	Individual fruit wt. (g)	Yield/plot (kg)	Yield (t/ha)
H_0	4.3 c	4.0 b	36.9 c	3.8 c	19.5 c
H_1	4.3 c	4.1 b	39.0 bc	4.2 b	21.6 b
H_2	5.2 a	4.7 a	41.9 a	4.4 a	22.7 a
H_3	4.8 b	4.4 a	39.6 b	4.2 ab	22.1 a
$LSD_{(0.05)}$	0.3	0.3	2.2	0.2	0.6
CV (%)	5.8	7.3	4.3	7.2	5.1

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

[Y]H_0: Control (no tomatotone), H_1: 1% tomatotone, H_2: 2% tomatotone, H_3: 3% tomatotone

IV. Conclusion

In this experiment, four level of Tomatotone were used which resulted significant variation on growth contributing characters of tomato plant. Among four level of Tomatotone, 2% tomatotone performed better compare to other level of Tomatotone in respect of yield per hectare of summer tomato.

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