EFFECT OF POTASSIUM AND PRUNING ON THE GROWTH AND YIELD OF TOMATO (*Lycopersicon esculentum* Mill.)

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ABSTRACT

The experiment was conducted in the farm of Sher-e-Bangla Agricultural University, Dhaka-1207 during October 2006 to March 2007 to determine the effect of potassium and pruning on the growth and yield of tomato. The experiment consisted of two factors: four levels of potassium 0 kg K_2O/ha, 150 kg K_2O/ha, 160 kg K_2O/ha, 170 kg K_2O/ha and four pruning options: No pruning, one stem pruning, two stem pruning and three stem pruning. There were altogether 16 treatments combination used in each block were as follows K_oP_o, K_oP_1, K_oP_2, K_oP_3, K_1P_o, K_1P_1, K_1P_2, K_1P_3, K_2P_o, K_2P_1, K_2P_2, K_2P_3, K_3P_o, K_3P_1, K_3P_2, K_3P_3. The K_3P_3 produced the highest yield (74.77 t/ha). The minimum yield (32.62 t/ha) was found from K_0P_0. The benefit cost ratio (3.72) was recorded highest in K_3P_3 and the lowest (1.17) was recorded from K_0P_0. It may be concluded that 170 kg K_2O/ha with three stem pruning was found suitable for growth and yield of tomato.

Keywords: Potassium rate, Pruning frequency, Growth and Productivity, Tomato

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is one of the important, popular and nutritious vegetables grown in Bangladesh during winter season and cultivated mostly in all parts of the country (Haque *et al.*, 1999). It is adapted to a wide variety of climates. At present, tomato ranks third, next to potato and sweet potato, in terms of world vegetable production (FAO, 2002). Its food value is very rich because of higher contents of vitamins A, B and C including calcium and carotene (Bose and Som, 1990). It is much popular as salad in the raw state and is made into soups, juice, ketchup, pickles, sauces, conserved puree, paste, powder and other products (Ahmad, 1976; Thompson and Kelly, 1983 and Bose and Som, 1990). Bangladesh produced 102 thousand tons of tomato in 15,790 thousand hectares of land during the year 2002-2003 and the average yield being 6.46 t ha^{-1} (BBS, 2004). The yield of tomato in the country is not enough in comparison to demand (Aditya *et al*., 1999). The low yield of tomato in Bangladesh, however, is not an indication of low yielding ability of this crop, but of the fact that the tomatoes grown here are not always of high yielding cultivars and that the cultural practices commonly used by the growers are not improved. Since the soil and

climatic conditions of Bangladesh during the winter season are congenial to proper growth of tomato, it is expected that improved management practices would augment the yield considerably. Pruning associated with different levels of potassium is an important factor for successful tomato production. However, the combined effects of these production practices have not been defined clearly and the information in this respect is lacking in Bangladesh. Therefore, the present study was aimed to find out the suitable combination of potassium level and pruning practices for enhancing yield of tomato.

MATERIALS AND METHODS

An experiment was conducted in the experimental farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207 during October 2006 to March 2007. Soil of the study site was silty clay loam in texture belonging to series. The area represents the Agro-Ecological Zone of Madhupur tract (AEZ-28) with P^H 5.8-6.5, (Haider *et al*., 1991). The experimental area is characterized by subtropical rainfall. There were altogether 16 treatments combination used in each block as K_oP_o, K_oP_1, K_oP_2, K_oP_3, K_1P_o, K_1P_1, K_1P_2, K_1P_3, K_2P_o, K_2P_1, K_2P_2, K_2P_3, K_3P_o, K_3P_1, K_3P_2, K_3P_3. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The size of unit plot was 3.2 m x 2 m. The tomato variety used in the experiments was "Ratan". Seeds were collected from the Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI), Joydebpur. Tomato seedlings were raised in five seedbeds of 3 m x 1m size. All weeds and stubbles were removed and 5 kg well rotten cow dung was mixed with the soil. Ten gram of seeds was sown on each seedbed on 27 October 2006. After sowing, seeds were covered with light soil. Heptachlor 40 WP was applied @ 4 kg ha^{-1} around each seedbed as precautionary measure against ants and worm. The land of the experimental field was ploughed with a power tiller. After ploughing and laddering, all the stubbles and uprooted weeds were removed and then the land was ready for planting. The quantity of manure, cow dung was also determined as recommended at the rate of 10 t/ha (BARC, 1997).The entire amount of cow dung and TSP were applied as basal during land preparation. Urea and MP were used as top dressing in equal splits at 20, 30 and 40 days after planting. Healthy and uniform 30 days old seedlings were uprooted separately from the seed bed and were planted in the experimental plots in the afternoon of 1 December, 2006 maintaining a spacing of 50 cm x 40 cm between the rows and plants respectively. All Intercultural operations were done as and when necessary. Fruits were harvested at 3 days intervals during early ripening stage when they attained slightly red color. Harvesting was started from 26 February, 2007 and was continued up to 29 March 2007. Ten plants were selected randomly from each plot for data collection. The data were collected on plant height, flower clusters per plant**,** flowers per plant, flowers per cluster, fruits per plant , fruits per cluster, weight of individual fruit , fruit length, fruit diameter, dry matter of leaves, dry matter of fruits, yield of fruits per plot (kg), yield of fruits per hectare (ton).The recorded data on various parameters were statistically analyzed using MSTAT statistical package and means were compared by Duncan`s Multiple Range Test (DMRT) according to Gomez and Gomez, (1984) at 5% level of significance.

RESULTS AND DISCUSSION

Plant height: Effect of potassium and pruning showed statistically significant on plant height at 40, 50, 60, 70 DAT and harvest, while before starting pruning at 40 DAT plant heights showed no significant differences. At 40 DAT the longest (62.1 cm) plant height was recorded from K_3P_1 (170 kg K_2O + one stem pruning) and the shortest (48.4 cm) plant height was found from K_0P_0 (no potassium + no pruning). The longest (82.1 cm) plant height was recorded from K_3P_1 and the shortest (63.7 cm) plant height was obtained from K_0P_0 at 50 DAT. At 60 DAT, the longest (108 cm) plant height was obtained from K_3P_1 and the shortest (82.6 cm) plant height was found from K_0P_0. The longest (122 cm) plant height was recorded from

K_3P_1 while the shortest (84.9 cm) was observed in K_0P_0 at 70 DAT. At harvest the longest (173.8 cm) plant height was recorded from K_3P_1 and the shortest (92.1 cm) was found from the treatment combination of K_0P_0 (Table 1).

Flower clusters per plant: Effect of potassium and pruning showed statistically significant differences on number of flower cluster per plant. The maximum (12.00) number of flower cluster per plant was recorded from K_2P_3 (160 kg K_2O + three stem pruning) and the minimum (5.8) number of flower cluster per plant was found from the treatment combination of K_0P_1 (no potassium + one stem pruning) (Table 2).

Table 1. Effect of potassium and pruning on plant height of tomato

Treatment(s) combination	Plant height (cm) at				
	40 DAP	50 DAP	60 DAP	70 DAP	At harvest
K_0P_0	48.4 c	63.7 e	82.6 g	84.7 f	92.1 f
K_0P_1	40.7 d	70.2 d	84.7 g	87.3 f	93.7 ef
K_0P_2	54.4 abc	71.6 cd	87.47 fg	94.84 ef	113.7 def
K_0P_3	51.8 bc	69.1 d	92.04 ef	103 de	109 def
K_1P_0	52.8 bc	68.9 d	93.8 de	104.3 de	106.8 def
K_1P_1	53.4 bc	77.5 b	102.2 bc	117.2 abc	136 bcd
K_1P_2	55.2 abc	72.9 cd	98.6 cd	111.5 abcd	115.8 def
K_1P_3	52.8 bc	69.8 d	91.7 ef	102.8 de	112.5 def
K_2P_0	53.9 bc	70.1 d	95.1 de	105.4 cde	112.1 def
K_2P_1	57.6 ab	79.2 ab	104.5 ab	119.1 ab	147.7 b
K_2P_2	56.6 abc	73.2 cd	98.8 bcd	112.4 abcd	118.3 cdef
K_2P_3	57.9 ab	72.8 cd	94.9 de	108.4 bcd	133.6 bcd
K_3P_0	58.2 ab	72.1 cd	97.1 cde	108.6 bcd	123.5 bcde
K_3P_1	62.1 a	82.1 a	108 a	121.7 a	173.8 a
K_3P_2	59.6 ab	75.5 bc	101.4 bc	113.9 abcd	145.8 bc
K_3P_3	51.3 bc	69.3 d	94.8 de	111.1 abcd	112.4 def
$LSD_{(0.05)}$	7.454	4.167	5.314	10.47	25.65
Level of significance	*	**	**	**	*
CV(%)	8.29	6.45	10.34	5.89	12.66

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

Flowers per cluster: Effect of potassium and pruning showed significant differences on number of flowers per cluster. The maximum (8.4) number of flowers per cluster was recorded from K_3P_1 (170 kg K_2O + one stem pruning) and the minimum (5.3) number of flowers per cluster was found from K_0P_0 (no potassium + no pruning) (Table 2).

Flowers per plant: Effect of potassium and pruning showed significant differences for number of flowers per plant. The maximum (88.7) number of flowers per plant was recorded from K_3P_2 (170 kg K_2O + Two stem pruning) and minimum (32.3) number of flowers per plant was recorded from K_0P_1 (no potassium + one stem pruning) (Table 2).

Dry matter content of leaves: Effect of potassium and pruning showed statistically significant differences on dry matter content on leaves. The maximum (11.75%) dry matter content on leaves was recorded from the treatment combination of K_2P_1 (160 kg K_2O + One stem pruning) and the minimum (8.40%) dry matter content on leaves was obtained from K_0P_1 (no potassium + one stem pruning) (Table 2).

Table 2. Effect of potassium and pruning on yield contributing characters of tomato

Treatment(s) combination	Number of flower cluster plant $^{-1}$	Number of flowers cluster $^{-1}$	Number of flowers plant $^{-1}$	Leaves matter (%)	Fruit matter (%)
K_0P_0	7.7 e	5.3 h	41.1 f	8.93 cd	8.1 d
K_0P_1	5.8 f	5.6 gh	32.3 f	8.40 d	7.7 d
K_0P_2	8.9 cd	6.2 fg	54 e	8.52 d	9.1 cd
K_0P_3	9.5 bcd	6.5 def	61.8 de	10.2 bc	10.6 bc
K_1P_0	9.1 cd	6.3 fg	55.1 de	10.6 ab	11.9 ab
K_1P_1	6.0 f	7.1 cde	42.7 f	11.3 ab	12.2 ab
K_1P_2	8.8 d	6.6 def	57.5 de	10.4 ab	11.7 ab
K_1P_3	10.2 b	6.5 def	66 cd	10 bc	10.8 abc
K_2P_0	9.6 bcd	6.3 ef	61.8 de	10.8 ab	11.8 ab
K_2P_1	7.6 e	7.1 ce	53.8 e	11.8 a	12.5 ab
K_2P_2	9.5 bcd	6.9 cdef	66.7 cd	10.4 ab	12.1 ab
K_2P_3	12.0 a	7.2 bcd	86.8 a	10.4 ab	11.6 ab
K_3P_0	11.3 a	7.4 bc	84.4 ab	10.9 ab	11.8 ab
K_3P_1	8.9 cd	8.4 a	75.1 bc	11.7 a	12.9 a
K_3P_2	11.2 a	7.9 ab	88.7 a	10.5 ab	11.9 ab
K_3P_3	9.9 bc	6.8 cdef	67.2 cd	10.5 ab	11.8 ab
$LSD_{(0.05)}$	0.957	0.715	10.31	1.173	1.880
Level of significance	*	**	**	**	**
CV(%)	6.28	6.36	9.94	6.82	10.12

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

Dry matter content of fruits: Effect of potassium and pruning showed statistically significant differences on dry matter content of fruits. The maximum (12.84%) dry matter content on fruits was recorded from K_3P_1 (170 kg K_2O + one stem pruning) and the minimum (7.72%) dry matter content of fruits was found from K_0P_1 (no potassium + one stem pruning) (Table23).

Fruits per plant: Effect of potassium and pruning showed significant differences on number of fruits per plant. The maximum (40.9) number of fruits per plant was recorded from K_3P_2 (170 kg K_2O + two stem pruning) and the minimum (15.9) number of fruits per plant was obtained from the treatment combination of K_0P_1 (no potassium + one stem pruning).

Length of fruit: Significant difference was recorded due to the combined effect of potassium and pruning on length of fruit. The maximum (9.3 cm) length of fruit was recorded from K_3P_1 (170 kg K_2O + one stem pruning) and the minimum (5.5 cm) length of fruit was obtained from the treatment combination of K_0P_1 (no potassium + one stem pruning).

Table 3. Effect of potassium and pruning on yield contributing characters and yield of tomato

Treatment(s) combination	Number of fruits plant $^{-1}$	Diameter of fruit (cm)	Weight of Individual fruit (g)	Number of fruits cluster $^{-1}$	Yield (t/ha)
K_0P_0	25.2 d	4.9 de	66.3 f	2.2 h	32.6 g
K_0P_1	1589 e	5.4 cde	73.7 ef	2.3 h	35.3 g
K_0P_2	29.8 cd	4.7 e	80.6 def	2.8 gh	47.3 f
K_0P_3	33.9 abc	5.6 c	87.5 cde	3.6 cdefg	60.1 cde
K_1P_0	34.2 abc	5.7 c	85 cdef	3.3 efg	60 cde
K_1P_1	30.5 bcd	6.7 ab	104 bc	4.3 bc	55.6 de
K_1P_2	31.8 bcd	5.6 c	83.3 cdef	3.1 fg	53.1 ef
K_1P_3	34.1 abc	5.5 cd	87.5 cde	3.5 defg	63.6 bcd
K_2P_0	35.6 abc	5.8 c	93 bcde	3.7 cdef	62.3 bcd
K_2P_1	30.8 bcd	6.7 ab	112.3 ab	4.9 ab	60.1 cde
K_2P_2	34.5 abc	5.7 c	88.1 cde	3.4 defg	61.2 bcde
K_2P_3	37.8 ab	5.8 c	97.9 bcd	4.2 bcd	69.1 ab
K_3P_0	40.9 a	6.1 bc	103.5 bc	4.6 b	63.7 bcd
K_3P_1	31.7 bcd	7 a	123.1 a	5.4 a	58.4 de
K_3P_2	40.6 a	5.9 c	93.8 bcde	4.1 bcde	67.1 bc
K_3P_3	35.6 abc	5.6 c	89 cde	3.6 cdefg	74.8 a
$LSD_{(0.05)}$	6.278	0.615	18.24	0.713	5.421
Level of significance	**	**	**	*	**
CV(%)	11.54	6.36	11.92	11.61	7.42

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

Diameter of fruit: Effect of potassium and pruning showed statistically significant differences for diameter of fruit. The maximum (7 cm) diameter of fruit was recorded from the treatment combination of K_3P_1 (170 kg K_2O + one stem pruning) and the minimum (4.7 cm) diameter of fruit was found from K_0P_2 (no potassium + two stem pruning) (Table 3).

Weight of individual fruit: Effect of potassium and pruning showed statistically significant differences for weight of individual fruit. The maximum (123.1 g) weight of individual fruit was recorded from K_3P_1 (170 kg K_2O + one stem pruning) and the treatment combination of K_0P_0 (no potassium + no pruning) performed the minimum (66.3 g) weight of individual fruit.

Fruits per cluster: Effect of potassium and pruning showed significant differences on number of fruits per cluster. The maximum (5.4) number of fruits per cluster was recorded from K_3P_1 (170 kg K_2O + One stem

pruning) and the minimum (2.2) number of fruits per cluster was found from K_0P_0 (no potassium + no pruning) (Table 3).

Yield (t/ha): Potassium and pruning showed significant combined effect on yield per hectare. The highest (74.8 t/ha) yield was obtained from K_3P_3 (170 kg K_2O + three stem pruning) and the lowest (32.6 t/ha) was recorded from K_0P_0 (no potassium + no pruning) (Table 3).

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