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EFFECT OF NITROGEN AND BORON ON THE GROWTH AND YIELD OF TOMATO (*Lycopersicon esculentum* MILL.)

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ABSTRACT

A field experiment was conducted at the research farm of Sher-e-Bangla Agricultural University, Dhaka, during November 2006 to March 2007 to study the effects of nitrogen and boron on growth and yield of tomato. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 3.96 m^2 (2.2 m x 1.8 m). There were 12 treatments combinations in the experiment comprising 4 levels of N (0, 60, 120 and 180 kg/ha designated as N_0, N_{60}, N_{120} and N_{180}, respectively) and 3 levels of B (0, 0.4 and 0.6 kg/ha designated as B_0, $B_{0.4}$ and $B_{0.6}$, respectively). The individual and combined effects of nitrogen (N) and boron (B) on growth, yield of tomato were studied. With increasing the levels of N, all the yield contributing characters and yield of tomato increased up to the 120 kg N/ha. Application of N @ 120 kg/ha gave the highest plant height (122.46 cm), flower clusters per plant (9.67), flowers per cluster (10.44), fruits per cluster (5.76), fruits per plant (52.44), fruit weight per plant (1.60 kg), fruit weight per plot (19.14 kg) and fruit yield (48.33 t/ha). Application of B @ 0.6 kg/ha also gave the highest values of all these parameters. In interaction, N @ 120 kg/ha along with B @ 0.6 kg/ha produced the highest plant height (142.2 cm), flower clusters per plant (12.67), flowers per cluster (11.67), fruits per cluster (6.33), fruits per plant (67.33), fruit weight per plant (1.95 kg), fruit weight per plot (23.20 kg) and fruit yield (58.59 t/ha).

Keywords: nitrogen, boron, growth, yield, tomato

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.), belongs to the family Solanaceae, is one of the most popular and quality vegetables grown in Bangladesh. It is popular for its taste, nutritional status and various uses. It was originated in tropical America (Salunke *et al.*, 1987), particularly in Peru, Ecuador, Bolivia of the Andes (Kallo, 1986). Tomato is cultivated all over Bangladesh due to its adaptability to wide range of soil and climate (Ahmed and Saha, 1976). It ranks third, next to potato and sweet potato, in terms of world vegetable production (FAO, 2002) and tops the list of canned vegetables (Choudhury, 1979). In Bangladesh, tomato has great demand throughout the year, but its production is mainly concentrated during the winter season. Recent statistics showed that tomato covered 48538 acres of land and the total production was approximately 143 thousand metric tons (BBS, 2008). Thus, the average yield is quite low as compared to that of other tomato producing countries such as India (15.14 t/ha), Japan (52.82 t/ha), USA (65.22 t/ha), China (30.39 t/ha) and Egypt (34.0 t/ha) (FAO, 2002). The low yield of tomato in Bangladesh, however, is not an indication of the low yielding potentiality of this crop. This is mainly due to the use of low yielding variety and lack of improved cultural practices including insufficient supply of required nutrient elements, water and poor disease management (Ali *et al.*, 1994). Out of these, proper fertilizer management practices may improve this situation greatly. Ali and Gupta (1978) reported that N, P, K and B fertilizers significantly increased the yield of tomato. In Bangladesh, there is a great possibility of increasing tomato yield per unit area with the proper use of fertilizers. Research results of scientists indicated that nitrogen has the largest effect on yield and quality of tomato (Xin *et al.*, 1997). It also promotes vegetative growth, flower and fruit set of tomato (Bose and Som, 1990). In addition, tomatos in general have a high boron requirement (Mengel and Kirkby, 1987). Fruit and seed set failure is a major reason for lower yield of rabi crops and this problem can be attributed to boron deficiency, as reported in

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tomato (Rahman *et al.,* 1993; Islam *et al.,* 1997). Boron deficiency may cause sterility i.e less fruits per plant attributing lower yield (Islam and Anwar, 1994). Deficiency of B causes restriction of water absorption and carbohydrate metabolism which ultimate affects fruit and seed formation and thus reduces yield. In Bangladesh, there is limited information on the effect of nitrogen and boron on growth and yield of tomato. In view of these limitations, a field experiment containing the treatments of nitrogen and boron was conducted with a view: to study the growth and yield performance of tomato by using different doses of nitrogen and boron fertilizers along with their interactions.

MATERIALS AND METHODS

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications of each fertilizer treatment combinations. Fertilizer treatments consisted of 4 levels of N and 3 levels of B. The study comprised the following treatments: A. Nitrogen levels: 1. N0 : (Control) 2. N60: 60 kg N/ha, 3. N120: 120 kg N /ha, 4. N180: 180 kg N / ha. B. Boron level: 1. B0: Control, 2. B0.4: 0.4 kg B/ha, 3. B0.6: 0.6 kg B/ha. There were 12 treatment combinations. The treatment combinations were as follows: N_0B_0 = Control (without N and B application), $N_0B_{0.4}$ = 0 kg N/ha+0.4 kg B/ha, $N_0B_{0.6}$ =0 kg N/ha+0.6 kg B/ha, $N_{60}B_0$= 60 kg N/ha+0 kg B/ha, $N_{60}B_{0.4}$= 60 kg N/ha+0.4 kg B/ha, $N_{60}B_{0.6}$= 60 kg N/ha+0.6 kg B/ha, $N_{120}B_0$ =120 kg N/ha+0 kg B/ha, $N_{120}B_{0.4}$ = 120 kg N/ha+0.4 kg B/ha, $N_{120}B_{0.6}$ = 120 kg N/ha+0.6 kg B/ha, $N_{180}B_0$ = 180 kg N/ha+0 kg B/ha, $N_{180}B_{0.4}$ = 180 kg N/ha+0.4 kg B/ha, $N_{180}B_{0.6}$ = 180 kg N/ha+0.6 kg B/ha. Fertilizer treatments were randomly distributed in each block as per layout without any biasness. The data on different attributes were statistically analyzed by using the ANOVA technique following factional arrangement. The mean comparisons were carried out by LSD technique (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect of N and B on Growth and Yield attributes of Tomato

Plant height

Plant height of tomato was significantly increased by different levels of nitrogen (Table 1). The tallest plant (122.46 cm) was produced with 120 kg N/ha which was statistically similar with that of 180 kg N/ha followed by 60 kg N/ha and the shortest plant (73.94 cm) was found in control treatment. It was observed that plant height increased gradually with the increment of nitrogen doses up to 120 kg N/ha. This might be due to higher availability of N and their uptake that progressively enhanced the vegetative growth of the plant. These are in agreement with those of Ali *et al.* (1990), Mondal and Gaffer (1983), Gaffer and Razzaque (1983), who have reported that different levels of nitrogen significantly increased plant height. There was positive and significant difference among the different levels of boron in respect of plant height (Table 2). Plant height increased with increasing levels of boron up to higher level. The tallest plant (112.17 cm) was produced with 0.6 kg B/ha and the shortest plant (95.89 cm) was found in control treatment. The treatment combinations of nitrogen and boron had significant effect on plant height (Table 3). The tallest plant (142.20 cm) was found in $N_{120}B_{0.6}$ treatment. The shortest plant (58.53 cm) was observed in the control treatment. The second highest plant (133.20 cm) was observed in the treatment of $N_{180}B_{0.4}$. These results revealed that higher dose of boron and medium dose of nitrogen were influential nutrients for increasing the plant height.

Number of flower clusters per plant

The effect of N on number of flower clusters per plant was influenced significantly (Table 1). The highest number of flower clusters per plant (9.67) was recorded from the treatment of 120 kg N /ha, which was statistically similar to the treatment N_{180}. Plants in control plots (N_0) produced the lowest number of flower clusters per plant (7.89), which was statistically similar to 60 kg N/ha and 180Kg N/ha. It is evident from the results that the application of N up to 120 kg/ha increased number of flower clusters per plant. Further addition of N decreased the number of flower clusters per plant.

Table 1. Effect of N on growth and yield attributes of tomato

Nitrogen levels (kg/ha)	Plant height (cm)	Number of flower clusters per plant	Number of flowers per cluster	Number of fruits per cluster	Number of fruits per plant
N_0	73.94 c	7.89 b	7.78 b	4.33 b	33.44 c
N_{60}	99.26 b	7.89 b	8.55 b	4.66 b	40.00 bc
N_{120}	122.46 a	9.67 a	10.44 a	5.76 a	52.44 a
N_{180}	120.87 a	8.76 ab	10.11 a	5.00 a	43.00 b
CV (%)	4.81	10.51	6.07	8.05	6.19
$LSD_{(0.01)}$	6.04	1.53	1.04	1.05	8.65

Figure in column, having same letter(s) do not differ significantly at 1% level of significance

Boron fertilizer had significant effect on number of flower clusters per plant (Table 2). The highest number of flower clusters per plant (9.75) was recorded from the treatment of 0.6 kg B /ha, which was statistically similar to 0.4 kg B/ha and the lowest number of flower clusters per plant (7.57) was produced in control treatment. The number of flower clusters per plant increased with increasing level of B.Interaction effect of N and B on the number of flower cluster per plant was found positive (Table 3). Treatment $N_{120}B_{0.6}$ produced the highest number of flower clusters per plant (12.67), which was statistically different from all other treatments. The lowest number of flower clusters per plant (6.67) was obtained from $N_0B_{0.}$ which was similar with $N_0B_{0.4}$, $N_{60}B_0$, $N_{60}B_{0.4}$, $N_{120}B_0$, $N_{120}B_{0.4}$ and $N_{180}B_{0.6}$. It was further observed that the second highest number of flower clusters per plant was found in treatment $N_{180}B_{0}.4$, which was similar to $N_0B_{0.6.}$

Table 2. Effect of B on growth and yield attributes of tomato

Boron levels (kg/ha)	Plant height (cm)	Number of flower clusters per plant	Number of flowers per cluster	Number of fruits per cluster	Number of fruits per plant
B_0	95.89 c	7.57 b	8.33 b	4.33 b	33.42 b
$B_{0.4}$	104.18 b	8.33 a	9.17 a	5.08 b	44.33 ab
$B_{0.6}$	112.17 a	9.75 a	10.17 a	5.33 a	48.92 a
CV (%)	4.81	10.51	6.07	8.05	6.19
$LSD_{0.01}$	2.9	2.08	1.31	0.95	10.49

Figure in column, having same letter(s) do not differ significantly at 1% level of significance

Number of flowers per cluster

Number of flower per cluster progressively increased with increasing level of N up to a certain level (Tablel). The highest number of flowers per cluster (10.44) was produced by 120 kg N/ha, which was statistically similar to the treatment of 180 kg N/ha. The lowest number of flower per cluster (7.78) was observed in control. It is evident from the results that the application of N up to 120 kg/ha increased number of flowers per cluster. Further addition of N decreased the number of flowers per cluster. Grela *et al.* (1988) reported that number of flowers was increased with increasing level of N up to 160 kg/ha.

Number of flowers per cluster was significantly influenced by the application of B .up to higher level (Table 2). The highest number of flowers per cluster (10.17) was produced by 0.6 kg B/ha, which was statistically similar to 0.4 kg B/ha. The lowest number (8.33) was produced by control treatment. These results indicated that higher dose of boron favoured the higher number of flowers per cluster.

Interaction effect of N and B on the number of flowers per cluster was significant (Table 3). The highest number of flowers per cluster (11.67) was found in $N_{120}B_{0.6}$ treatment, which was not statistically different from $N_{120}B_{0.4}$, $N_{180}B_{0.4}$ and $N_{180}B_{0.6}$ treatment. The treatment combination N_0B_0 gave the lowest number of flowers per cluster (7.33), which was statistically similar to the treatment combination of $N_0B_{0.4}$, $N_0B_{0.6}$, $N_{60}B_0$, $N_{60}B_{0.4}$ and $N_{120}B_0$.

Number of fruits per cluster

There were significant differences in number of fruits per cluster under the different levels of N (Table 1). Number of fruits per cluster gradually increased with increasing levels of nitrogen up to a certain level. The highest number of fruits per cluster (5.76) was recorded with the application of 120 kg N/ha, which was statistically similar to 180 kg N/ha. The lowest number of fruits per cluster (4.33) was produced by control treatment. It was observed that the application of N up to 120 kg/ha increased number of fruits per cluster. Further addition of N decreased the number of fruits per cluster. This result was similar with Sharma (1995).

The effect of boron on the number of fruits per cluster was found positive and significant (Table 2). Number of fruits per cluster gradually increased with increasing level of B up to higher level. The highest number of fruits per cluster (5.33) was obtained with the application of 0.6 kg B/ha. The lowest number of fruits per cluster (4.33) was found in control treatment. Further it was observed that number of fruits per cluster was increased with increasing level of boron.

The effects of treatment combinations of nitrogen and boron on number of fruits per cluster were significant (Table3). The highest fruits per cluster (6.33) was obtained in $N_{120}B_{0.6}$ treatment combination, which was identical as the treatment combination N_{120} $B_{0.4}$. The lowest number of fruits per cluster (4.0) was produced by the control treatment, which was not statistically different from the treatment combination of $N_0B_{0.4}$, $N_0B_{0.6}$, $N_{60}B_{0.4}$, $N_{60}B_0$, $N_{120}B_0$ and $N_{180}B_0$.

Table 3. Interaction effect of N and B on growth and yield attributes of tomato

Interactions (N x B)	Plant height (cm)	Number of flower cluster per plant	Number of flower per cluster	Number of fruit per cluster	Number of fruit per plant
N_0B_0	58.53 h	6.67 d	7.33 f	4.00 b	28.67 e
$N_0B_{0.4}$	71.01 g	7.00 d	7.67 ef	4.66 b	34.67 cde
$N_0B_{0.6}$	92.29 f	10.00 b	8.33 def	4.33 b	37.00 cde
$N_{60}B_0$	99.06 def	7.00 d	8.00 def	4.33 b	35.67 cde
$N_{60}B_{0.4}$	94.83 ef	7.33 d	8.33 def	4.33 b	43.67 bcd
$N_{60}B_{0.6}$	103.30 cde	9.33 bc	9.33 cde	5.33 ab	40.67 b-e
$N_{120}B_0$	107.50 d	8.00 cd	8.33 def	4.33 b	37.0 bcd
$N_{120}B_{0.4}$	117.70 b	8.33 cd	10.33 abc	6.33 a	53.00 b
$N_{120}B_{0.6}$	142.20 a	12.67 a	11.67 a	6.33 a	67.33 a
$N_{180}B_0$	118.50 b	8.60 c	9.667 bcd	4.66 b	32.33 de
$N_{180}B_{0.4}$	133.20 b	10.67 b	10.33 abc	5.00 ab	46.0 bc
$N_{180}B_{0.6}$	110.90 b	7.00 d	11.33 ab	5.33 ab	50.67 bc
CV (%)	4.81	10.51	6.07	8.05	6.19
$LSD_{0.01}$	8.506	1.552	1.729	1.245	11.570

Figure in column, having same letter(s) do not differ significantly at 1% level of significance

Number of fruits per plant

The effect of different levels of N on the number of fruits per plant was significant (Table 1). Number of fruits per plant gradually increased with increasing levels of nitrogen up to N_{120} treatment. The highest number of fruits per plant (52.44) was obtained with the application of 120 kg N/ha, which was statistically different from other treatments. The lowest number of fruits per plant (33.44) was produced by control treatment. It was observed that the application of N up to 120 kg/ha increased number of fruits per plant. Further addition of N decreased the number of fruits per plant. Sharma (1995) found the highest number of fruits per plant with 120 kg N/ha.

The effect of different levels of boron on the number of fruits per plant was found positive and significant (Table 2). Number of fruits per plant gradually increased with increasing level of B up to the highest level of the present trial. The highest number of fruits per plant (48.92) was obtained with the application of 0.6

kg B/ha, which was statistically similar to 0.4 kg B/ha application. The lowest number of fruits per plant (33.42) was found in control treatment. Further it was observed that number of fruit per plant was increased with increasing level of boron up to higher level.

The interaction effect of nitrogen and boron on number of fruits per plant was significant (Table 3). The highest fruits per plant (67.33) was found in 120 kg N/ha along with 0.6 kg B/ha application, which was highly significant with all other treatments. The lowest number of fruits per plant (28.67) was produced by the control treatment, which was not statistically different from the effect of treatment combinations of $N_0B_{0.4}$, $N_0B_{0.6}$, $N_{60}B_0$ and $N_{60}B_{0.6}$.

Effect of Nitrogen on Fruit Weight and Fruit Yield

Fruit weight per tomato plant was significantly affected by different levels of N (Table 4). Fruit weight per plant increased with increasing level of N up to 120 kg/ha. Further addition of N above 120 kg/ha decreased fruit weight per plant of tomato. The highest fruit weight per plant (1.61 kg) was obtained in N_{120} treatment and the lowest fruit weight per plant (1.02 kg) was obtained in control treatment.

Fruit weight per plot of tomato was significantly affected by different levels of nitrogen (Table 4). Plant receiving N at the rate of 120 kg/ha produced significantly higher weight of fruit per plot (19.14 kg), which was statistically similar to 180 kg N/ha. The lowest weight of fruit per plot (12.20 kg) was recorded in control treatment.

Table 4. Effect of N on yield and yield attributes of tomato

Nitrogen levels (kg/ha)	Fruit weight/plant (kg)	Fruit weight/plot (kg)	Fruit yield (t/ha)
N_0	1.02 b	12.20 b	30.82 d
N_{60}	1.11 b	13.75 b	35.74 c
N_{120}	1.60 a	19.14 a	48.33 a
N_{180}	1.41 a	16.94 ab	42.77 b
CV (%)	8.87	7.63	6.19
$LSD_{0.01}$	0.2278	5.461	3.134

Figure in column, having same letter(s) do not differ significantly at 1% level of significance

Fruit yield was significantly increased with increasing levels of N up to a certain level (120 kg/ha). Application of 120 kg N/ha produced the highest fruit yield (48.33 t/ha) which was significantly different from other treatments of nitrogen (Table 4 and Fig.1). The lowest fruit yield (30.82 t/ha) was obtained in control treatment. Pandey *et al.*, (1996) reported that fruit yield increased as N rate increased up to 80 kg/ha. Banerjee *et al.*, (1997) found highest fruit yield with 125 kg N/ha.

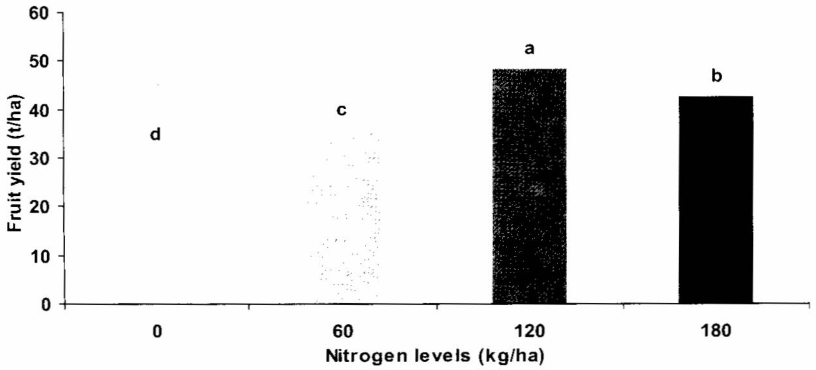

Fig.1. Effect of nitrogen levels on the fruit yield of tomato

Effect of Boron on Fruit Weight and Fruit Yield

Fruit weight per plant was not significantly affected by different levels of B (Table 5). Application of B at the rate of 0.6 kg/ha produced numerically the maximum fruit weight per plant (1.40 kg) and the minimum fruit weight per plant (1.16 kg) was produced with control treatment. Further it was observed that fruit weight per plant was increased with increasing level of boron up to higher level. Fruit per plot was not significantly affected by different levels of boron (Table 5). Absence of B (B_0) gave numerically the minimum weight of fruits per plot (14.04 kg) and 0.6 kg B/ha gave the maximum weight of fruits per plot (16.75 kg).

Table 5. Effect of B on yield and yield attributes of tomato

Boron levels (kg/ha)	Fruit weight/plant (kg)	Fruit weight/plot (kg)	Fruit yield (t/ha)
B_0	1.16	14.04	36.32 b
$B_{0.4}$	1.29	15.72	39.71 ab
$B_{0.6}$	1.40	16.75	42.22 a
CV (%)	8.87	7.63	6.19
$LSD_{0.05}$	NS	NS	3.556

Figure in column, having same letter(s) do not differ significantly at 5% level of significance   NS = Not significant

The effect of B on fruit yield was found positive and significant (Fig. II). Fruit yield increased with increasing level of B up to the highest level of B (0.6 kg B/ha) application, but it was not significantly higher than that noted in $B_{0.4}$ treatment. Application of 0.6 kg B/ha produced the highest fruit yield (42.22 t/ha) which was statistically similar with 0.4 kg B/ha (39.71 t/ha). The minimum fruit yield (36.32 t/ha) was recorded in control treatment. Prasad *et al.*, (1997) found the highest fruit yield with the application of 2.5 kg borax/ha. Pregno and Arour (1992) observed the highest tuber yield of potato with 2 kg B/ha application.

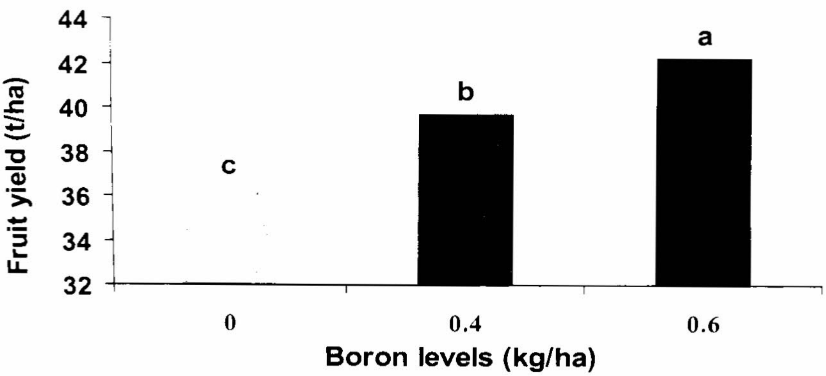

Fig. 2. Effect of boron levels on the fruit yield of tomato

Combined Effect of Nitrogen and Boron on Fruit Weight and Fruit Yield

Different treatment combinations of nitrogen and boron had significant effect on fruit weight per plant (Table 6). The highest fruit weight per plant (1.95 t/ha) was recorded in $N_{120}B_{0.6}$ treatment, which was highly significant compared to other treatments. The lowest fruit weight per plant (0.89 t/ha) was found by the control treatment, which was statistically similar to $N_0B_{0.4}$ and $N_{180}B_0$. The combined effect of N and B on weight of fruits per plot of tomato was significant (Table 6).

Table 6. Interaction effect of N and B on yield and yield attributes of tomato

Treatment	Fruit weight/plant (kg)	Fruit weight/plot (kg)	Fruit yield (t/ha)
N_0B_0	0.89 g	10.70 e	27.02 h
$N_0B_{0.4}$	1.02 fg	12.19 de	30.79 g
$N_0B_{0.6}$	1.15 ef	13.72 cde	34.59 f
$N_{60}B_0$	1.46 bc	13.83 cde	34.64 f
$N_{60}B_{0.4}$	1.38 cd	17.60 bc	44.45 c
$N_{60}B_{0.6}$	1.36 cd	19.58 ab	49.45 b
$N_{120}B_0$	1.24 de	14.97 b-e	41.07 d
$N_{120}B_{0.4}$	1.63 b	16.62 bcd	41.96 cd
$N_{120}B_{0.6}$	1.95 a	23.20 a	58.59 a
$N_{180}B_0$	1.03 efg	12.40 cde	33.72 f
$N_{180}B_{0.4}$	1.14 ef	15.02 b-e	36.89 e
$N_{180}B_{0.6}$	1.15 ef	16.27 bcd	37.92 e
CV (%)	8.87	7.63	6.19
$LSD_{0.05}$	0.193	4.628	2.656

Figure in column, having same letter(s) do not differ significantly at 5% level of significance

The treatment combination $N_{120}B_{0.6}$ gave the highest weight of fruits per plot (23.20 kg), which was statistically similar with $N_{60}B_{0.6}$. The lowest weight of fruits per plot (10.70 kg) was obtained from the N_0B_0 treatment combination, which was not statistically different from $N_0B_{0.4}$, $N_0B_{0.6}$, $N_{60}B_0$, $N_{120}B_0$, $N_{180}B_0$ and $N_{180}B_{0.4}$. The combined effect of N and B on fruit yield was significantly influenced (Table 6). The highest fruit yield (58.59 t/ha) was recorded in $N_{120}B_{0.6}$ treatment, which was statistically different from other treatment combination. The second highest fruit yield (49.45 t/ha) was found in $N_{60}B_0$.6 treatment combination, which was also significantly different from other treatments. The lowest fruit yield (27.02 t/ha) was noted in control treatment where no N and B was added. The treatment combinations $N_0B_{0.6}$, $N_{60}B_0$ and $N_{180}B_0$ were statistically similar in respect of fruit yield of tomato. Sarker *et al.* (1996) found maximum tuber yield of potato with combined application of N @ 150 kg/ha and B @ 2 kg/ha.

Nitrogen and Boron fertilization at different levels individually and in combination created a significant impact on growth, yield and nutrient content of tomato plants and fruits. The highest numbers of flowers per cluster of 10.44 and 10.17 were produced by 120 kg N/ha and 0.6 kg B/ha, respectively and the lowest number of flowers per cluster was observed in control treatment. The highest numbers of flowers per cluster (11.67) was found in $N_{120}B_{0.6}$ treatment and the control treatment (N_0B_0) gave the lowest numbers of flowers per cluster (7.33). The highest numbers of fruits per cluster (5.76 and 5.33) were obtained with the application of 120 kg N/ha and 0.6 kg B/ha, respectively and the lowest numbers of fruit per cluster was produced by control treatment. The highest fruits per cluster (6.33) was obtained in $N_{120}B_{0.6}$ treatment and the lowest number of fruit per cluster (4.0) was produced by the control treatment. The highest numbers of fruits per plant (52.44 and 48.92) were obtained with the application of 120 kg N/ha and 0.6 kg B/ha, respectively and the lowest numbers of fruit per plant was produced by control treatment. Application of B at the rate of 0.6 kg/ha produced higher fruit weight per plant (1.40 kg) and the lowest fruit weight per plant (1.16 kg) was produced with control (B_0) treatment. Combined application of N and B resulted the highest fruit weight per plant (1.95 t/ha) in $N_{120}B_{0.6}$ treatment and the lowest fruit weight per plant (0.89 t/ha) was found by the control treatment (N_0B_0). Individual application of 120 kg N/ha produced the highest fruit yield (48.33 t/ha) and the lowest fruit yield (30.82 t/ha) was obtained in control treatment. Fruit yield increased with increasing levels of B. Combined application of N and B produced the highest fruit yield (58.59 t/ha) by the $N_{120}B_{0.6}$ and the lowest fruit yield (27.02 t/ha) was obtained from control treatment (N_0B_0).

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