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RESPONSE OF REPEATED FOLIAR APPLICATION OF BORON-ZINC ON STRAWBERRY

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ABSTRACT

Mehraj H, Hussain MS, Parvin S, Roni MZK, Jamal Uddin AFM (2015) Response of repeated foliar application of boron-zinc on strawberry. *Int. J. Expt. Agric.* 5(1), 21-24.

An experiment was conducted to evaluate the response of repeated foliar application of boron-zinc on strawberry. Mixtures of boron-zinc (100 ppm) were sprayed on the strawberry plantlets by following T_1 (no spray), T_2 (spraying one time at 30 Days after transplanting, DAT), T_3 (spraying two times at 30 and 45 DAT), T_4 (spraying three times at 30, 45 and 60 DAT). The tallest plant (21.1 cm), maximum number of leaves (21.9), early flowering (72.7 days) and fruit harvesting (97.0 days), maximum number of flowers/plant (25.3), maximum number of fruits/plant (23.3), fruit length (3.3 cm), fruit diameter (31.6 mm), single fruit weight (15.0 g), fruit yield/plant (354.5 g) and degree of brix (11.3%) were found from the foliar application of boron-zinc three times spraying three times at 30, 45 and 60 DAT whereas the lowest values for all the above mentioned parameters were found from T_1. Our results suggest that three times spraying of boron-zinc at a concentration of 100 ppm could increase the growth and yield of strawberry.

Key words: *strawberry, boron-zinc, frequency of spraying*

INTRODUCTION

Strawberry (*Fragaria ananassa*) is introduced as a new fruit and gaining popularity rapidly in Bangladesh. The foliar applications of macro and micro-nutrients have showed positive response for improving fruit setting, productivity and quality of fruits. It has also beneficial effect in recovery of nutritional and physiological disorders in fruit trees. Various experiments have been conducted earlier on foliar spray of micro-nutrient in different fruit crops and shown significant response to improve yield and quality of fruits (Kumar *et al*. 2004; Singh *et al*. 2001). Foliar application is based on the principle that the nutrients are quickly absorbed by leaves and transported to different parts of the plant to fulfill the functional requirement of nutrition. Foliar application of the nutrients is obviously an ideal way of evading the problems of nutrient availability. Zinc and boron have important role on pollination; fruit set and yield (Motesharezade *et al.* 2001) among the micronutrients. Boron has an effect on cell wall structure, cell elongation (pollen tube) and root growth (Barker and Pilbeam, 2006) also considered to be a nutrient that increases the phloem carbohydrate movement (Marschner 1995) which may increase fruit soluble solid content. Application of boron has increased yield and fruit quality, in raspberry (Wojcik 2005) decreased acidity in fruit of prune (Wojcik 1999). Foliar application of boron increased yield and fruit quality of grape (Donna 1986). Zinc plays important role either as a metal component of enzymes or as a functional, structural or regulatory factor of a large number of enzymes (Bowler *et al.* 1994) also induces pollen tube growth through functioning tryptophan as an auxin precursor biosynthesis (Chaplin and Westwood, 1980). Zinc can be increased fruit number, size and quality by controlling growth of receptacle through auxin which is synthesized in achenes (Archbold and Dennis, 1984) also allow the development of new leaves (Barker and Pilbeam, 2006). Foliar application of zinc increases fruit size, total soluble solids (TSS) (Dixi and Gamdagin, 1978) also increasing sugar and decreasing acidity (Abedy 2001). Keeping the above point in view, the present study was conducted for the evaluation of repeated foliar application of boron-zinc on growth and yield of strawberry.

MATERIALS AND METHOD

An experiment was conducted at the Horticulture Farm, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the month of November 2012 to February 2013 following Completely Randomized Design (CRD) with five replications. Pots were filled with cowdung mixed soil 7 days before transplanting. For the experiment, one seedling (1.5 month aged) of RABI-3 variety (collected from BRAC Nursery, Gulshan, Dhaka) were planted in each pot. Boron and zinc mixture (100 ppm) were applied through foliar spray. Boric acid (H_3BO_3) and zinc sulphate heptahydrate ($ZnSO_4.7H_2O$) were used for the application of boron and zinc, respectively. 100 ppm boron and zinc mixture solution was applied on the strawberry plantlets by following T_1 (No spray), T_2 (spraying one times at 30 DAT), T_3 (spraying two times at 30 and 45 DAT), T_4 (spraying three times at 30, 45 and 60 DAT). Data were collected on plant height, number of leaves, number of runner, days to first flowering, days to first fruit harvesting, number of flower/plant, number of fruit/plant, fruit length, fruit diameter, single fruit weight, yield/plant and percentage of brix. Digital caliper (DC-515) was used for measuring fruit diameter. Collected data were statistically analyzed using MSTAT-C computer package program then mean was calculated and analysis of variance for each of treatment was represented by F-test (Variance Ratio). Differences between treatments were evaluated by Least Significance Difference (LSD) Test at 5% level of significance (Gomez and Gomez, 1984).

RESULTS

Maximum number of leaves was observed from T_4 treatments (21.9) whereas minimum from T_1 (10.8) at 70 days after transplanting (Fig. 1a). Leaf number was increased with the repeated foliar application of boron-zinc. Plant height varied significantly among the treatments. The tallest plant was found from T_4 (21.1 cm) whereas the shortest plant was observed from T_1 (15.2 cm) (Fig. 1b).

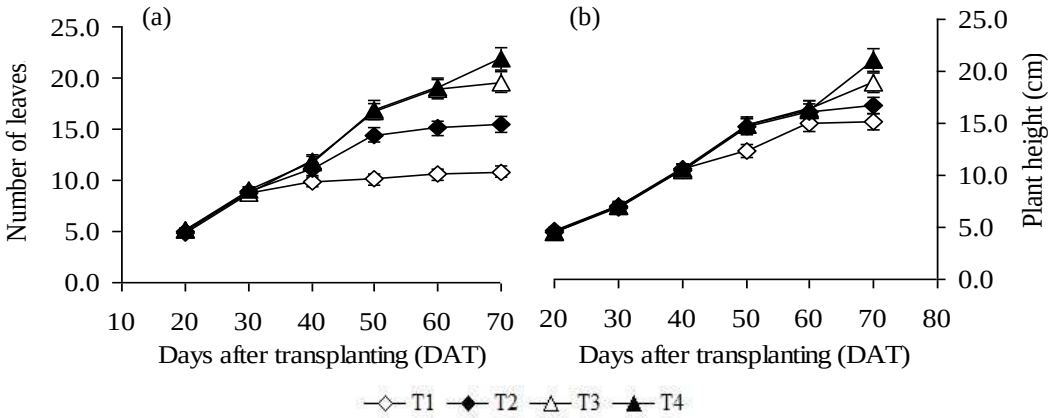

Fig. 1. Effect of repeated foliar application of boron-zinc on (a) number of leaves and (b) plant height of strawberry

Number of runner of strawberry plant differed significantly among the treatments. Maximum number of runner was found from T_1 (6.5) whereas minimum from T_4 (2.1) which was statistically similar with T_2 (2.9) (Table 1). Days to first flowering varied significantly among the treatments. Early flowering was observed from T_4 (72.7 days) whereas late flowering from T_1 (81.0 days) (Table 1). Days to first fruit harvesting varied significantly among the treatments. Early fruit harvesting was done from T_4 (97.0 days) whereas delay harvesting was done from T_1 (107.0 days) (Table 1).

Number of flower/plant varied significantly with the repetition of foliar application of boron-zinc. Maximum number of flower/plant was found from three times spraying (T_4; 25.3) whereas minimum from no spray (T_1; 15.3) of 100 ppm boron-zinc (Table 1). Number of fruit/plant varied significantly with the repetition of spraying of boron-zinc. Maximum number of fruit/plant was found from three times spraying (T_4; 23.3) whereas minimum from no spray (T_1; 13.0) of 100 ppm boron-zinc (Table 1). Length of strawberry fruit varied significantly with the repetition of spraying of boron-zinc. The longest fruit was obtained from three times spraying (T_4; 3.3 cm) whereas the shortest from no spray (T_1; 2.9 cm) and one time spraying (T_2; 2.9 cm) of 100 ppm boron-zinc (Table 2). Diameter of strawberry fruit varied significantly with the repetition of spraying of boron-zinc. Maximum fruit diameter was obtained from three times spraying (T_4; 31.6 mm) whereas minimum from no spray (T_1; 26.6 mm) which was statistically similar with one time spraying (T_2; 27.3 mm) of 100 ppm boron-zinc (Table 2). Individual fruit weight of strawberry differed significantly with the repetition of spraying of boron-zinc. Maximum individual fruit weight was found from three times spraying (T_4; 15.0 g) whereas minimum from no spray (T_1; 9.7 g) of 100 ppm boron-zinc (Table 2). Fruit weight/plant of strawberry differed significantly with the repetition of spraying of boron-zinc. Maximum fruit weight/plant was found from three times spraying (T_4; 354.5 g) whereas minimum from no spray (T_1; 141.4 g) which was statistically similar with the one time spraying (T_2; 146.8 g) of 100ppm boron-zinc (Table 2). Percentage of brix of strawberry differed significantly with the repetition of spraying of boron-zinc. Maximum percentage of brix of strawberry fruit was found from three times spraying (T_4; 11.3%) whereas minimum from no spray (T_1; 5.1%) of 100 ppm boron-zinc (Table 2).

Table 1. Effect of foliar application of zinc and boron on strawberry [x]

Treatments	No of runner	Days to first flowering	Days to first fruit harvesting	Number of flower/plant	Number of fruit/plant
T_1	6.5a	81.0a	107.0 a	15.3d	13.0d
T_2	2.9b	76.3b	100.9b	16.7c	14.3c
T_3	3.8ab	73.3c	100.3b	21.5b	19.5b
T_4	2.1b	72.7d	97.0c	25.3a	23.3a
LSD(0.05)	1.2	0.1	1.6	0.6	0.5
CV%	7.2	9.8	14.2	7.6	4.3

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

Table 2. Effect of foliar application of zinc and boron on strawberry [x]

Treatments	Fruit length (cm)	Fruit diameter (mm)	Individual fruit weight (g)	Fruit weight (g)/plant	Percentage of brix (%)
T_1	2.9c	26.6c	9.7 d	141.4c	5.1 d
T_2	2.9c	27.3c	11.2 c	146.8c	7.1 c
T_3	3.1b	28.9b	13.1 b	260.0b	8.9 b
T_4	3.3a	31.6a	15.0 a	354.5a	11.3 a
LSD(0.05)	0.2	0.8	0.1	8.1	0.9
CV%	1.0	1.9	0.9	17.2	1.7

[x] In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly at 0.05 level of significance

DISCUSSION

From the current study it was observed that supplement of boron and zinc through foliar application increases the number of leaves. Boron and zinc significantly increased mean leaf number. Maximum leaf number was observed within the concentrations of (100-300 mg/L) boron and (100-200 mg/L) zinc (Abdollahi *et al.* 2010). Meena (2010) reported that the increase in vegetative growth of tomato which could be attributed to physiological role of boron and its involvement in the metabolism of protein, synthesis of pectin, maintaining the correct water relation within the plant, re-synthesis of adenosine triphosphate (ATP) and translocation of sugar at development of the flowering and fruiting stages. Boron and zinc sprays being highly helpful in the process of photosynthesis which laid to accumulation of carbohydrate which ultimately improved the fruits quality in fact zinc works as a stimulant for amino acid synthesis and helps in the process of photosynthesis (Singh *et al.* 2012). For that reason repeated foliar application of boron-zinc might helped to increase the plant height (Fig. 1a). From this study it was observed that three times spraying of 100 ppm boron-zinc yielded more (Table 2). Strawberry plant generally yielded 434.0 g/plant (Ahsan *et al.* 2014), 282.8 g/plant (Mehraj *et al.* 2014), 361 g/plant (Islam *et al.* 2013), 379.8 g/plant (Hossan *et al.* 2013) and 336.6 g/plant (Jamal Uddin *et al.* 2012) which showed the resemblance of our results. Three times foliar application of potassium (1.5%), boron (150 ppm) and zinc (400 ppm) increased the yield, soluble solids of strawberry (Cakici and Arslan, 2012). Study referred that repeated spraying of boron-zinc increased the percentage of brix of strawberry fruit. Boron alone significantly decreased but zinc alone increased the TSS of strawberry fruit (Abdollahi *et al.* 2010). On the other hand, Khayyat *et al.* (2007) reported that boron increased pulp weight, TSS, fruit length, fruit diameter and yield of fruits in 'Shahany' date palm. Indian gooseberry fruit improved its quality when boron was applied (Sukla 2011) and it may be due to the fact that boron is associated with carbohydrate transportation within the plants. Similar findings were reported by Samant *et al.* (2008). Since zinc has an important role in photosynthesis and enzymes responsible for plant metabolism. Zinc application increases the percentage of brix (Table 2) that was similar to the opinion of Singh *et al.* (2012). Zinc also increased the vitamin C content of strawberry fruit (Abdollahi *et al.* 2010). The present study also proved that foliar application of boron and zinc increased number of fruit, fruit weight, fruit length, fruit diameter and yield/plant (Table 2). The physico-chemical composition of fruit was significantly influenced for the combined foliar spray of 0.3–0.6% borax and 0.2–0.4% zinc sulphate showing maximum fruit set, minimum fruit drop and maximum fruit yield (Kumar and Shukla, 2010). Micro-nutrients which are known to impart direct and indirect effects on fruit yield and quality. Similarly, Kumar and Shukla (2005) also reported that fruit quality of litchi increased by spray of Borax and Zinc Sulphate 0.3–0.5%.

CONCLUSION

Repeated foliar applications of boron-zinc improve yield, fruit size and sweetness of strawberry. Three times spraying (firstly at 30 DAT, secondly at 45 DAT and thirdly at 60 DAT) of 100 ppm boron-zinc could be improved growth, fruit size, individual fruit weight, yield/plant and sweetness of the strawberry fruit.

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