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RESPONSE OF FOLIAR APPLICATION OF BOEON ON VEGETATIVE GROWTH, FRUIT YIELD AND QUALITY OF TOMATO VAR. PUSA RUBY

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ABSTRACT

An investigation was carried out to comprehend the influence of various concentrations of foliar application of boron on growth, yield and quality characteristics of tomato during 1998-99 and 1999-2000 at ICAR Research complex for NEH region, Jharnapani, Nagaland. The results showed that in a field experiment with tomato (cv Pusa Ruby), boron had profound positive response on yield and quality parameters. The highest yield (327.18 and 334.58q/ha) was obtained when the plant was drenched with 250 ppm aqueous solution of boron. The element had also positive influence on plant height, number of branches, flowers and number of fruit set/plant resulting in increase number of fruits/plant and the total yield. Response of applied boron was quite visible even at the lower concentrations on the chemical composition of tomato fruit. It was more pronounced at higher concentrations and significantly improved total soluble solids (TSS), reducing sugar and ascorbic acid contents. Acidity of fruits showed marked increase with increasing levels of boron up to 250 ppm levels. However, the significant influence was recorded in the second year only.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill) is an important solanaceous vegetable by virtue of its high vitamin A content and its common use in the every household. In recent years, the production of this crop has tremendously increased due to its multifarious uses in raw, cooked and processed forms as soups, sauces, ketchups, preserve, paste and puree (Tiwari and Chaudhary 1986). The role of micro-nutrients in better production of tomato both in terms of quantity and quality of fruits has been matter of study by various workers. Boron has been found to influence various physiological processes such as respiration, photosynthesis, nitrogen metabolism, fat synthesis and water balance (Nason and Elory, 1963 and Brendnikova et. Al., 1976). Boron application has been reported to increase the fruit set and hastening of the ripening processes (Kim, 1976; 5; Pais and Hodossi, 1976). The work done in the north-east hill region on nutritional requirement of tomato is very scanty. It is, therefore, highly imperative to work out the precise requirement of boron for sustained growth and productivity in tomato under foot hills of Nagaland. Hence, the present investigations were carried out to standerdise the boron requirement for optimum productivity and quality in tomato.

MATERIAL AND METHODS

The studies were conducted for two years during 1998-99 and 1999-2000 on tomato var. Pusa Ruby at ICAR Research Complex for NEH Region, Jharnapani, Nagaland. The soil of the experimental plot was sandy loam having a pH of 5.6, organic carbon 1.09%, available N 25.23, P 5.06 and K 28.00 kg/ha, respectively. Two consecutive pre-harvest spray of boron at 50,100,150,200,250,and 300 ppm concentrations along with control were made on tomato plants. The first spray was done after one month of transplanting and the second after fruit set. Boron was used in the form of boric acid. In all, there were twenty eight plots each measuring 5.4 sq.mt. (3.0x1.8m) with in lines to plant spacing of 75 cm x 60cm. Seeds were sown in nursery in the last week of October and transplanting was done in the last week of November during both years. A uniform dose of farmyard manure at the rate of 30 t/ha was applied 15 days before transplanting. Total quantities of phosphorus (as single super phosphate, 80 kg, P_2O_5/ha), potassium (as muriate of potash, 60 kg, K_2O/ha) along with ¾ of nitrogen (as urea, 80 kg, N_2/ha) were applied at the time of transplanting. The remaining ¼ dose of nitrogen was applied as top dressing one month after transplanting. The treatments were tested in randomised block design with four replications.

Observations on vegetative growth parameters such as plant height, number of branches, flowers, fruit yield and fruit qualities were recorded. Fruit quality parameters were analyse following the procedure described by Ranganna (1986).

RESULTS AND DESCUSSION

Boron application did not show much effect on increasing the height of the plant at lower concentrations, but it was significantly perceptible at higher concentrations (Table 1). The concentration of 200 ppm induced maximum height (92.86 and 104.41 cm) as compared to other treatments during both years. The trend observed in case of plant height was also observed in the number of branches/plant. Number of branches increased significantly in treatments with 150 ppm B (50.55%), 200 ppm B (53.51%) and 250 ppm B (60.24%) in the second year. There was increase in number of branches with increasing levels of boron in both the years. The boron treatments had also marked effect on the number of flowers/plant at lower concentrations. All treatments of boron recorded significantly higher number of flowers except 50 ppm B as compared to control. Boron application increased the level of phenolic compounds, which acted on the growth processes by regulating polar auxin transport (Brown and Amblem, 1973). The increased auxin activity resulted in the increase of plant height, number of branches as well as number of flowers.

Number of fruit set, fruits/plant and fruit weight increased with the increase in the levels of boron up to 250 ppm. Maximum value of these attributes were recorded at the optimum levels of B at 250 ppm which was at par with 200 ppm of B, but significantly higher than other levels of B. The decrease in growth beyond 250 ppm of boron might be due to the depressing effect of B levels on the N. uptake. There was significant increase in fruit yield in 200 and 250 ppm B treatments over control in first year whereas in the second year, all the treatments showed significant fruit yield over control. The treatments with 200 ppm and 250 ppm B were at par with each other in the first year of experimentation. However, in the second year, treatment with 250 ppm B was significantly superior to 200 ppm B. The yield in control fell marginally in the second year. Pandita et al (1976) and Pais and Hodossi (1976) also observed substantial yield gains in tomato with boron application. Such a gain was due to beneficial effect of the element for better fertilization of the flowers and faster fruit development. Some direct effects of boron are reflected by the close relationship between boron supply and the pollen producting capacity of the anthers, as well as the viability of the pollen grains (Agarwala et al., 1981). Moreover, boron stimulate germination, particularly pollen tube growth (Dickinson, 1978) which subsequently leads to better fruit set, fruit weight and better yield.

Similarly, quality parameters such as TSS acidity, reducing sugar and ascorbic acid contents were maximum at the 250 ppm of B and then decreased (Table 2). The TSS of fruits significantly increased from 4.36 and 4.39% at control to 6.01 and 6.19% at 150 ppm level. Further increase was in the range of 6.33 to 6.40 and 6.45 to 6.56% which were at par with each other. Acidity of fruit showed marked increase with increasing levels of boron up to 250 ppm. However, the significant influence was recorded only in the second year. The maximum acidity of 0.36 and 0.38 was recorded with 250 ppm level which was 28.57 and 32.14% more compared to the acidity of control during both year of studies. The reducing sugar increased significantly at 150 ppm but further increases at 200-250 ppm. Concentrations were marginal. A similar trend was evident for ascorbic acid (mg/100 ml juice) rapidly and significantly increased from 14.31 and 15.28 mg/ 100 ml juice in control to 19.45 and 20.03 mg/100 ml juice at 150 ppm and increased slightly (1967 to 20.16 and 20.46 to 20.93 mg/100 ml juice) at higher concentrations (200-250 ppm).

It may, therefore be concluded that two spray of boric acid may bring about a significant change in the productivity and quality of tomato.

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Table 1. Effect of boron application on vegetative growth and fruit yield characteristics of tomato var. Pusa Rubby

Treatments Conc.(ppm)	Plant height (cm)		No. of branches		No. of flowers		No. of fruit set		No. of fruits		Weight of fruit (g)		Yield (q/ha)	
	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000	1999	2000
B.50	78.23	83.13	9.97	10.31	79.83	82.05	65.39	72.53	59.50	62.23	51.31	54.04	251.24	268.03
B.100	79.35	87.68	10.39	10.58	88.50	89.34	86.82	79.24	71.68	72.61	56.69	63.13	253.05	271.10
B.150	89.38	96.54	10.57	12.27	91.29	97.23	76.64	86.63	73.91	79.04	59.56	65.40	258.72	279.43
B.200	92.86	104.41	11.45	12.73	121.35	126.67	93.29	98.56	89.59	93.36	61.36	67.15	311.43	286.76
B.250	88.54	93.87	12.91	13.06	134.08	143.81	103.56	106.31	93.72	95.72	65.20	71.24	327.18	334.58
B.300	83.67	89.30	10.38	11.16	113.56	119.39	89.30	97.77	83.60	86.45	53.26	55.13	263.46	303.07
Control	67.53	71.25	7.78	8.15	68.87	73.45	57.37	64.55	53.94	60.10	46.51	49.32	247.72	244.86
S.E.	3.01	4.56	1.25	1.22	6.28	6.80	4.96	4.29	5.25	3.43	3.76	3.02	7.78	6.80
C.D. at 5%	6.32	9.59	2.26	2.56	13.19	14.29	10.41	9.02	11.03	7.21	7.91	6.38	16.34	14.28

Table-2. Effect of boron application on fruit quality characteristics of tomato var. Pusa Ruby

Treatment concern. (ppm)	TSS (%) (%)		Acidity (%) (%)		Reducing Sugar (%) (%)		Ascorbic acid (mg/100 ml juice)	
	1999	2000	1999	2000	1999	2000	1999	2000
B-50	4.67	4.73	0.29	0.30	1.16	2.13	17.14	17.39
B-100	5.19	5.26	0.30	0.30	1.29	2.40	18.21	18.61
B-150	6.01	6.19	0.31	0.32	2.48	3.03	19.45	20.03
B-200	6.33	6.45	0.32	0.34	4.26	4.65	19.67	20.46
B-250	6.40	6.56	0.36	0.39	4.37	4.77	20.16	20.93
B-300	5.83	5.96	0.34	0.36	3.86	4.09	16.28	17.10
Control	4.36	4.39	0.28	0.28	1.06	1.17	14.31	15.28
S.E.	0.14	0.06	NS	0.02	0.05	0.06	0.76	1.00
C.D. at 5%	0.29	0.13	NS	0.05	0.12	0.13	1.59	2.11