Madras Agric. J., 86(10-12): 583-586 October - December 1999
https://doi.org/10.29321/MAJ.10.A00664

RESPONSE OF TOMATO (*Lycopersicon esculentum* Mill.) TO BORAX AND BORONATED SUPER PHOSPHATE IN A CALCAREOUS RED SOIL

P. SINGARAM AND K. PRABHA

Department of soil science and Agricultural Chemistry,
Tamil Nadu Agricultural University,
Coimbatore-641003, India.

ABSTRACT

In calcareous soils where the uptake of boron (B) is depressed, foliar B application may be more effective than soil application. The present study describes an experiment on B uptake in tomato (*Lycopersicon esculentum*), in a calcareous soil. Foliar Application significantly increased the concentration and uptake of B as well as the fruit yield of tomato and its biomass at 50% flowering. The concentration of B was lessser in fruits than the foliage and root of tomato. Application of B through foliar spray was equally or more effective in increasing fruit yield in calcareous soils. Tomato yield also significantly increased with the addition of soil applied borax and boronated superphosphate. The hybrid tomato yielded more fruit but responded similarly to the non-hybrild to B fertilisation.

KEY WORDS: Borax, Boronated superphosphate, Calcareous soil, Fruit yield.

Excess calcium carbonate limits B availability in soil its absorption by plants (A1 Mustafa et al., 1993). However, genotypes of cultivars have been observed to differ in their response to B application may be advantageous compared to soil application. The present investigation was undertaken to study the effect of B applied either to the soil or as a foliar spray on B uptake, biomass and fruit yields of two tomato *(Lycopersicon esculentum)* genotypes grown in a calcareous red soil.

MATERIALS AND METHODS

A pot culture experiment was conducted using a calcareous soil with a hybrid tomato (cv. Naveen – 115 days duration) and a non hybrid variety (cv. CO 3 – 105 days duration) at the Tamil Nadu Agricultural University, Coimbatore. The experimental soil (Typic Haplustalf) had pH 8.5; cation exchange capacity 16.8 cmol(P^+) kg^{-1}; available nitrogen 90 mg kg^{-1}, available phosphorus 10 mg kg^{-1}, available potassium 120 mg kg^{-1}; calcium carbonate 37.5 g kg^{-1} (Jackson, 1973) and available B 0.25 mg kg^{-1} (Hatcher and Wilcox, 1950).

The experiment was laid out in a factorial randomized block design with 8 treatments viz., soil application of borax equivalent to 0, 10,20 and 30 kg ha^{-1}(T_1, T_2, T_3, T_4), foliar application of borax at 0.1, 0.2, and 0.3% (w/v) (T_5, T_6, T_7) and soil application of boronated superphosphate (T_8). Boronated superphosphaate containing 1.1% B was applied at a B rate equivalent to 30 kg of borax ha^{-1}. Each treatment had 4 replications. Three 25 days old seedlings were planted in each pot with 15 kg of soil. Out of the four replications, plants in two replications were removed at 50 percent flowering stage and the remaining two at harvest. At 50%flowering, root and shoot were separated, dried and weighed. At harvest, besides shoot and root dry weight, the fruit yield was also recorded. The plant and soil samples collected at these stages were analysed for B concentration. The sampling and processing of soil and plant was according to the procedures detailed by Jackson (1973) and Martin Prevel *et al.* (1984). Boron in soil was extracted with hot water for five minutes by maintaining soil water ratio of 1:2 (v/v) and estimated using carmine method (Hatcher and Wilcox, 1950). Boron concentration of plant sample was estimated following nitric-sulfuric acid (10:3) digestion (Banuelos et al., 1992). Analysis of variance for B concentration, uptake and tomato fruit yield data was based on the procedure outlined by Panse and Sukhatme (1978).

Table 1. Effect of soil and foliar boron (B) application rates on boron concentration (mg B kg^{-1} dry wt) and uptake in shoots and roots of two tomato genotypes, Naveen and Co 3

B Treatments	At 50% flowering				At harvest			
	Shoot		Root		Shoot		Root	
	Naveen	Co 3	Naveen	Co 3	Naveen	Co 3	Naveen	Co 3
T_1 Control	25.2	24.3	22.1	20.5	22.2	21.4	20.4	19.1
T_2 Borax 10 kg ha^{-1} (Soil)	27.2	26.1	23.3	22.5	24.2	23.1	21.1	19.9
T_3 Borax 20 kg ha^{-1} (Soil)	28.5	26.5	23.7	24.0	25.8	23.5	21.9	20.9
T_4 Borax 30 kg ha^{-1} (Soil)	29.2	26.9	24.1	24.5	27.6	24.3	23.6	22.0
T_5 Borax 0.1% (Foliar)	29.6	27.2	22.1	20.5	28.2	25.5	20.0	18.9
T_6 Borax 0.2% (Foliar)	30.0	27.7	22.4	21.2	28.6	26.1	20.4	19.8
T_7 Borax 0.3% (Foliar)	30.6	27.9	22.5	21.5	29.2	26.8	21.5	20.0
T_8 Boronated superphosphate (Soil)	29.5	26.9	23.2	23.4	27.3	25.2	21.5	20.0
LSD (P=0.05)								
Treatment	0.33	0.69	0.24	1.07				
Variety	0.16	0.34	0.11	1.54				
Treatment x Variety	0.46	NS	0.34	NS				

NS - Non Significant

RESULTS AND DISCUSSION

Boron concentration

Application of borax increased the B concentration of the shoot at both flowering and final harvest in the hybrid and non hybrid vareity of tomato (Table 1). At 50 per cent flowering, the highest B concentration in the shoot was with the foliar spray of 0.3% borax. Foliar application of borax was found to be better than the soil application as far as B concentration of the shoot was concerned, persumably because, the experimental soil contained $CaCO_3$ 37.5 g kg^{-1} which inhibited the availability and absorption of B.

By contrast, in the roots, the treatments involving the soil application of borax produced higher concentration of B than the foliar spray of borax (Table 1). At 50 per cent flowering stage and at harvest the highest B concentration was with the highest dose of soil applied borax (30 kg ha^{-1}). The differential response of root and shoot B concentrations to soil and foliar B application suggests that roots could absorb B from soil applied borax but could not translocate it efficiently to the shoots.

The B concentration of the fruits was not significantly influenced by the treatments (Table 2). Preferential accumulation of B in the leaves but not in the fruits is consistent with B movement predominantly in the xylem and limited retranslocatilon of B in the phloem (Marschner, 1995).

Boron uptake

The foliar application of borax was generally associated with higher B uptake in shoots as a result of the twin effects of high concentration in shoots combined with enhanced shoot dry matter. In the case of roots, the treatments involving the soil application of borax at 30 kg ha^{-1} resulted in

Table 2. Effect of soil and foliar boron (B) application rates on B concentration and fruit yield of two tomato genotypes, on a calcareous red soil

B Treatments	B concentration ($mg\ kg^{-1}$)		Fruit yield ($kg\ pot^{-1}$)	
	Naveen	Co 3	Naveen	Co 3
T_1 Control	11.5	10.3	3.39	2.85
T_2 Borax 10 kg ha^{-1} (Soil)	11.6	11.7	4.24	3.56
T_3 Borax 20 kg ha^{-1} (Soil)	12.4	10.3	3.90	3.28
T_4 Borax 30 kg ha^{-1} (Soil)	13.3	12.3	3.73	3.14
T_5 Borax 0.1% (Foliar)	11.1	13.2	4.07	3.42
T_6 Borax 0.2% (Foliar)	14.7	12.8	4.41	3.71
T_7 Borax 0.3% (Foliar)	11.2	14.1	4.58	3.85
T_8 Boronated superphosphate (Soil)	11.3	12.4	4.15	3.49
LSD (P=0.05)				
Treatment	NS	0.42		
Variety	NS	0.21		
Treatment x Variety	NS	NS		

NS - Non Significant

Table 3. Effect of soil and foliar boron (B) application rates on boron concentration (mg B kg^{-1} dry wt) and uptake in shoots and roots of two tomato genotypes, Naveen and Co 3

B Treatments	At 50% flowering				At harvest			
	Shoot		Root		Shoot		Root	
	Naveen	Co 3	Naveen	Co 3	Naveen	Co 3	Naveen	Co 3
T_1 Control	27.3	22.2	6.5	5.0	33.2	27.8	10.5	10.2
T_2 Borax 10 kg ha^{-1} (Soil)	28.3	23.3	7.8	5.4	34.8	28.5	11.6	10.1
T_3 Borax 20 kg ha^{-1} (Soil)	28.8	23.7	6.9	4.7	35.6	27.2	11.3	9.2
T_4 Borax 30 kg ha^{-1} (Soil)	28.1	22.5	7.8	6.3	36.3	27.8	11.9	10.9
T_5 Borax 0.1% (Foliar)	28.5	22.1	7.8	6.0	35.4	27.6	11.0	10.5
T_6 Borax 0.2% (Foliar)	28.1	21.5	7.2	6.2	35.1	28.4	11.6	10.4
T_7 Borax 0.3% (Foliar)	29.3	22.5	7.7	5.6	34.8	27.6	11.7	9.8
T_8 Boronated superphosphate (Soil)	27.8	21.3	7.2	6.1	35.6	27.2	11.5	10.1
LSD (P=0.05)								
Treatment	0.57	0.61	0.69	0.35				
Variety	0.28	0.31	0.34	0.17				
Treatment x Variety	0.81	NS	0.98	0.49				

NS - Non Significant

the highest B uptake. The uptake of B by fruits was found to be increased only with foliar applied B. The uptake of B by the fruits had a significant positive correlation with that of the yield (r=0.680* for the hybrid and r = 0.879** for Co 3). Since there was evidence of limited retranslocation of soil applied B to fruits, it can be concluded that application of foliar borax increased the weight and number of fruits, thereby contributing to the increased B uptake.

Biomass yield of shoot and root

The application of borax generally increased the dry weight of tomato shoot at both the flowering and harvest stages (Table 3). At 50 per cent flowering and harvest, the application of borax at 20 – 30 kg ha^{-1} or as foliar application at 0.2 – 0.3% produced the highest dry weights. By contrast at harvest, highest shoot and root dry weight was obtained with the application of borax at 30 kg ha^{-1}.

Fruit yield

The fruit yield was higher in the hybrid than variety Co 3 but generally their responses to B were the same (Table 2). By contrast with shoot and root dry weight, the maximum fruit yield in the calcareous soil was obtained with the spray of 0.2 – 0.3% borax. Boron deficiency occurs as a result of increased B adsorption by soil with pH increase and as a result of co-precipitation of B with Ca Co_3. Hence it is suggested for calcareous soils that foliar spraying of borax could result in better fruit yield compared to soil application of borax or boronated superphosphate.

REFERENCE

BANUELOS, G.S, CARDON,G, PILAUM,T. and AKOHOUE. (1992). Composition of dry ashing and wet acid digestion on the determination of B in plant tissue. Commun. **Soil Sci. Plant Anal.23:** 2383-2397.

HATCHER, J.T. and WILCOX, L.V. (1950). Colorimetric determination of boron using carmine. **Anal. Chem. 22:** 567 – 569.

JACKSON, M.L. (1973). **Soil Chemical analysis.** Prentice Hall, New Delhi, India.

MARSCHNER, H. 1995. **Mineral Nutrition of Higher Plants.** Academic Press, London, U.K. 889p.

MARTIN PREVEL, P. GAGNARD, J. GAUTIER, P. (1984). **Plant Analysis as a Guide to the Nutirent Requirements of Temperature and Tropical Crops.** SBA Publications. Calcutta, India.

PANSE, V.G. and SUKHATME, P.V. (1978). **Statistical Methods for Agricultural Workers.** Indian Council of Agricultural Research Publication, New Delhi, India.

Yang, Y., Xue, J. Ye, Z. and Wang, K. (1993). Response of rape genotypes to boron application. **Plant and Soil 155/156:** 321 – 324.

(Received : December 1997 Revised : September 1998)

Madras Agric. J., 86(10-12): 586-589 October - December 1999

SEASONAL INCIDENCE AND MANAGEMENT OF THE MANGO LEAF MITE, *CISABEROPTES KENYAE* KEIFER (ABEROPTINAE : ERIOPHYIDAE : ACARI).

G. UMAPATHY and B. RAJENDRAN

Sugarcane Research Station, TNAU,
Cuddalore – 607 001.

The occurrence of the leaf mite. *Cisaberoptes kenyae* K. was continuous on varieties Malgoa and Rumani throughout the study period (December 1995 to May 1997), whereas in the varieties like Neelum, Bangalora and Sappattai the occurrence was not noticed between the months of August '96 to May '97. A similar trend was observed on the infestation of the mite. Among the treatments tested, neem seed kernal extract (10%) recorded the lowest number of mites (6.9 mites./ square inch area) with 54.3 per cent reduction over control followed by dicofol 0.03% (39.1%) endosulfan 0.07% (33.1%), Wettable sulphur – 0.02% (25.8%) and neem oil 3.0% (21.9%) after two rounds of spray.

KEY WORDS: *Cisaberoptes kenyae,* Eriophyid, Incidence, Management.