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EFFECT OF ORGANIC MANURES AND BORON ON THE YIELD AND FRUIT QUALITY OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)

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Abstract

Tomato is one of the most popular and widely grown vegetables in India and cultivated throughout the world for its fresh and as well as for processed products. In order to study the effect of organic manures and boron application, the growth, and yieldof tomato a field experiment was conducted at Vallampadugai village, Chidambaram Taluk, Cuddalore district of Tamil Nadu. Tomato var. PKM-1 was grown as test crop. The experiment was conducted in Randomized block design with nine treatments. Each treatment was replicated thrice. The treatments consisted of T_1 - Control, T_2 – B @ 3.0 kg ha^{-1} as CBH, T_3 – B @ 3.0 kg ha^{-1} as polybor, T_4 – T_2 + FYM @ 12.5 t ha^{-1}, T_5 – T_2 + Vermicompost @ 6.25 t ha^{-1}, T_6 – T_2 + Biocompost @ 6.25 t ha^{-1}, T_7 – T_3 + FYM @ 12.5 t ha^{-1}, T_8 – T_3 + Vermicompost @ 6.25 t $ha^{-1}$and T_9 –T_3 + Biocompost @ 6.25 t ha^{-1}. The recommended NPK dose of 75:100:50 kg ha^{-1} was applied through urea, single superphosphate, muriate of potash to all the plots. The required quantities of boron were supplied through calcium borohumate and polybor as per the treatments.The yield and quality parameters namelynumber of fruits $plant^{-1}$, fruit yield and stover yield were recorded at appropriate stage of crop growth. The results of the study clearly revealed that tomato responded well for the boron fertilization. Irrespective of sources of B noted that calcium borohumate excelled polybor in improving theyield. Application of B @ 3.0 kg ha^{-1} as CBH + FYM @ 12.5 t ha^{-1} was established as the best treatment by recording 51.3 per cent increased fruit yield and produced superior quality fruits.

Keywords: Tomato, Boron, Calcium borohumate, Polybor.

Introduction

Tomato (*Lycopersicon esculentum* L.) assumes great significance due to its nutritional excellence. . It is one of the most popular and widely grown vegetables in India and cultivated throughout the world for its fresh and as well as for processed products. Application of boron to tomato has got the tremendous effect besides the use of major nutrient fertilizers to increase the crop yield (Swati Barche*et al*., 2011). Boron governs the significant function of translocation of sugar, reproduction and germination of pollen, fruits and seed setting. Depletion of boron from soils is mainly through leaching to the lower layers and though the uptake of crops, which removes a significant amount of boron from the nutrient reserve in each season. These two factors together deplete the boron supply in the top soil or bring boron to the levels that are not accessible by the crops (Sathya *et al*., 2009). Recently disodium octa borate texta hydrate (polybor) has been introduced in the market which is costly and sparingly soluble in water. Though, the polybor is more efficient than conventional boron fertilizers, their high cost is not economical to the farmers. In order to minimize the cost as well as to improve the complex boron fertilizers, humic acid based boron complex, calcium borohumate (CBH) which improves the use efficiency boron is used in the study.

Materials and Methods

The field experiment was conducted at Vallampadugai village, Chidambaram Taluk, Cuddalore district of Tamil Nadu .The soil was sandy loam with neutral in reaction (pH 7.2), EC (0.19 dSm^{-1}), carbon content (4.9 g kg^{-1}), low in available N (123.0 kg ha^{-1}), available P (9.0 kg ha^{-1}) and medium in available K (90 kg ha^{-1}). The contents of available (DTPA) extractable Fe, Mn, Zn, Cu and B were 11.48, 33.41, 3.19, 0.60 and 0.30 mg kg^{-1} respectively. Tomato var. PKM-1 was grown as test crop. The experiment was conducted in Randomized block design with nine treatments. Each treatment was replicated thrice. The treatments consisted of T_1 - Control, T_2 – B @ 3.0 kg ha^{-1} as CBH, T_3 – B @ 3.0 kg ha^{-1} as polybor, T_4 – T_2 + FYM @ 12.5 t ha^{-1}, T_5 – T_2 + Vermicompost @ 6.25 t ha^{-1}, T_6 – T_2 + Biocompost @ 6.25 t ha^{-1}, T_7 – T_3 + FYM @ 12.5 t ha^{-1}, T_8 – T_3 + Vermicompost @ 6.25 t $ha^{-1}$and T_9 –T_3 + Biocompost @ 6.25 t ha^{-1}. The recommended NPK dose of 75:100:50 kg ha^{-1} was applied through urea, single superphosphate, muriate of potash to all the plots. Required quantity of FYM, vermicompost and biocompost was applied to the respective plots as per the treatments and incorporated into the soil just before planting. Boron fertilizers were also applied to the plots as per the treatment schedule just before planting of tomato seedlings. Representative plants from pots are labeled and the

observation on the growth attributes like plant height, Number of branches plant^{-1}, Internodal length (cm), Dry matter production (kg ha^{-1}) were recorded periodically. Yield characters likeNumber of fruits plant^{-1}, Fruit set percentage, Days taken for ripening, Single fruit weight(g), Fruit yield (q ha^{-1}) were recorded at the time of harvest and periodically analysed quality characters like fruit volume, fruit density, total sugar content, TSS, ascorbic acid, titrable acidity, and lycopene content.

Results and Discussion

Application of B @ 3.0 mg kg^{-1} as CBH + FYM @ 12.5 t ha^{-1} recorded highest number of fruits plant^{-1}(21.66), single fruit weight (97.6 g) and fruit yield(348.33 q ha^{-1}). It was 51.3 per cent increase over control(table 2). This might also be due to the better utilization of B by plants in presence of both macro and micronutrients released from FYM. Similar observation in tomato was made by Oyinlola and Chude (2004).

In the present study, the quality parameters like TSS, ascorbic acid, titrable acidity, total sugars, lycopene content were found to be significantly influenced by the application of boron to tomato (Table 1). Application of boron through CBH produced best quality fruits and registered highest fruit volume (54.00), fruit density of 0.92 g cc^{-1}, total sugar content of 4.82 per cent, total soluble solids (11.46%), ascorbic acid content (45.37 mg 100 g^{-1}) and lycopene content(5.94 mg 100 g^{-1}) was noticed in the treatment receiving B @ 3.0 kg ha^{-1} + FYM @ 12.5 t ha^{-1}. It is observed that boron is involved in synthesis and transport of carbohydrate. The increase in the carbohydrate content might have increased the TSS content of tomato (Bose and Tripathi, 1996). The titrable acidity of fruits decreased due to boron application. This might be due to the effective conversion of acid into sugars, which was reflected in total sugar content of the fruits. In this field experiment, total sugar content was increased with boron application. These results are in agreement with the findings of Sathya *et al*. (2010).

Application of boron through CBH and polybor significantly influenced the ascorbic acid content of tomato. This might be ascribed to the inhibiting effect of boron on the activity of the enzyme ascorbic acid oxidase. This result was in conformity with the findings of Thirumavalavan (2012). In the present study, boron application improved the total quality of tomato fruits. A similar result was observed by Paithankar *et al*. (2004). They reported that boron played major role in cracked fruits. Deficiency of boron cause thinner collenchyme. Boron is also associated with flexibility of cell wall and thus affects cracking of fruits. Sathya *et al*. (2010) also made similar observation in tomato.

Conclusion

From the present investigation, it can be concluded that application of B @ 3.0 kg ha^{-1} as CBH + FYM @ 12.5 t ha^{-1} was established as the best treatment by recording 51.3 per cent increased fruit yield and produced superior quality fruits.

Table 1: Effect of organic manures and boron on single fruit weight, fruit yield and percentage over control

Treatments	Single fruit weight (g)	Fruit yield (q ha^{-1})	Percentage of increase over control
$_1$ – Control	74.6	230.00	-
T_2 – B @ 3.0 kg ha^{-1} as CBH	83.3	265.33	15.2
T_3 – B @ 3.0 kg ha^{-1} as Polybor	80.6	247.00	7.3
T_4 – T_2 + FYM @ 12.5 t ha^{-1}	97.6	348.33	51.3
T_5 – T_2 + Vermicompost @ 6.25 t ha^{-1}	81.3	302.60	31.3
T_6 – T_2 + Biocompost @ 6.25 t ha^{-1}	90.0	312.60	35.6
T_7 – T_3 + FYM @ 12.5 t ha^{-1}	94.3	346.33	50.4
T_8 – T_3+ Vermicompost @ 6.25 t ha^{-1}	82.3	280.00	21.7
T_9 – T_3 + Biocompost @ 6.25 t ha^{-1}	85.0	308.00	33.9
SEd	1.5	12.5	
CD (p=0.05)	6.9	24.8	

Table 1: Effect of organic manures and boron on fruit quality characters

Treatments	Fruit volume (cc)	Fruit density (g cc^{-1})	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)	Total soluble solids (%)	Titrable acidity (%)	Ascorbic acid content (mg 100 g^{-1})	Lycopene content
$_{1}$ – Control	45.66	0.74	1.92	0.80	2.62	5.26	0.79	26.56	3.45
T_2 – B @ 3.0 kg ha^{-1} as CBH	47.00	0.80	2.70	0.81	3.51	7.24	0.66	32.35	4.47
T_3 – B @ 3.0 kg ha^{-1} as Polybor	46.00	0.76	2.24	0.74	2.98	7.12	0.77	31.86	4.33
T_4 – T_2 + FYM @ 12.5 t ha^{-1}	54.00	0.92	3.59	0.73	4.82	11.46	0.38	45.37	5.94
T_5 – T_2 + Vermicompost @ 6.25 t ha^{-1}	49.33	0.88	3.42	0.87	4.29	9.60	0.58	41.35	5.00
T_6 – T_2 + Biocompost @ 6.25 t ha^{-1}	50.00	0.90	3.51	0.83	4.54	10.52	0.48	42.20	5.79
T_7 – T_3 + FYM @ 12.5 t ha^{-1}	53.66	0.91	3.56	0.75	4.71	10.87	0.42	43.42	5.86
T_8 – T_3+ Vermicompost @ 6.25 t ha^{-1}	48.6	0.83	3.24	0.93	4.17	8.13	0.60	37.69	4.64
T_9 – T_3 + Biocompost @ 6.25 t ha^{-1}	49.00	0.95	3.47	0.98	4.45	8.92	0.54	38.37	5.73
SEd	1.029	0.21	0.085	0.20	0.100	0.259	NS	0.736	0.316
CD (p=0.05)	2.054	NS	0.171	NS	0.201	0.514	NS	1.473	0.222

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