EFFECT OF ZINC AND BORON ON GROWTH OF TOMATO (*LYCOPERSICON ESCULENTUM*. MILL.) CV. *HEEM SOHNA*, UNDER PROTECTED CULTIVATION

Rawaa Shakir Shnain■, V. M.Prasad♦ and S.Saravanan□

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ABSTRACT

the experiment was carried out at vegetable Research Farm in Department of Horticulture, Sam Higginbottom University of Agriculture Technology And Sciences, Allahabad, during mid-November to 8- may during the year 2012 - 2013. The experiment was laid out in R.B.D. with three replications and nine treatments with following combination of which was T_1 (control), T_2 (Zn 1.25 g/L), T_3 (Zn 2.0 g/L), T_4 (B 1.25g/L),T_5 (B 1.25g/L + Zn 1.25 g/L), T_6 (B 1.25 g/L), T_7 (B 2.0g/L), T_8 (B 2.0g/L + Zn 1.25g/L) and T_9 (B 2.0 g/L + Zn 2.0 g/L). The cultivar of tomato was "heem shona" syngenta company.The highest plant height (2.93) m that is T_5, followed by T_6 it was (2.90) m, No. of leaves per plant (39.33) leaves that is T_5, followed by T_6 it was (38.67), under Allahabad agro climatic conditions.

INTRODUCTION

Tomato (*Lycopersicon esculentum* MiLL.) belongs to family solanaceae having chromosome number (2n=24), it is a self pollinated crop. Tomato is one of the most popular and nutritious fruit vegetable; widely grown around the world and second ranked after potato.

Tomato has its origin in Peru, Ecuador and Bolivia on the basis of availability of numerous wild and cultivated relatives of the tomato in this area. From its centre of origin, the tomato first moved to Mexico for domestication and cultivation. From Mexico it arrived in Europe by 1554.

The major tomato growing countries are China, India, USA, Turkey, Egypt and Italy. In the world total area under tomato is 4, 582, 438 thousand ha with production of 150, 513, 813 thousand t and with productivity of 32.8 t/ha in 2010 - 11. **(Indian Horticulture Database, 2011)**. Total area under tomato crop in India is assessed to be 0.865 million ha with the productivity of (16,826,000 t) with productivity of 19.5 t/ha **(Indian Horticulture Database, 2011)**.

To improve the yield and quality of the produce, it is necessary to pay attention on the optimum balanced use of nutrients through fertilizer application. Plants require mineral elements for normal growth and development. Plants require to essential for the normal life processes of plants and are needed in very small amounts are called trace elements or minor elements such as boron and zinc etc.

Boron (B) play an essential role in the development and growth of new cell in the plant meristem, improvement of fruit quality and fruit set. Boron is needed by the crop plants for cell division, nucleic acid synthesis, uptake of calcium and transport of carbohydrates. Boron also plays an important role in flowering and fruit formation. Boron deficiency affects the growing points of roots and youngest leaves. The leaves become wrinkled and curled with light green colour. Its deficiency affects translocation of sugar, starches, nitrogen and phosphorus, synthesis of amino acids and proteins.

Zinc (Zn), as one of the essential micronutrients in plants is necessary for plant growth and development and involved in many enzymatic activities and IAA formation to increase flower number and fruit set.. However, excessive Zn in plants can profoundly affect normal ionic homeostatic systems by interfering with the uptake, transport, osmotic and regulation of essential ions and results in the disruption of metabolic processes such as transpiration, photosynthesis and enzyme activities related to metabolism **(Sainju *et al.*, 2003)**.

Tomato is a warm season crop and requires relatively long season to produce a profitable crop. it is highly susceptible to frost. Environment factors such as temperature and moisture etc. markedly influence the process of fruit set of tomato and subsequent in fruit development and yield **(Calvert, 1959)**. Despite its economic importance, growers are not in a position to produce good quality tomato with high productivity due to various biotic (pest and diseases), a biotic (rainfall, temperature, relative humidity and light intensity) and crop factors (flower and fruit drop). Due to erratic behavior of weather, the crops grown in open field are often exposed to fluctuating levels of temperature, humidity, wind flow etc. which ultimately affect the crop productivity adversely **(Ochigbu and Harris, 1989)**. Besides this, limited availability of land for cultivation hampers the vegetable production. Hence, to obtain a good quality produce and production during off season, there is a need to cultivate tomato under protected conditions such as green house, poly house and net house etc. Growth, development, productivity and post harvest quality parameters of tomato crop largely depend on the interaction between the genetic constitution of the plants and environmental conditions under which they are grown. Basically tomato is a warm season crop and lacks adaptability to varied environmental conditions. Hence tomato is one such crop which responds very well to the favorable environmental conditions.

Growing environment can be modified to suit to crops by use of protected structure for cultivation. Protected cultivation

■M.Sc Student, ♦Professor and Head, □Associate Professor
■Ministry of Agriculture, General Company for Agricultural Supplies, Baghdad, Iraq
♦,□Department of Horticulture, College of Agriculture, SHUATS, Allahabad - 211007 (U.P)

involves protection of crop at various production stages from adverse environmental conditions such as extreme temperature, hail storm, scorching sun and heavy rain The optimum temperature for most varieties between 18 to 24 °C. But the plant tissues are damaged below 10 °C and above 38 °C, keeping all the fact in view, a field experiment entitled To Study effect of FYM, NPK and Micronutrients on Growth of Tomato (*Lycopersicon esculentum* .MiLL) cv. Heem Sohna under protected cultivation.

OBJECTIVES

To find out the most suitable treatment for growth.

MATERIALS AND METHODS

The experiment entitled "Effect of Boron and Zinc on growth of tomato (*Lycopersicon esculentum*. Mill) cv. Heem Sohna, under protected cultivation" was carried out separately during the year 2012-2013 under the agro-climatic conditions of Allahabad, at research farm of horticulture department, Sam Higginbottom University of Agriculture, Technology And Sciences, Allahabad.

Experimental Design

The experiment was laid out in Randomized Block Design comprising of 9 treatments with three replications. Treatments were randomly arranged in each replication, divided into nine plots. applied as foliar sprays two times, The particulars of the treatments are presented below.

Treatment details

The following treatments were applied:

TREATMENT **NOTATIONS**

Boron → B0 (0)
Boron → B1(1.25 g/L)
Boron → B2(2.0 g/L)

Zinc → Zn0 (0)
Zinc → Zn1(1.25 g/L)
Zinc → Zn2 (2.0 g/L)

Treatment Combinations :

T_1 control
T_2 B_0Zn_1 (Zn 1.25 g/L)
T_3 B_0Zn_2 (Zn 2.0 g/L)
T_4 B_1Zn_0 (B 1.25 g/L)
T_5 B_1Zn_1 (B 1.25 g/L +Zn 1.25 g/L)
T_6 B_1Zn_2 (B 1.25 g/L +Zn 2.0 g/L)
T_7 B_2Zn_0 (B 2.0 g/L)
T_8 B_2Zn_1 (B 2.0 g/L +Zn 1.25 g/L)
T_9 B_2Zn_2 (B 2.0 g/L +Zn 2.0 g/L)

Observational details

Five plants from each net plot were randomly selected and they were labeled. These plants were used for recording all morphological observations in respect of growth, The details of the observations recorded are given below.

Growth parameters:

1 . Plant height (m):

Height of plant was recorded from base of the plant to the growing tip of the plant in meter, the observation was recorded on the five labeled plants in each net plot and the average was worked out.

2. Number of leaves per plant

The number of leaves for each observation plant was recorded at the end of harvest and the observation was recorded on the five labeled plants in each net plot and the average was worked out.

RESULTS AND DISCUSSION

1. Plant height

The data presented in *table - 1* clearly showed that the boron and zinc played significant role in directly affecting plant height. The maximum of plant height was recorded statistically significant in boron and zinc application @ (1.25 g/L B+ 1.25 g/L Zn) that is T_5, which was recorded (2.93) m, followed by T_6 @ (1.25 g/L B+ 2.0 g/L Zn) (2.90) m. The minimum of plant height (1.94) m was noticed with control. These results are in close conformity with the findings of **Chaudhary and Prasad (2002)**, **Hamsaveni *et al.*, (2003)**, **Sharma (2006)**, **Patil *et al.*, (2008)** and **Naga *et al.* (2013)**.

Table - 1 Effect of zinc and boron on plant height of tomato (Lycopersicon esculentum. Mill) cv. Heem Sohna under protected cultivation.

S.O.N	Treatments	Treatments Combinations	Plant height (m)
1	T_1	CONTROL	1.94
2	T_2	B_0Zn_1	2.57
3	T_3	B_0Zn_2	2.80
4	T_4	B_1Zn_0	2.42
5	T_5	B_1Zn_1	2.93
6	T_6	B_1Zn_2	2.90
7	T_7	B_2Zn_0	2.73
8	T_8	B_2Zn_1	2.83
9	T_9	B_2Zn_2	2.78
		F- test	S
		S. Ed. (±)	0.038
		C. D. (P = 0.05)	0.080

Table.2 Effect of zinc and boron on number of leaves per plant of tomato (Lycopersicon esculentum MiLL) cv. Heem Sohna under protected cultivation.

S.O.N	Treatments	Treatments Combinations	No. of leaves
1	T_1	CONTROL	29.00
2	T_2	B_0Zn_1	31.33
3	T_3	B_0Zn_2	34.33
4	T_4	B_1Zn_0	31.33
5	T_5	B_1Zn_1	39.33
6	T_6	B_1Zn_2	38.67
7	T_7	B_2Zn_0	33.33
8	T_8	B_2Zn_1	35.00
9	T_9	B_2Zn_2	34.00
		F- test	S
		S. Ed. (±)	1.268
		C. D. (P = 0.05)	2.688

2. Number of leaves per plant

The data presented in *table - 2*, clearly showed that the boron and zinc played significant role in directly affecting the number of leaves per plant. The maximum number of leaves per plant was recorded statistically significant in boron and zinc application @ (1.25 g/L B+ 1.25 g/L Zn) that is T_5, which was recorded (39.33) leaves , followed by T_6 @ (1.25 g/L B+ 2.0 g/L Zn) (38.67) leaves. The minimum number of leaves per plant (29.00) leaves was noticed with control.

DISCUSSION

Tomato (*Lycopersicon esculentum*. Mill), is one of the highly remunerative vegetables cultivated in most parts of the World. It has attained a status of high value crop in the world in recent years and occupies a pride of place among vegetables in the world. The high market price it fetches is attributed to heavy demand from the urban consumers. There is a good demand for export too. The export market needs fruits with longer shelf life, medium sized fruits with good taste. However, the supply is inadequate due to the low productivity of the crop **(El-Dissoky R.A. and A.E.S. Abdel-Kadar, 2013)**.

Plants require to essential for the normal life processes of plants and are needed in very small amounts are called trace elements or minor elements such as boron, zinc and magnesium etc. Boron play an essential role in the development and growth of new cell in the plant meristem, improve of fruit quality and fruit set. Zinc is involved in many enzymatic activities and IAA formation to increase flower number and fruit set. Mg is primary constituent of chlorophyll and ATP require Mg.Fe is a constituent of many enzyme in the nutritional metabolasim **(Sainju *et al.*, 2003)**. which in turn might have increased the rate of growth, application of B and Zn which might have accelerated the vigorous growth , increase of yield and improve quality of tomato plant. It is also relevant to mention that tomato plants nourished with interaction between B and Zn gave maximum values in growth.

SUMMARY AND CONCLUSION

The present investigation entitled "Effect of zinc and boron on growth, yield and quality of tomato (*Lycopersicon esculentum*.Mill) cv. Heem Sohna, under protected cultivation" was carried out at the vegetable research farm at Department of Horticulture, Sam Higginbottom University of Agriculture, Technology And Sciences, Allahabad during the year 2012 - 2013 to study the effect of boron and zinc on growth of tomato.

The treatment was laid out in randomized block design (3 x 3) comprising 3 levels of boron (0,1.25 and 2.0 g/L) and 3 levels of zinc (0,1.25 and 2.0g/L) making 9 treatment combinations each replicated two times.

The results of the investigation, regarding the influence of boron, zinc and their interaction applied as foliar sprays on growth of tomato have been presented, interpreted in the light of impact of different treatments during the experimentation, and discussed in the preceding chapters.

Results of the experiment are summarized below:

1. Boron @1.25g/L(B1) recorded maximum plant height, number of leaves per plant, followed by B2 (2.0g/L boron) and the minimum was with (control).
2. Zinc @1.25 (Zn1) recorded maximum plant height, number of leaves per plant, followed by ZN2 (2.0g/L Zn) and the minimum was with (control).
3. Treatment combination B1Zn1 (1.25 g/L boron + 1.25g/L zinc) recorded maximum plant height, number of leaves per plant, followed by B1Zn2 (1.25g/L boron + 2.0g/L zinc) and the minimum was with (control).
4. 1.25 g/L boron (B1) and 1.25 g/L zinc (Zn1) were found as appropriate level of boron and zinc and their combination B1Zn1 (1.25 g/L % boron + 1.25 g/L zinc) emerged as superior over all other treatment combinations tried in this experiment, in relation to vegetative growth of tomato.

CONCLUSION

Based on the result of experiment it was aimed to identify suitable treatment for tomato cv. Heem Sohna with respect to productivity and quality during 2012 - 13. It is concluded that the treatment T_5 (1.25g/l boron + 1.25 g/l zinc) was recorded the best among all the treatment combinations on growth of tomato. The treatment T_5 (1.25g/l boron + 1.25 g/l zinc) was obtained the highest plant height (2.93) m that is T_5, followed by T_6 it was (2.90) m, No. of leaves per plant (39.33) leaves that is T_5, followed by T_6 it was (38.67), under protected cultivation.

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