Environment & Ecology 35 (3) : 1745—1748, July—September 2017
Website: environmentandecology.com ISSN 0970-0420

Effect of Foliar Application of Micronutrients on Growth and Yield Parameters in Eggplant cv HLB 12

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Received 10 September 2016 ; Accepted 5 October 2016 ; Published online 28 October 2016

Abstract The present investigation was carried out during autumn-winter season of 2014-15 The experimental treatments viz., T_1 (control-water spray), T_2 (zinc sulfate 0.3%), T_3 (zinc sulfate 0.4%), T_4 (zinc sulfate 0.5%), T_5 (iron sulfate 0.3%), T_6 (iron sulfate 0.4%), T_7 (iron sulfate 0.5%), T_8 (borax 0.3%), T_9 (borax 0.4%) and T_{10} (borax 0.5%) were laid out in a randomized block design (RBD) for field studies with three replications and plot size 3.0×3.0 m. Five competitive plants were randomly selected from each experimental treatment to record data on various parameters, which were influenced significantly by different concentrations of micronutrients. The plant height (cm) at 60, 90 and at maturity, the number of fruits per plant, fruit length and diameter (cm) and average fruit weight (g), increased significantly with increasing concentration of micronutrients (up to 0.4%). However, the character days to physiological maturity was found non-significant with the application of micronutrients. The study suggested that for getting maximum plant growth and yield of eggplant cv HLB 12, the crop should be sprayed with zinc sulfate 0.4%.

Keywords Micronutrients, Eggplant, Zinc, Iron, Borax.

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Introduction

Eggplant (*Solanum melongena* Linn) belonging to the family solanaceae is the native of India and is one of the most popular and widely grown crops of commercial and dietary significance in the world. It is popularly known as *brinjal* in India and *aubergine* in France and United Kingdom. It is an annual herbaceous plant with semi-erect or semi-spreading growth habit [1] and it is classified as an often or facultative cross-pollinated. It can be grown under a wide range of soil and temperature conditions but the most optimum temperature range for its record yield is 21 to 27°C. India ranks second to China in area and production in the world accounting 7.11 lakh hectares with annual production of 135.58 lakh tonnes and productivity of 19.1 metric tonnes per hectare [2]. In India, eggplant is grown throughout the country. The major growing states are West Bengal, Odisha, Andhra Pradesh, Gujarat, Bihar, Madhya Pradesh, Maharashtra, Chhattisgarh, Karnataka, Jharkhand and Assam.

Micronutrients play a catalytic role in nutrient absorption and balancing other nutrients. They are required in small quantity for normal growth and de-

velopment of plants. Zinc is an essential component of a number of enzymes, i.e., dehydrogenase, aldolase, isomerases, proteinase, peptidase and phosphohydrolase [3]. Boron helps in the absorption of water and carbohydrate metabolism [4], translocation of carbohydrates in plants, etc., and it also plays an important role in flowering and fruit formation. Iron helps in the synthesis of enzymes and chlorophyll. Foliar application of micronutrients viz., ferrous sulfate, zinc sulfate and borax, brings profound changes in various metabolic processes within the plant system, thereby influencing growth and yield considerably. Am ong the alternate methods of plant nutrient application, foliar spray of micronutrients is one of the possibilities for increasing productivity and reducing environmental hazards besides, it is simple and does not need much infrastructure facilities. Their foliar spray helps in efficient utilization of nutrients to plant directly through leaves within few days. Recommendations about the micronutrients sprays for high yield of eggplant under different agroclimatic conditions are available but the same may or may not be appropriate for its cultivar HLB 12 under Haryana conditions. Hence, the present investigation was carried out.

Materials and Methods

The experiment was conducted at Research Farm and Laboratory of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during autumn-winter season of 2014-15. Total ten treatments comprising one water spray (control) and three micronutrients viz., zinc sulfate, ferrous sulfate and borax were applied at different concentrations, i.e., 0.3, 0.4 and 0.5% as foliar spray. All three micronutrients were sprayed at an interval of 10 days, starting from flowering. The experiment was laid out in a randomized complete block design, and the treatments were replicated three times randomly with a plot size of 3.0 × 3.0 m size at a spacing of 60 × 60 cm. The observations on plant height at maturity (cm), number of fruits per plant, days to physiological maturity, fruits length and fruit diameter (cm), and average fruit weight (g) were recorded on randomly selected five plants in each treatment. The data collected on yield and other attributes were subjected to statistical analysis using the procedure suggested by Panse and Sukhatme [5].

Table 1. Effect of micronutrients on plant height (cm) at different growth stages of eggplant cv HLB 12.

Sl. No.	Treatments	Plant height (cm) 60 DAP	90 DAP	At maturity
1.	Control-water spray	40.39	48.69	55.14
2.	Zinc sulfate (0.3%)	43.19	54.50	60.88
3.	Zinc sulfate (0.4%)	45.48	58.04	63.44
4.	Zinc sulfate (0.5%)	46.40	58.93	64.48
5.	Ferrous sulfate (0.3%)	41.53	49.28	58.12
6.	Ferrous sulfate (0.4%)	42.86	52.10	59.35
7.	Ferrous sulfate (0.5%)	43.76	54.03	60.91
8.	Borax (0.3%)	42.83	53.12	60.07
9.	Borax (0.4%)	46.12	57.85	63.10
10.	Borax (0.5%)	45.69	57.17	62.02
CD at 5% level of significance		1.25	1.63	1.55
Coefficient of variance (CV)		6.65	6.73	6.47

The statistical analysis was carried out by using OPSTAT statistical analysis tool (www.hau.ernet.in).

Results and Discussion

Vegetative growth characteristics

The data presented in Table 1 indicate that foliar application of micronutrients (zinc, boron and iron) had a significant effect on vegetative growth parameter, i.e., height of the plant. It clearly shows that the increasing concentration of micronutrients from 0.3 to 0.5% caused an increase in height of the eggplant but the highest concentration of borax (0.5%) decreased the plant height. The maximum plant height of eggplant (46.40, 58.93 and 64.48 cm) was found in treatment T_4 (zinc sulfate 0.5%) at 60, 90 and at maturity days after planting, respectively. On the contrary, the lowest values (40.39, 48.69 and 55.14 cm, respectively) for plant height were recorded with control plants, which received only the simple water as foliar spray.

Besides, no significant difference was realized between the highest and the medium rate of zinc sulfate with respect to height of the plant. The increase

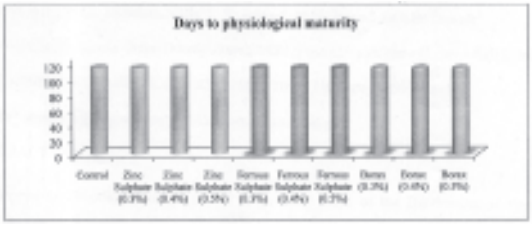

Fig. 1. Effect of micronutrients on days to physiological maturity of eggplant cv HLB 12.

in plant height under zinc sulfate might be due to the fact that zinc in addition to its role in chlorophyll synthesis it also influenced the cell division, meristamatic activity of tissue, expansion of cell and formation of cell wall [6, 7]. Foliar application of zinc increased the photosynthetic activity, which ultimately resulted in improving the plant growth.

Fruit and yield characteristics

The data presented in Table 2 suggest that the maximum fruits per plant (26.13 cm) was found in treatment T_4 (zinc sulfate 0.5%) as compared to other treatments. Increased number of fruits due to foliar spray of micronutrients might be attributed to enhanced photosynthetic activity, resulting in increased production and accumulation of carbohydrates and favorable effect on vegetative growth and retention of flowers and fruits, which might have increased number and weight of fruits. Increased number of fruits in response to micronutrients (B, Zn and mixture) has been reported by Basavarajeshwari et al. [6] and Davis et al. [8] in different vegetable crops.

The perusal of data presented in Table 2 reveals that the fruit attributes, such as fruit length, fruit diameter and average fruit weight were recorded significantly superior to T_9 micronutrients level, where plants received borax 0.4%. The probable cause for it might be that the supply of borax led to absorption of water, synthesis and translocation of more metabolites, which resulted in increased fruit length, fruit diameter and ultimately average fruit weight [4]. Boron is associated with the development of cell wall and cell differentiation, and hence, it helps in root elongation and shoot growth of plant. These results confirm the findings of Kiran et al. [9] and Yadav et al. [10] who also reported increased fruit size with increasing rates of micronutrients.

The longest fruits (24.04 cm) were harvested from treatment borax 0.5%, while the smallest fruits (15.70 cm) were obtained from treatment T_1, where simple water was sprayed on foliage. The perusal of data presented in Table 2 indicates that similar to fruit length, the diameter of fruits also increased significantly with increasing concentration of micronutri-

Table 2. Effect of micronutrients on number of fruits per plant, fruit length (cm), fruit diameter and average fruit weight (g) of eggplant cv HLB 12.

Sl. No.	Treatments	No. of fruits per plant	Fruits length (cm)	Fruit diameter (cm)	Average fruit weight (g)
1.	Control- Water spray	18.80	15.70	3.94	56.06
2.	Zinc sulfate (0.3%)	22.70	19.41	4.50	65.61
3.	Zinc sulfate (0.4%)	25.56	20.71	4.65	70.57
4.	Zinc sulfate (0.5%)	26.13	21.12	4.73	71.72
5.	Ferrous sulfate (0.3%)	20.54	17.18	4.17	61.79
6.	Ferrous sulfate (0.4%)	22.59	18.76	4.35	63.57
7.	Ferrous sulfate (0.5%	23.23	19.14	4.45	64.51
8.	Borax (0.3%)	22.27	20.12	4.49	69.52
9.	Borax (0.4%)	25.46	23.17	4.89	73.60
10.	Borax (0.5%)	25.42	24.04	5.10	75.77
	CD at 5% level of significance	2.14	1.50	0.39	3.12
	Coefficient of variance (CV)	5.36	4.35	4.91	4.68

ents. The maximum fruit diameter (5.10 cm) was measured with borax 0.5%, while the fruits with minimum diameter (3.94 cm) were harvested from treatment T_1 (simple water spray). The heaviest fruits (75.77 g) and the minimum fruit weight (56.06 g) were registered with borax 0.5% and treatment T_1 (simple water spray), respectively (Table 2). The results of this study are in good accordance with the findings of Suganiya et al. [11], Rab and Haq [12] and Karuppaiah [13]. All of them reported that the increasing concentration of micronutrients led to significant increase in fruit size as well as weight of the fruits of different solanaceous fruit vegetables.

The different concentrations of micronutrients had no significant effect on days to physiological maturity since increasing levels of micronutrients decreased the days to physiological maturity of the fruits in same fashion in all the treatments (Fig. 1), yet the minimum days to physiological maturity (114.99) was recorded with treatment T_4 (zinc sulfate 0.5%) and maximum days to physiological maturity (115.74) with treatment T_1, where only water was sprayed on foliage. The findings corroborate the results of Hamsaveni et al. [14].

Conclusion

On the basis of results of present investigation it is concluded that foliar application of micronutrients enhanced most of the growth and yield attributes of eggplant cv HLB 12. The crop should be sprayed thrice with zinc sulfate 0.4% at 10 days interval starting from flowering.

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