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Influence of Foliar Application of Zinc and Boron on Physico-chemical Attributes of Pomegranate cv. Ganesh

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ABSTRACT: Effect of foliar spray of zinc and boron on physical and bio-chemical characteristics of pomegranate (*Punica granatum* L.) cv. 'Ganesh' was carried out at Fruit Research Station Imaliya, Department of Horticulture, JNKVV, Jabalpur, India during Hast bahar of 2017-18. The experiment was laid in randomized block design with three replications. The treatment consisted of two foliar applications of Zinc sulphate and Boric acid with their different combinations. The findings revealed that foliar spray of T_{11} (B + Zn @ 0.4% each) was found to be the best as compared to control treatment. Among the treatment the foliar application of B + Zn @ 0.4% each was effective in enhancing physical parameters of fruit viz. Fruit length (7.0 cm), (8.1 cm), (8.7 cm), fruit diameter (6.0 cm), (7.6 cm), (8.3 cm) at 60,90 and 120 days. juice content (55.60%), Bio- chemical parameters viz. Total soluble solids TSS 15.33 ^{0}Brix), reducing sugar (11.35%), non- reducing (1.70%), total sugar (13.2%).

Keywords: Pomegranate, Micro nutrient, Physical and Bio-chemical parameter.

INTRODUCTION

One of the most popular table fruits growing in tropical and sub-tropical areas is the pomegranate (*Punica granatum* L.), a member of the Punicaceae family. Although originated from Iran, this plant has long been widely grown across the Mediterranean area (Sheikh and Manjula 2009). The plant grows well when it receives moisture and is resistant to cold. The major application for pomegranate fruits is on tables. Additionally, pomegranate juice is utilized to create the popular post-harvest product "Anar-rub." A variety of products may be produced and sold in both local and foreign markets, including candies, tuti-fruity, squash, powder, and ready-to-serve beverages. Many ailments, including prosy, high cholesterol, and heart problems, are reportedly treated with its juice. Because of their resilience and capacity to endure unfavorable soil and weather conditions, pomegranates are becoming one of the most meaningful fruit crops. Many countries grow it, including China, Iran, India, Malaya, the East Indies, the drier regions of Southeast Asia, the United States, and portions of Latin America and Arizona. Indian pomegranates are grown commercially in Maharashtra, Andhra Pradesh, Rajasthan, Gujarat, Karnataka, Tamil Nadu, and Uttar Pradesh, and the country produces the most pomegranates worldwide. India has 288 thousand hectares of total land planted for pomegranate farming, producing 3271 thousand MT annually. MP accounts for 6.74 thousand hectares of this total area (NHB, 2021). Fruit's edible sections are a good source of proteins, sugars, minerals, vitamins, carbs, and polysaccharides. Hasani *et al*. (2012) state that ascorbic acid, acidity, total soluble solids, reducing and non-reducing sugars, total sugar content, and other factors are crucial in evaluating the quality of fruit juice from pomegranates. Furthermore, the fruit is prized for its medicinal qualities. Secondary metabolites, including tannins, dyes, and alkaloids, can be found in abundance in fruit peels, tree stems, root bark, and leaves (Mirdehghan and Rahemi 2006).

For any fruit crop to be produced, nutrition is essential. Similar to this, pomegranate production is enhanced by both macro- and micronutrients. Nutrients to the plant can be made available by the basal as well as by the foliar applications. Foliar spray of nutrients has several advantageous in terms of low application rate and high efficiency, uniform distribution of fertilizer material and quick response to applied nutrients. The physiochemical properties, fruit output, and quality of pomegranates are enhanced by the foliar administration of certain micronutrients at the appropriate time. Additionally, it enhances the physiochemical properties and quality of pomegranates while assisting in the correction of nutritional deficiencies. Micronutrients that are essential for plant growth and development include zinc, boron, and ferrous iron. A balanced diet is essential for better fruit harvest and quality. Micronutrients are crucial for a balanced diet and are necessary for the growth of plants. Among them are those essential for improving the growth, yield, and quality of many crops. Micronutrient deficiencies have been effectively filled by foliar application of these nutrients during crop growth, which also improves the mineral status of plants and boosts crop production and quality (Kolota and Osinska 2001). One of the most important elements for plants is zinc (Zn), and deficiencies in Zn are prevalent in many crops. A variety of enzymes, such as RNA and DNA polymerases, aldolases, isomerases, transphosphorylases, dehydrogenases, and cell division, depend on zinc for their activity. Zinc also plays a regulatory role in protein synthesis and is necessary for the synthesis of tryptophan, the maintenance of membrane structure, and photosynthesis. According to Barker & Pilbeam (2006), a typical micronutrient issue in agriculture is a deficit in boron (B), which lowers crop quality and yields. In addition to its direct impact on fruit set and yield, germination of pollen grains, pollen tube elongation, and plant hormone production, boron also has an indirect function in the activation of dehydrogenase enzymes, sugar translocation, nucleic acids, and plant hormones.

MATERIALS AND METHODS

A field experiment was conducted at Fruit Research Station Imaliya, Department of Horticulture, JNKVV, Jabalpur, India during hast bahar of 2017-18. The experiment was laid out in randomized block design with three replications. The treatment consisted of two foliar applications of Zinc sulphate and Boric acid with their combinations viz., T1 (control), T2 (B+Zn @ 0+0.2%), T3 (B+Zn @ 0+0.4%), T4 (B+Zn @ 0+0.6%), T5 (B+Zn @ 0.2+0%), T6 (B+Zn @ 0.2% each), T7 (B+Zn @ 0.2+0.4%), T8 (B+Zn @ 0.2+0.6%), T9 (B+Zn @ 0.4+0%), T10 (B+Zn @ 0.4+0.2%), T11 (B+Zn @ 0.4% each), T12 (B+Zn @ 0.4+0.6%), T13 (B+Zn @ 0.6+0%), T14 (B+Zn @ 0.6+0.2%), T15 (B+Zn @ 0.6+0.4%) and T16 (B+Zn @ 0.6% each). The nutrition sprays were sprayed on September 10, 2017, and February 25, 2018. Fruit length, fruit diameter, juice percentage, acidity, TSS, total sugar, reducing sugar, and non-reducing sugar are among the many qualitative characteristics of fruits. Using the crucial difference (CD) test and analysis of variance (ANOVA) at the 5% probability level, the significance of the variation among the treatments was determined.

RESULT AND DISCUSSION

A. Fruit size (Length and diameter)

The foliar application of Boron and Zinc showed significant effect on length and diameter of fruit at 60, 90 & 120 days after fruit set. The data presented in table 1. The maximum fruit length (7.0, 8.1, and 8.7 cm) and diameter (6.0, 7.6, and 8.4 cm) were recorded respectively under foliar application of B (0.4%) + Zn (0.4%). Whereas, the minimum length of fruits (6.3, 7.3 and 7.7 cm) and diameter (4.5, 6.1 and 7.3 cm) were recorded control (B_0 + Zn_0 (0%). This might be the result of a sufficient and well-balanced intake of nutrients and a decrease in nutrient losses, which are essential for the growth and development of fruits. The current investigation's findings are consistent with those of Meena *et al*. (2005); Parmar *et al*. (2014); Monga *et al*. (2004). Fruit weight ultimately increases with increased fruit length and girth. These results are consistent with those of Meena *et al.* (2005) and might be the result of controlling the semi-permeability of the cell wall, which would mobilize more water into the fruits and increase their size. Who observed that fruit enlargement results from photosynthesis being drawn to the fruit as a result of the sink's intensification; this process aids in cell proliferation and elongation (Singh and Rajput 1977).

Juice (%). The foliar spray of zinc and B had a noteworthy impact on the pomegranate fruit's juice content. Table 1 displays the data. The data revealed that the maximum content of juice 55.60 % was recorded under foliar application of B(0.4%)+ Zn(0.4%) which showed superiority over the rest of the treatments. Whereas, the minimum percentage of juice content 50.97 % was recorded under control. The results of the current study are consistent with those of Permar *et al*. (2014); Meena *et al*. (2005); Monga *et al*. (2004). Rama and Bose (2000) also noted a higher juice content, which was confirmed by the micronutrient spray.

Table 1: Effect of foliar application of Zn and B on fruit size and juice of pomegranate.

Treatment	Fruit length(cm) at days			Fruit diameter (cm) at days			Juice %
	60	90	120	60	90	120	
B0+ Zn_0(0%)	6.3	7.3	7.7	4.5	6.1	6.1	50.79
B0+ Zn_1(0% +0.2%)	6.4	7.4	7.8	4.8	6.3	6.3	51.88
B0+ Zn_2(0% +0.4%)	6.6	7.6	8.1	5.0	6.7	6.7	52.83
B0+ Zn_3(0% + 0.6%)	6.5	7.5	8.0	4.7	6.2	6.2	50.92
B1+ Zn_0(0.2% + 0%)	6.7	7.6	8.1	4.8	6.4	6.4	51.74
B1+ Zn_1(0.2% + 0.2%)	6.8	7.8	8.3	5.2	6.8	6.8	52.89
B1+ Zn_2(0.2% + 0.4%)	6.6	7.5	8.1	5.0	7.0	7.0	53.50
B1+ Zn_3(0.2% + 0.6%)	6.5	7.5	8.0	5.0	6.7	6.7	52.47
B2+ Zn_0(0.4% + 0%)	6.6	7.7	8.2	5.3	7.0	7.0	53.70
B2+ Zn_1(0.4% + 0.2%)	6.8	7.8	8.3	5.4	7.2	7.2	54.76
B2+ Zn_2(0.4% + 0.4%)	7.0	8.1	8.7	6.0	7.6	8.3	55.60
B2+ Zn_3(0.4% + 0.6%)	6.8	7.7	8.2	5.6	7.3	7.3	54.13
B3+ Zn_0(0.6% + 0%)	6.5	7.5	8.3	5.3	7.0	7.0	51.77
B3+ Zn_1(0.6% + 0.2%)	6.6	6.7	8.4	5.5	7.2	7.2	53.05
B3+ Zn_2(0.6% +0.4%)	6.4	7.8	8.6	5.7	7.4	7.4	53.73
B3+ Zn_3(0.6% + 0.6%)	6.6	7.6	8.4	5.4	6.9	6.9	51.97
SEm±0	**0.033**	**0.030**	**0.031**	**0.050**	**0.056**	**0.056**	**0.317**
CD at 5%	**0.097**	**0.086**	**0.090**	**0.145**	**0.164**	**0.164**	**0.921**

TSS (ºBrix). The pomegranate fruit's TSS concentration was significantly impacted by the foliar application of zinc and B the information shown in Table 1. By applying B2 (0.4%) + Zn2 (0.4%) topically, the findings showed that the greatest concentration of TSS 15.33 (°Brix) was observed, outperforming the other treatments. On the other hand, TSS 11.83 (^{0}Brix) minimum content was noted within specified bounds. According to Eman *et al*. (2007), the maximum TSS resulting from the application of combined nutrients may be caused by increased photosynthesis activity, the translocation of sugars from the source to the sink, and the conversion of complex sugars (polysaccharides) to simple sugars (glucose and fructose) in fruits as a result of zinc-dependent enzyme activity. For fruit development, blooming, and quality, zinc is also a crucial nutritional component. The plant hormone indole acetic acid is biosynthesised with its help. Important for the creation of proteins and nucleic acids, zinc also aids in the use of phosphorous and nitrogen in Rana and Rawat (2016).

Sugar (Total, reducing and non reducing). The pomegranate fruit's total sugar, reducing sugar, and non-reducing sugar content were all significantly impacted by the foliar application of zinc and b. Table 2 displays the data. With foliar application of B(0.4%)+ Zn(0.4%), the greatest total sugar, reducing sugar, and non-reducing sugar content of 13.03, 11.70, and 1.70 percent were observed, indicating superiority over the remaining treatments. In contrast, with foliar application of B(0%)+ Zn(0%), the minimal total sugar, reducing sugar, and non-reducing sugar concentrations of 9.75, 8.65, and 1.10 percent were reported. El-Khawga (2007) observed that the foliar application of $ZnSO_4$ in pomegranates considerably affects the quality metrics, reporting maximum total sugars, maximum reducing sugars, and highest total soluble solids. The fruit's improved quality may be attributed to the catalytic activity of micronutrients, especially when present in greater concentrations. As a result, the foliar spray of micronutrients enhances fruit quality and rapidly increases the absorption of macronutrients in all tissues and organs Alila and Achumi (2012). Dewangan (2014) observed that applying $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% + boric acid @ 0.3% in pomegranates resulted in the highest TSS, reducing sugars, total sugars, and non-reducing sugars.

Table 2: Effect of foliar application of Zinc and Boron on biochemical attributes of pomegranate.

Treatment	TSS (ºBrix)	Reducing sugar (%)	Non-reducing sugar (%)	Total sugar (%)
B0+ Zn_0(0%)	11.83	8.65	1.10	9.75
B0+ Zn_1(0% +0.2%)	12.63	9.04	1.37	10.41
B0+ Zn_2(0% +0.4%)	13.47	9.59	1.37	11.15
B0+ Zn_3(0% + 0.6%)	12.73	9.46	1.23	10.70
B1+ Zn_0(0.2% + 0%)	12.20	9.74	1.30	11.03
B1+ Zn_1(0.2% + 0.2%)	12.67	10.35	1.43	11.79
B1+ Zn_2(0.2% + 0.4%)	14.43	10.60	1.60	12.19
B1+ Zn_3(0.2% + 0.6%)	14.00	10.38	1.33	11.71
B2+ Zn_0(0.4% + 0%)	13.70	10.76	1.47	12.26
B2+ Zn_1(0.4% + 0.2%)	14.43	11.10	1.53	12.64
B_2+ Zn_2(0.4% + 0.4%)	15.33	11.35	1.70	13.02
B2+ Zn_3(0.4% + 0.6%)	13.73	10.62	1.43	12.05
B3+ Zn_0(0.6% + 0%)	13.67	9.54	1.27	11.14
B3+ Zn_1(0.6% + 0.2%)	13.27	10.45	1.37	11.81
B3+ Zn_2(0.6% +0.4%)	14.26	10.90	1.33	12.22
B3+ Zn_3(0.6% + 0.6%)	13.03	10.03	1.17	11.23
SEm±0	**0.290**	**0.201**	**0.042**	**0.210**
CD at 5%	**0.842**	**0.583**	**0.122**	**0.610**

CONCLUSIONS

Based on the findings of the current study, it was determined that, when compared to the control treatment, the foliar spray of B_2(0.4%) + Zn_2(0.4%) was the most effective. Among the treatments, the foliar spray of B_2(0.4%) + Zn_2(0.4%) was successful in improving the biochemical parameter, TSS, acidity, total sugar, reducing sugar, fruit length (cm), fruit diameter (cm), non-reduction (%), and juice (%) of hast bahar in pomegranates.

FUTURE SCOPE

1. To confirm the results, the current inquiry should be conducted again.
2. Additional pomegranate cultivars ought to be included in the experiment as well.
3. Given that the study was only in its first year, it is advised that the experiment be repeated over a longer period of time and in a different area in order to verify the validity of the results.
4. Additional plant growth regulators (auxin), GA_3, NAA, and macronutrients should be used in the experiment.

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Conflict of Interest. None.

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