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Effects of Various Micronutrient Levels on the Biochemical and Organoleptic Attributes of Guava cv. 27

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment entitled "Effects of various micronutrient levels on the biochemical and organoleptic attributes of guava cv. 27" was carried out at Agrotechnology Park, Krishi Vigyan Kendra, College of Agriculture, Gwalior (M.P.) during 2016-2017**.** The experiment was consisting of 9 treatments having two levels of each Borax (0.2 per cent and 0.4 per cent) and Zinc sulphate (0, 0.4 and 0.6 per cent). The experiment was laid out in Factorial randomized block design with three replications. Among different doses of foliar spray of nutrients, borax @ 0.4 per cent and zinc sulphate @ 0.6 per cent were found significantly superior over control with respect bio chemical parameters and organoleptic attributes of guava.

Keywords: Borax; zinc sulphate; guava; organoleptic characters; biochemical attributes.

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1. INTRODUCTION

The guava, also known as the "Apple of the Tropics" (*Psidium guajava* L.), is a significant fruit crop in the nation, not because of its size or volume of production but rather because of its wider edapho-climatic adaptability, resistance to a wide range of biotic and abiotic stresses, precocious and prolific bearing behaviour, high-quality fruit with medicinal properties, use as both a fresh fruit and after processing in various value-a Most of the world's warmer tropical nations are where it is cultivated. In the 17th century, the Portuguese introduced it to India. Only *Psidium guajava* L. has been used commercially out of the 150 species that make up the Psidium genus, which includes the guava [1]. It is well-liked in India because of its mouthwatering flavour, pleasant flavour, great palatability, and digestive value. It is crucial for the human diet as a source of ascorbic acid since its concentration is three to five times higher than that of fresh orange juice. Along with minerals like iron, calcium, and phosphorus, it is a particularly rich source of vitamins C and A. Pectin, sugars, and carbs are also present in large amounts. The fruit is frequently referred to as "Poor man's apple" because of its superior flavour, great nutritional content, and widespread availability at a fair price. Guava is a fruit that is often produced as jelly, jam, pulp, concentrate, juice, cheese, toffee, dried guava, and canned guava. The quality of the products is enhanced by the prudent provision of micronutrients [2], which also boosts production. Foliar applications are an efficient way to maintain nutrient levels since they make it simple to supply nutrients as and when they are necessary. It is a powerful technique for addressing vitamin deficits. As a result, it has recently been a common practice in high-value fruit crops including grape, mango, banana, citrus, and pomegranate, among others. The guava plant is said to be able to quickly absorb mineral nutrients sprayed on the leaf [3]. It just takes one or two weeks for the spraying approach with the proper concentration to create noticeable results. Foliar application studies were out in India revealed that guava responded well to the foliar administration of several micronutrients. The use of various mixed and single micronutrients through foliar application, such as zinc sulphate, borax, and urea, was found to be beneficial, and the recommendations made by various workers for various micronutrients appear to have a significant impact on fruit quality through their effects on size, appearance, colour, soluble solids, sugar, acidity, pectin, and vitamin contents [4,5]. Different micronutrients were applied topically to the leaves of guavas, which improved their growth, yield, and quality metrics. For plants, zinc (Zn) is a crucial microelement. It participates in a variety of enzymatic processes. Zinc is essential for the growth and development of plants. Additionally, it controls how proteins and carbohydrates are metabolized [6]. In soils with a high pH, it is less readily available to plants. It is well recognized that zinc plays a significant role in many different enzymes, either as a metal component of enzymes or as a functional, structural, or regulatory factor. A substantial non-metal micronutrient is boron. It is taken up by plants as boric acid (H3BO3). Boron is required for the movement of sugar, plant reproduction, and pollen grain germination. Its function in hormone transport and active salt absorption has been observed. It is crucial for fruit quality as well. Boron has an impact on the composition of cell walls, as well as a significant impact on cell elongation (pollen tube), and root growth [7,8].

2. METHODS AND MATERIALS

The present investigation entitled "Effects of various micronutrient levels on the biochemical and organoleptic attributes of guava cv. 27" was conducted during the 2016-2017**.** The present experiment was conducted at Agrotechnology Park, Krishi Vigyan Kendra, College of Agriculture, Gwalior (M.P.). 7 years old guava cv. "Gwalior 27" planted at 6 X 6 m apart under square system of planting. In order to assess the effects of various treatments, all the plants were subjected to uniform cultural practices during the period of experimentation. The experiment was laid out in Randomized Block Design with three replications with a unit of one plant in each replication of a treatment. The treatments consisted of two different chemicals namely Borax and Zinc sulphate with two concentrations of Borax and Zinc sulphate. The plain distilled water was sprayed on the plants under control. The stock solution of different concentrations of zinc sulphate (neutralized with hydrated lime) and borax were prepared by dissolving the required amount of zinc sulphate and boric acid in required amount of water. The fruits were harvested when the skin of fruit turns light yellow. Randomly selected branch in all direction of tree from each treatment were tagged for various observations. The sensory evaluation was carried out for each sample to estimate the organoleptic quality of ripened fruit as per the method suggested by Ranganna [9]. The organoleptic quality in terms of colour, flavour, taste, texture and overall acceptability was done by a panel of judges comprising of scientific workers. All the judges were conversant with the factors governing the quality of the samples using 10 point scale as described. The various growth, yield and sensory quality parameters were subjected to statistical analysis as given by Panse and Sukhatme [10].

Table 1. List of treatments used for the study

Treatments	Details of the treatment
T_1 (B_0Z_0)	Control (Water spray)
T_2 (B_1)	Borax (0.2%)
T_3 (B_2)	Borax (0.4%)
T_4 (Z_1)	$ZnSO_4$ (0.4%)
T_5 (Z_2)	$ZnSO_4$ (0.6%)
T_6 (B_1Z_1)	Borax (0.2%) + $ZnSO_4$ (0.4%)
T_7 (B_1Z_2)	Borax (0.2%) + $ZnSO_4$ (0.6%))
T_8 (B_2Z_1)	Borax (0.4%) + $ZnSO_4$ (0.4%)
T_9 (B_2Z_2)	Borax (0.4%) + $ZnSo_4$ (0.6%))

3. RESULTS AND DISCUSSION

The data on bio chemical and organoleptic of guava as influenced by application of different nutrients are presented in Table 2. the bio-chemical parameters of guava increased significantly by the application of borax and zinc sulphate on guava under experimentation over control. The maximum TSS (13.4) and (11.89) were recorded under B_2 (Borax @ 0.4%) and Z_2 ($ZnSo_4$@ 0.6%) respectively, while the minimum TSS was recorded under control. The minimum acidity (0.22 %) and (0.24) of guava fruits were recorded under B_2 (Borax @ 0.4%) and Z_2 ($ZnSo_4$@ 0.6%) respectively, while the maximum acidity were recorded under control.

The increase in total soluble solids in calcium and boron treated plants may be due to calcium and boron's role in trans-membrane sugar transfer [11]. Additionally, meristematic cells require more boron than mature tissues do [12]. It is fundamentally necessary for the growth of buds, new leaves, and other actively developing parts of plants. Inadequate boron availability has been linked to a number of impairments, including sugar transport, cell wall synthesis, lignification, cell wall structure, carbohydrate metabolism, RNA metabolism, respiration, indole acetic acid (IAA) metabolism, phenol metabolism, and membrane integrity [13]. Therefore, the presence of boron in these processes may account for the increase in fruit quality features in treated plants. The concentration of acidity in guava fruit was also impacted throughout fruit development and harvesting by changes in sugars and other compounds as a result of rising nutrient levels in plant parts, which may be advantageous for enhancing fruit quality by lowering the acidity percentage. The application of calcium and boron to guava throughout the fruit development stage increases fruit size and quality, according to research by Awasthi and Lal [14] and Singh et al. [15].

It's possible that acid was degraded while the fruit was maturing. Additionally, it seems that these fruits' total soluble solids rose at the price of their acidity. Acid may have been quickly transformed into sugars and their derivatives under the effect of borax and calcium chloride through a process involving the reversal of the glycolytic pathway, or it may have been utilised in respiration, or both. Application of nutrients results in a decrease in acidity and a concomitant rise in the sugar content of guava fruits. has been reported earlier by Ali et al. [16], Pal et al. [17] and Awasthi and Lal [14] also.

The data pertaining to various organoleptic parameters of the guava plant viz. taste, aroma, over all acceptability, colour and appearance, significantly and non significantly increased by the various sprays of Borax and zinc sulphate. The taste was found to be significantly influenced due to the foliar spray of Borax and zinc sulphate. The maximum taste score (7.20) and (7.03) were recorded under treatment B_2 (Borax @ 0.4%) and Z_2 ($ZnSo_4$@ 0.6%) respectively, followed by B_1(Borax @ 0.2%) and Z_1 ($ZnSo_4$@ 0.4%) respectively whereas, minimum taste score (6.66) under control (B_0 and Z_0). The colour and appearance was found to be non significantly influenced due to the foliar spray of Borax and zinc sulphate. The mean maximum colour and appearance score (6.33) and (6.23) was recorded under treatment B_2 (Borax @ 0.4%) and Z_2 ($ZnSo_4$@ 0.6%) respectively followed by B_1 (Borax @ 0.2%) and Z_1 ($ZnSo_4$@ 0.4%) whereas, minimum colour and appearance score (6.07, 6.17) under control (B_0, Z_0) respectively. The aroma was found to be significantly influenced due to the foliar spray of Borax and zinc sulphate. The mean maximum aroma score (6.40) and (6.28) was recorded under treatment B_2 (Borax @ 0.4%) and treatment Z_2 respectively followed by B_1(Borax @ 0.2%) and Z_1 ($ZnSo_4$@ 0.4%) whereas, minimum aroma score (6.04, 6.14) under control (B_0, Z_0) respectively. The over all acceptibility was found to be significantly influenced due to the foliar spray of Borax and zinc sulphate. The maximum over all acceptibility score (6.53) and (6.44) were recorded under treatment B_2 (Borax @ 0.4%) and Z_2 ($ZnSo_4$@ 0.6%) respectively followed by B_1(Borax @ 0.2%) and Z_1 ($ZnSo_4$@ 0.4%) whereas, minimum over all acceptability score (6.22, 6.30) under control (B_0, Z_0) respectively.

Along with the rise in enzymatic activity, the relationship between zinc and auxin production in plants was critical. Additionally, it serves as a catalyst for oxidation-reduction procedures in plants. The climacteric characteristic that guava has causes large fluctuations in breathing. This triggers metabolic processes that include the conversion of complicated dietary components like starch into less complex ones like sugars. The formation of flavo-proteins is linked to Fe. In addition, Zn aids in other enzymatic processes such as carbohydrate transformation, hexokinase activity, cellulose synthesis, and sugar change due to its effect on zymohexose [18].

Table 2. Effect of foliar spray of Borax and zinc sulphate on TSS (^{0}Brix), acidity (%), Taste, Aroma, over all acceptability, colour and appearance in guava cv. Gwalior-27

Treatments	TSS (^{0}Brix)	acidity (%)	Taste	Colour and appearance	Aroma	Over all acceptability
Borax (H_3BO_3)						
B_0	8.54	0.30	6.66	6.07	6.04	6.22
B_1	11.63	0.28	7.09	6.21	6.20	6.42
B_2	**13.4**	**0.22**	**7.20**	**6.33**	**6.40**	**6.53**
S.Em.±	0.038	0.006	0.032	0.012	0.018	0.056
CD at 5% level	0.113	0.018	0.095	NS	0.054	0.169
Zinc sulphate ($ZnSO_4$)						
Z_0	10.44	0.31	6.91	6.17	6.14	6.30
Z_1	11.30	0.25	7.00	6.21	6.22	6.43
Z_2	**11.89**	**0.24**	**7.03**	**6.23**	**6.28**	**6.44**
S.Em.±	0.038	0.006	0.032	0.012	0.018	6.13
CD at 5% level	0.113	0.018	0.095	NS	0.054	6.23

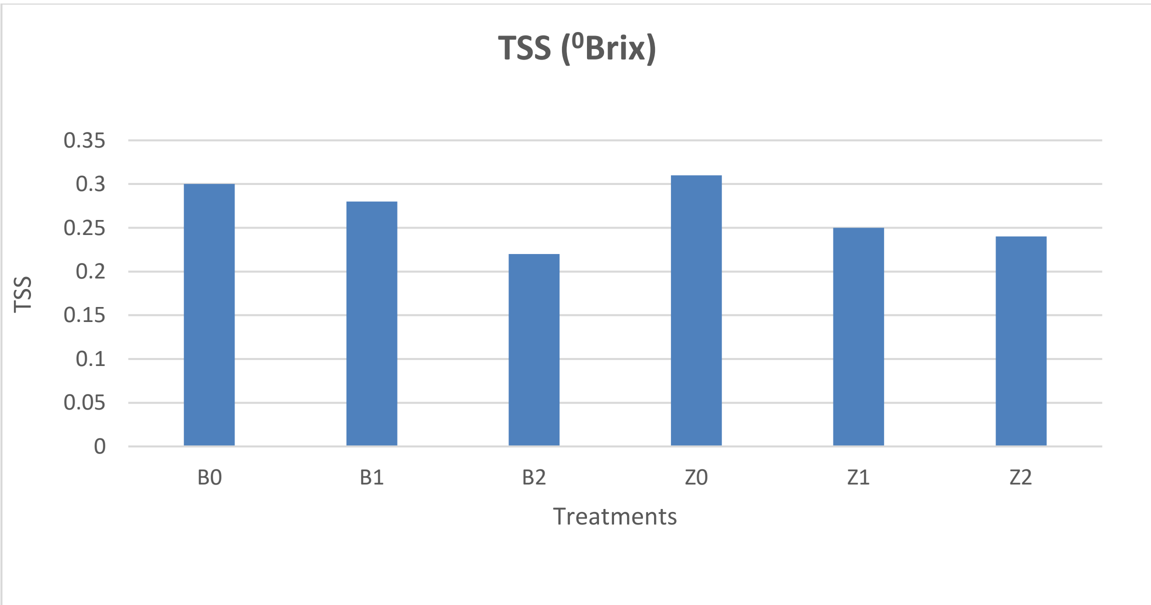

Fig. 1. Variation in TSS among various treatments

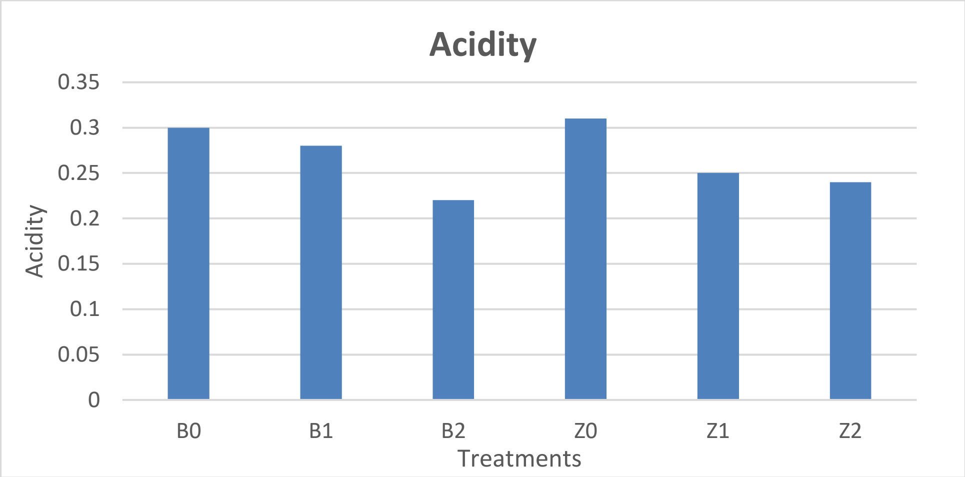

Fig. 2. Variation in acidity among various treatments

4. CONCLUSION

On the basis of results obtained in present investigation, it is concluded that foliar spray of Borax and Zinc sulphate had significantly and non-significantly improved the bio- chemical analysis of fruits and organoleptic parameters of the guava plant viz. taste, over all acceptibility, aroma, colour and appearance. Individual spray of Borax i.e. B_2 (Borax @ 0.4%) and Zinc sulphate i.e. Z_2 (Zinc sulphate @ 0.6%) were found to be the best treatments for almost all the biochemical and organoleptic characters of guava.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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