



Research Article

Effect of Foliar Application of Micronutrients on Growth, Yield and Fruit Quality of Guava (*Psidium guajava* L.) cv. Shweta

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Abstract	Manuscript Information
<p>The present investigations on “Effect of foliar application of micronutrients on growth, yield and fruit quality of Guava (<i>Psidium guajava</i> L.) cv. Shweta” were conducted at the experimental farm of Mata Gujri College, Fatehgarh Sahib, Punjab, during 2021-2023. Experiments were laid out in “Randomised Block Design (RBD) with eight treatments viz. T₁ -ZnSO₄@0.1%, T₂ -FeSO₄@0.2%, T₃ -Borax@0.3%, T₄ - ZnSO₄@0.1% + FeSO₄@0.2%, T₅ -ZnSO₄@0.1%+ Borax@0.3%, T₆ -FeSO₄@0.2%+Borax@0.3%, T₇-ZnSO₄@0.1%+FeSO₄@0.2%+ Borax@0.3%, T₈-Control. The maximum growth parameters viz., plant height(cm), stem girth(cm), tree spread E-W(m), tree spread N-S (m) were reported with the application of T₇ (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%) which was at par with the application of T₆ (FeSO₄ @0.2% + Borax @0.3%) and T₅ (ZnSO₄ @0.1% + Borax@ 0.3%) and it was significantly superior over the other treatments at all stages of observation. The maximum yield kg/plant no. of fruits/plant was recorded in T₇ (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%) which was at par with the application of T₆ (FeSO₄ @0.2% + Borax @0.3%) and T₅ (ZnSO₄ @0.1% + Borax@ 0.3%) and it was significantly superior over the other treatments at all stages of observation. The maximum chemical parameters viz., TSS(°Brix), ascorbic acid(mg/100g) and all sugars (%) were recorded with the application of T₇ (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%) which was at par with the application of T₆ (FeSO₄ @0.2% + Borax @0.3%) and T₅ (ZnSO₄ @0.1% + Borax@ 0.3%) and it was significantly superior over the other treatments at all stages of observation.</p>	<ul style="list-style-type: none"> ▪ ISSN No: 2583-7397 ▪ Received: 09-11-2023 ▪ Accepted: 26-12-2023 ▪ Published: 30-12-2023 ▪ IJCRM:2(6); 2023:201-205 ▪ ©2023, All rights reserved ▪ Plagiarism Checked: Yes ▪ Peer Review Process: Yes <p>How to Cite this Manuscript</p> <p>Kaur R. Effect of Foliar Application of Micronutrients on Growth, Yield and Fruit Quality of Guava (<i>Psidium guajava</i> L.) cv. Shweta. International Journal of Contemporary Research in Multidisciplinary. 2023; 2(6):201-205.</p>

Keywords: Zinc Sulphate, Ferrous Sulphate, Borax, Micronutrients.

1. INTRODUCTION

Guava (*Psidium guajava* L.) is one of the popular delicious fruits grown in tropical, subtropical regions of India, and belongs to family Myrtaceae. It is considered as fourth most important fruit crop grown all over India after mango, banana and citrus. In terms of area, it is fifth after mango, banana, citrus and apple; with respect to production, it is positioned fifth too following banana, mango, citrus and papaya. It has been grown in India since the beginning of the 17th century, with the materialization of its wider adaptability traits suitable to various soils and agroclimatic conditions; low cost of cultivation, its prolific bearing and high remunerative prices, sweet in taste, high nutrition values have made guava very popular among the fruit growers. The fruit is native to tropical America but is grown numarously in South Asian countries. India is best suitable for its cultivation, and it grows well everywhere in the country, but the leading guava-growing states of India are probably Uttar Pradesh, Bihar, Neemuch, Ratlam, Jhabua, and Mandasaur. The major guava-producing districts in Punjab include Sangrur, Patiala, Amritsar, Gurdaspur, Shaheed Bhagar Singh Nagar, Ferozepur, Ludhiana, Bathinda, Happy Punjat, Hoshiarpur, and Jalandhar.

The guava fruit contains 80-82% of water, 0.71% of protein, 0.5% of fat, 11-13% of carbohydrates, and 1.2% of acids. It ranks third among fruits in exported vitamin C after acerola and amla. Guava's dietary fibers contain lots of vitamin C, and it carries a moderate amount of folic acid in contrast to carbohydrates, sugars, and pectin. Because of its fine taste and aroma, good nutritional value, it comes in plenty and cheap fruit may be addressed "poor man's apple" (Suman et al., 2016).

There is autobiography founded on the principle that the elements are lone invaders by the leaves may be taken across in the tissue, argument issued at the earliest is the correction of elemental deficiencies. The mechanism, through the diagnosis and rectification of mal-adapted nutrition, its short-lived oppression, has attained roles far higher measured effects than supplementary nutrition for uptake. Thereby aiding the fruit's end and production at high quality, while they go as far as helping the aforesaid tree for malnutrition and other fruit-related physiological ailments (N. K. Shukla, 2011).

Application of zinc and nano nutrients is necessary at the commencement of vegetative stage and prior to opening into flowers wherein the primary roles of zinc usually occur, i.e. inducing chlorophyll synthesis, participating in the generation phase of plant growth hormones as well as enhancing photosynthesis and nitrogen metabolism. Zinc is closely associated with the functions of auxin synthesis and protein biosynthesis particularly needed at and after maturation. Zinc also boosts the size and yield of fruits. Boron plays structural roles in the cell membrane and plays an essential role in cell division, whereas, on the other hand, the calcium / potassium ratio in the plant is worthy of regulation and enables the plant to take in nitrogen right from the soil. Nitrogen fixation increases in the cell deficits of the plant. Iron aids in enhancing the amount of chlorophyll in leaves by controlling the leaf color. Iron is responsible for several metabolic activities including synthesis of DNA, respiration, and photosynthesis. (Zagade et al., 2017).

2. MATERIALS AND METHODS

Table 1. Experimental Site and Plant Material

Parameter	Description
Location	Experimental farm of Mata Gujri College, Fatehgarh Sahib
Crop	Guava (<i>Psidium guajava</i> L.) cv. Shweta
Plant Age	3 years
Experimental Design	Randomized block design (RBD)
Replications	3 replications per treatment

Table 2. Treatment Structure (Foliar Micronutrient Sprays)

Treatment Code	Foliar Spray Composition	Concentration (%)
T ₁	ZnSO ₄	0.1%
T ₂	FeSO ₄	0.2%
T ₃	Borax	0.3%
T ₄	ZnSO ₄ + FeSO ₄	0.1% + 0.2%
T ₅	ZnSO ₄ + Borax	0.1% + 0.3%
T ₆	FeSO ₄ + Borax	0.2% + 0.3%
T ₇	ZnSO ₄ + FeSO ₄ + Borax	0.1% + 0.2% + 0.3%
T ₈	Control	-

3. RESULTS AND DISCUSSION

Vegetative growth attributes

The maximum tree height raise recorded for treatment T7 (ZnSO₄ @ 0.1% + FeSO₄ @ 0.2 % + Borax 0.3%) is not significantly different from the height of trees in treatment T6 (13.00 cm) (0.2% FeSO₄+ 0.3% Borax). The tree height in the minimum treatment (8.33 cm) was recorded under treatment T8 (control)

The maximum increase in the stem girth (1.07 cm in height) was observed in treatment T7 (ZnSO₄ @ 0.1% + FeSO₄ @ 0.2 % + Borax 0.3%). This increase was not statistically different from the stem girth in T4 (0.90 cm)—ZnSO₄ @ 0.1% + FeSO₄ @ 0.2 %. Minimum tree stem girth (0.43 cm) was recorded in the conduct? treatment T8 (control).

Maximum tree spread increase (N-S) 0.30 m and (E-W) 0.32 m were recorded in treatment T7 (ZnSO₄ @ 0.1% + FeSO₄ @ 0.2 % + Borax 0.3%) which was not statistically different from 0f (N-S) 0.27 m and (E-W) 0.30 m observed under treatment T5 (ZnSO₄. 1 %+ Borax @ 0.3%). The minimum tree spread (N-S) 0.03 m and (E-W) 0.02 m were record in the control treatment T8.

The highest leaf area was noted in it only when following the highest content level which included T7 @ 0.1% ZnSO₄+0.2% FeSO₄+ 0.3% of Borax in treatment T7. This was at par with variations of varied leaf area (68.54 cm²) in treatment T3 to keep multiple profiles with B for 0.3%. The lowest leaf area benefited from all advantages at 49.59 cm² only in treatment T8, right with the super control (t₀).

Table 3. Effect of foliar application of micronutrients on tree height, stem girth and leaf area of guava tree.

Sr. No.	Treatments	Tree height increase (cm)	Stem girth increase (cm)	Leaf area (cm ²)
T ₁	ZnSO ₄ @0.1%	11.00	0.43	63.34
T ₂	FeSO ₄ @0.2%	8.33	0.77	60.50
T ₃	Borax @0.3%	11.67	0.80	68.54
T ₄	ZnSO ₄ @0.1% + FeSO ₄ @0.2%	10.67	0.90	66.18
T ₅	ZnSO ₄ @0.1% + Borax @0.3%	10.00	0.77	54.94
T ₆	FeSO ₄ @0.2% + Borax @0.3%	13.00	0.83	51.60
T ₇	ZnSO ₄ @0.1% + FeSO ₄ @0.2% + Borax 0.3%	16.67	1.07	70.72
T ₈	Control (water spray)	10.33	0.83	49.59
S. Em. ±	-	2.28	0.16	0.61
CD (0.05%)	-	6.91	0.48	1.84

Fruit quality parameters

Maximum fruit TSS was highest (13.130Brix) in treatment T7 (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%); but it was not significantly different from T4 also with TSS of 13.070Brix. The treatment T4 possessed the lowest TSS i.e., zero. But T8 had the lowest TSS (10.60 0Brix). Maximum ascorbic acid was obtained in treatment T7 (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%) with 172.02mg/100g pulp. The ascorbic acid content for treatment T7 was not significantly different from what was recorded for treatment T6 (170.40mg/100g pulp). The lowest values for ascorbic acid were observed in treatment T8 (control). Titration acidity was the lowest in treatment T7 (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%) with 0.23%; statistically significant with only T1 (ZnSO₄ @0.1%) with 0.44%. The treatment acute in fruit acidity shows up in the very high treatment T8 to 0.48%. The maximum total sugar content (7.67%) was recorded for plants in T7 (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%), which, statistically, equals to 7.43% in T6 (FeSO₄ + Borax @0.3%). However, treatments T8 (control) observed a minimum total sugar content (5.33%).

The highest reducing sugar content (4.64%) was observed in plants in T7 (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%), which is not differentially significant (4.60%) in T5 (ZnSO₄ @0.1% + Borax @0.3%), while the least reducing sugar (3.24%) was obtained in treatments T8 (control). The maximum non-reducing sugar content (3.27%) was obtained for the plants in T7 (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3%) which is statistically at par (3.22%) with T6 (FeSO₄ @0.2% + gran Borax @30). The minimum non-reducing sugar content (1.73%) was recorded for treatment T8 (control).

Table 4. Effect of foliar application of micronutrients on TSS, ascorbic acid and titratable acidity of guava fruit.

Sr. No.	Treatments	TSS (^o Brix)	Ascorbic acid (mg/100 g)	Acidity (titratable acidity)
T ₁	ZnSO ₄ @0.1%	11.20	165.49	0.44
T ₂	FeSO ₄ @0.2%	12.37	150.98	0.26
T ₃	Borax @0.3%	12.40	150.59	0.38
T ₄	ZnSO ₄ @0.1% + FeSO ₄ @0.2%	13.07	161.47	0.25
T ₅	ZnSO ₄ @0.1% + Borax @0.3%	12.83	151.99	0.36
T ₆	FeSO ₄ @0.2% + Borax @0.3%	12.43	170.40	0.42
T ₇	ZnSO ₄ @0.1% + FeSO ₄ @0.2% + Borax 0.3%	13.13	172.02	0.23
T ₈	Control (water spray)	10.60	147.83	0.48
S. Em. ±	-	0.22	1.00	0.01
CD (0.05%)	-	0.66	3.02	0.03

Table 5: Effect of foliar application of micronutrients on total sugar, reducing sugar and non-reducing sugar of guava fruit.

Sr. No.	Treatments	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)
T ₁	ZnSO ₄ @0.1%	6.30	4.38	1.84
T ₂	FeSO ₄ @0.2%	6.20	4.51	1.75
T ₃	Borax @0.3%	5.55	3.27	3.17
T ₄	ZnSO ₄ @0.1% + FeSO ₄ @0.2%	6.10	4.33	1.77
T ₅	ZnSO ₄ @0.1% + Borax @0.3%	7.10	4.60	3.04
T ₆	FeSO ₄ @0.2% + Borax @0.3%	7.43	4.03	3.22
T ₇	ZnSO ₄ @0.1% + FeSO ₄ @0.2% + Borax 0.3%	7.67	4.64	3.27
T ₈	Control (water spray)	5.33	3.24	1.73
S. Em. ±	-	0.09	0.01	0.03
CD (0.05%)	-	0.24	0.04	0.08

Yield parameters

A maximum of 169 fruits per plant was registered with the treatment T7 (ZnSO₄ @0.1 per cent + FeSO₄ @0.2 per cent + Borax 0.3 per cent) and it was statistically non-significantly lower with 167 fruit in treatment T6 (FeSO₄ @0.2 per cent + Borax 0.3 per cent). However, the lowest number of fruits (143.33) was obtained in treatment T8 (control).

The highest yield of ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax 0.3% was 30.17 kg, again at par with FeSO₄ @0.2% + Borax 0.3% which gave 29.46 kg for price T7. The minimum fruit weight recorded was 20.16 kg for treatment T8.

Maximum output (14.89 t/ha) was with T7 (ZnSO₄@0.1% + FeSO₄@0.2% + Borax@0.3%) followed by at par (14.54 t/ha) in T6 (FeSO₄@0.2% + Borax@0.3%), and the least (9.95t/ha) was obtained with T8 (control).

Table 6: Effect of foliar application of micronutrients on total number of fruits per tree fruit yield (kg/ha) and fruit yield (t/ha) of guava fruit.

Sr. No.	Treatments	Total no. of fruits (per tree)	Fruit yield (kg/tree)	Fruit yield (t/ha)
T ₁	ZnSO ₄ @0.1%	145.67	20.64	10.19
T ₂	FeSO ₄ @0.2%	154.33	23.66	11.68
T ₃	Borax @0.3%	159.67	26.41	13.03
T ₄	ZnSO ₄ @0.1% + FeSO ₄ @0.2%	157.33	27.59	13.62
T ₅	ZnSO ₄ @0.1% + Borax@0.3%	165.00	28.81	14.22
T ₆	FeSO ₄ @0.2% + Borax @0.3%	167.00	29.46	14.54
T ₇	ZnSO ₄ @0.1% + FeSO ₄ @0.2% + Borax 0.3%	169.00	30.17	14.89
T ₈	Control (water spray)	143.33	20.16	9.95
S. Em. ±	-	0.79	0.20	0.10
CD (0.05%)	-	2.39	0.61	0.30

4. CONCLUSION

This study reports significant height, spread, leaf area and girth of the trees with micronutrients or their substituents. T7 (ZnSO₄ @0.1% + FeSO₄ @0.2% + Borax @0.3 %) did the most to improve plant height, plant spread, leaf area and stem girth with a maximum surge in these parameters, while T8 (control) did the least to increase tree height, tree spread, leaf area, and stem girth. Sole applications of micronutrients displayed significantly higher plant height, canopy width, and trunk circumference of guava. These findings are comparable to those of El-Kassab (1984), who reported an enhanced vegetational growth of Balady lime tree due to foliar iron application. Foliage or fertilizer sprinkled with ferrous products brought about improved growth and yield (as in their own experiments) in the respective crops mentioned above. The maximum gain in almost all growth parameters could reasonably be credited to the encouraging action of the tells applied for the betterment in growth fundamentals, majorly brought about by way of stimulatory and catalytic roles to accompany a good number of physiological and

metabolic processes of plants; for example, iron is essential for several major plant metabolic functions including chlorophyll formation, various enzymatic reactions, respiration, and photosynthesis (Singh et al.,2019) while boron is one of the constituents of enzyme activity involved in the metabolic assimilation of nitrogen and carbohydrates, which directly increase nitrogen uptake and likewise help in supporting overall plant growth. It is assumed that these essential micronutrients are bound to boost various plant metabolic activities while providing an enhanced translocation pathway for the higher rates of photosynthates from source to sink, thereby influencing favorable yield attributes like length of lateral branches, length of terminal branches, leaf area, and leaf area as compared to the controls. Likely, the reason for growth succor from zinc could emanate from the involvement of zinc in the synthesis of tryptophan, a precursor auxin that mediates apical growth and further impels upward growth and extension. Fine zinc sprays on foliage caused an upsurge in height and girth of guava plants (Kumar et al., 2012).

The union of zinc in the biosynthesis of auxins in plants makes high enzymatic activity. It also helps shoot oxidoreduction action from plants. In contrast to guava's intense rise, guava exhibits climacteric behavior. So, the respiratory changes are to be initiated. The biochemical reactions string up, leading to the breaking down of complex food materials like sugar to simple substances. Iron is connected to the flavoproteins in their growth". Thus, Zn is also able to function with other enzymes as involved in carbohydrate metabolism, hexokinase activity, cellulose rendering, and sugar to zymogenous conversion (Rathore, 2020).

REFERENCES

1. Arshad I, Ali W. Effect of foliar application of zinc on growth and yield of guava (*Psidium guajava* L.). Adv Sci Technol Eng Syst J. 2016;1(1):19-22.
2. Kumar J, Kumar R, Rai R, Mishra DS. Response of 'Pant Prabhat' guava trees to foliar sprays of zinc, boron, calcium and potassium at different plant growth stages. The Bioscan. 2012;10(2):495-498.
3. Mishra KK, Pathak S, Sharma N, Nehal N. Effect of pre-harvest nutrients spraying on physicochemical quality and storage behaviour of rainy season guava (*Psidium guajava* L.) fruits cv. L-49. Plant Arch. 2017;17(1):597-600.
4. Rathore DS, Patel P. Influence of foliar boron and zinc on fruit retention and yield of guava. Ann Plant Soil Res. 2020;22(1):56-60.
5. Rawat V, Tomar YK, Rawat JMS. Influence of foliar application micronutrients on the fruit quality of guava cv. Lucknow-49. J Hill Agric. 2010;1(1):63-66.
6. Sau S, Sarkar S, Ghosh B, Ray K, Deb P, Ghosh D. Effect of foliar application of B, Zn and Cu on yield, quality and economics of rainy season guava cultivation. Curr J Appl Sci Technol. 2018;28(1):1-10.
7. Shukla HS, Kumar V, Tripathi VK. Effect of gibberellic acid and boron on development and quality of aonla fruits 'Banarasi'. Acta Hort. 2011;890:375-380.

8. Singh SR, Tiwari V. Effect of foliar feeding of micronutrients on biochemical quality parameters in guava. *Indian J Plant Physiol.* 2019;24(3):482-488.
9. Suman M, Dubalgunde SV, Poobalan O, Sangma PD. Effect of foliar application of micronutrients on yield and economics of guava (*Psidium guajava* L.) cv. L-49. *Int J Agric Environ Biotechnol.* 2016;9(2):221-224.
10. Tripathi PC, Shukla AK. Role of iron and magnesium in enhancing photosynthetic efficiency and chlorophyll stability in tropical fruit crops. *J Hortic Sci Biotechnol.* 2015;90(6):623-630.
11. Yadav RK, Yadav A. Standardization of micronutrient spray schedule for guava cv. Shweta under field conditions. *Hortic Int J.* 2018;2(5):230-236.
12. Zagade PM, Munde GR, Shirsath AH. Effect of foliar application of micronutrients on yield and quality of guava (*Psidium guajava* L.) cv. Sardar. *J Pharm Biol Sci.* 2017;12(5):56-58.

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