International Journal of Agricultural Sciences
Volume 20 | Issue 1 | January, 2024 | 47-51 ■ ISSN : 0973-130X

☞DOI:10.15740/HAS/IJAS/20.1/47-51
Visit us : *www.researchjournal.co.in*

RESEARCH PAPER

Interaction effect of boron and zinc on growth, yield and quality of guava (*Psidium gaujava* L.) Cv. 'Lalit'

Suresh Kr. Yadav*, M.K. Bundela[1], Rajendra P. Maurya[1], D.C. Meena[1], Atul Sharma[1], Anita Yadav[2], Deepika Yadav[3], Latasha Yadav **and** Shankar Lal Kumawat[4]
Department of Horticulture, School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan) India
(Email: vmmeena543@gmail.com)

Abstract : The present investigation was carried out at Agricultural Research Farm, Suresh Gyan Vihar University, Jaipur (Rajasthan) to study the effect of foliar application of boron and zinc on growth, yield and quality of guava (*Psidium gaujava* L.) during the year 2022-23. The various concentrations of boric acid, zinc sulphate and their interactions had significant effect on various vegetative growth, yield and quality parameters and the maximum (22.07 cm) tree height increment, (70.39 cm) annual shoot growth, (215.96) fruits per tree, longest (8.74 cm) fruit length, (7.84 cm) fruit diameter, heaviest (264.20 g) fruit, yield (58.57 kg/tree) and (16.27 t/ha), (15.87%) TSS, (7.60%) total sugar, (268.25 mg/100 g) ascorbic acid and (1.36%) pectin was recorded under Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11}).The non-significant effects were observed in application of different combinations of boric acid and zinc sulphate on acidity percentage.

Key Words : Guava, Boron, Zinc, Growth, Yield

View Point Article : Yadav, Suresh Kr., Bundela, M.K., Maurya, Rajendra P., Meena, D.C., Sharma, Atul, Yadav, Anita, Yadav, Deepika, Yadav, Latasha and Kumawat, Shankar Lal (2024). Interaction effect of boron and zinc on growth, yield and quality of guava (*Psidium gaujava* L.) Cv. 'Lalit'. *Internat. J. agric. Sci.*, **20** (1) : 47-51, **DOI:10.15740/HAS/IJAS/20.1/47-51.**

Article History : Received : 03.07.2023; **Accepted :** 07.08.2023

INTRODUCTION

Guava (*Psidium guajava* L.), also known as" apple of the tropics", is the most important, highly productive, delicious and nutritious fruit, grown commercially through out tropical and subtropical regions of India. Its fruits are available through out the year except during the summer season. It claims to be the fourth most important fruit in are a and production after mango, banana and citrus (Sharma *et al.,* 2007).

Botanically, guava belongs to the large family Myrtaceae and it has basic chromosome number 11. Tropical America is considered to be its native place and seems to have been growing from Mexico to Peru. Records suggest that guava has been introduced in India

***Author for correspondence:**
[1]School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan) India
[2]Department Soil Science, Swami Keshwanand Rajasthan Agricultural University, Bikaner (Rajasthan) India
[3]Department Entomology, Sri Karan Narendra Agriculture University, Jobner, Jiapur (Rajasthan) India
[4]Department Fruit Science, Junagadh Agriculture University Junagadh (Gujarat) India (Kumawatshankarlal516@gmail.com)

at a very early time in the 17th century (Hayes, 1970 and Singh, 1998) and gradually became a crop of commercial significance. The total area under its cultivation in India is 1,55,000 ha with an annual production of 17,93,000 tons but the actual productivity is 11.6 tonnes/ha, while it has a potential to show the productivity upto 20 tons/ha (NHB, 2021). Bihar is the leading state in guava production followed by Andhra Pradesh and Uttar Pradesh.

Guava is an excellent source of ascorbic acid, dietary fibre, pectin and minerals. Guava fruit contains water (80-82%), protein (0.71%), fat (0.5%), carbohydrate (11-13%) and acids (2.4%). Among fruits, it ranks 3rd in vitamin C content after Barbados cherry and Aonla. Guava fruits are rich in dietary fibres and vitamin C and have moderate levels of folic acid. Multiple health benefits of guava due to the presence of compounds like lycopene, quercitin, vitamin C and various polyphenols improves the immune system and protects against common infectious diseases (Rajkumar, 2016).

Micronutrients are those trace elements which are essential for the normal healthy growth and reproduction of plants. The requirement of micronutrients for yields can be affected by deficiencies; they can also be reduced by toxicity due to excessive concentrations of the same elements. It is therefore important that soils and/or crops are monitored to ensure that the available micronutrient concentrations in soils are in the optimum range, being neither too low, nor too high (Arnon and Stout, 1939). The foliar application of micronutrients plays a vital role in improving the quality and comparatively more effective for rapid recovery of plants. The yield parameters like average fruit weight, number of fruits/ tree and yield/tree are increased by the spray of micro-nutrients. Zinc is important constitute of several enzyme systems which regulate various metabolic reaction associated with water relation in the plant.Zinc is essential for auxin and protein synthesis, seed production and proper maturity. It also increases fruit size as well as yield. Zinc is essential for improving the vegetative growth of guava trees in terms of terminal shoots, shoot diameter and number of leaves per shoot. Boron is a constituent of cell membrane and essential for cell division. It's role as a regulator of potassium/calcium ratio in plant and help in nitrogen adsorption and translocation of sugar in plant. Boron increase nitrogen availability to plant. It is involved in the synthesis of cell wall components. It has a role in pollen viability and good fruit set. It increases the growth of primary and lateral roots. The experiment comprised foliar sprays of boron and zinc on guava plant. Singh *et al.* (1983) reported that boric acid has good effect on physico-chemical composition of guava. The deficiency of boron, next to zinc deficiency, has imparted a greater significance to boron amendment. An adequate boron amendment ensures not only ample fruit set, but guarantees optimum fruit yield with excellent quality in terms of juice content, ratio between total soluble solids and acidity, and fruit peel colour (Srivastava and Singh, 2005). Very little information is available on effect of zinc and boron under agro-climatic conditions of Rajasthan. The available information regarding the impact of micronutrients on fruit plants is scanty. Keeping this in view, the present investigation was undertaken with the objective to find out best combination of micronutrient for quality guava production under semi-arid conditions of Jaipur.

Material and Methods

The present research was carried out in the at Agricultural Research Farm at Suresh Gyan Vihar University, Jaipur (Rajasthan) to study the effect of micronutrients on chilli during the year 2022-23. The experiment was laid down in Factorial Randomized Block Design which consisted 16 treatment combinations *viz;* Control (T_0), Boric acid @0.12% (T_1), Boric acid @0.25% (T_2), Boric acid @0.50% (T_3), $ZnSO_4$ @ 0.12% (T_4), $ZnSO_4$ @ 0.25% (T_5), $ZnSO_4$ @ 0.50% (T_6), Boric acid @ 0.12% + $ZnSO_4$ @ 0.12% (T_7), Boric acid @ 0.12% + $ZnSO_4$ @ 0.25% (T_8), Boric acid @ 0.12% + $ZnSO_4$ @ 0.50% (T_9), Boric acid @ 0.25% + $ZnSO_4$ @ 0.12% (T_{10}), Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11}), Boric acid @ 0.25% + $ZnSO_4$ @ 0.50% (T_{12}), Boric acid @ 0.50% + $ZnSO_4$ @ 0.12% (T_{13}), Boric acid @ 0.50% + $ZnSO_4$ @ 0.25% (T_{14}) and Boric acid @ 0.50% + $ZnSO_4$ @ 0.50% (T_{15}) and treatments were replicated three times. Appraisal of the result indicated that the influence of plant growth regulators on important parameters like vegetative growth, yield and quality attributes of guava were significantly influenced by micronutrients under local agro-climatic conditions of Jaipur (Rajasthan). The observations were measured on the five randomly selected and tagged plants in each plot and their mean value was calculated. To test the significance of variation in data obtained from various growth, yield and quality characters. Significance of difference in the treatment effect was tested through 'F' test at 5 per cent level of significance and CD (critical difference) was calculated, wherever the results found significant.

Results and Discussion

The experimental findings obtained from the present study have been discussed in following heads :

Vegetative growth parameters:

The data presented in Table 1 revealed that the interaction effect of boron and zinc showed significant effect on tree height increment. The maximum (22.07 cm) tree height increment, (70.39 cm) annual shoot growth, (27.36 cm) plant spread and (215.96) fruits per tree was observed in plant sprayed with Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11}). It might be due to synergistic effect of boron and zinc on vegetative parameters. The produced auxine promote the apical dominance that ultimately enhance the tree height, shoot growth and plant spread. Kumawat *et al.* (2012) who have shown that application of micronutrients alone or in combinations had significant effect on plant height, plant spread, shoot length and leaf area, in guava plant. These results are in accordance with the findings of Kumar *et al*. (2015); Kaur and Singh (2022) and Meena *et al.* (2023).

Yield attributing parameters:

The data presented in 2 revealed that the interaction

Table 1: Interaction effect of boron and zinc on vegetative parameters of guava cv. 'Lalit'

Treatments	Tree height increments (cm)	Annual shoot growth (cm)	Increase in plant spread (cm)	Number of fruits per tree
Control (T_0)	15.58	49.64	19.32	187.99
Boric acid @ 0.12% + $ZnSO_4$ @ 0.12% (T_7)	16.76	53.41	20.79	201.01
Boric acid @ 0.12% + $ZnSO_4$ @ 0.25% (T_8)	17.05	54.34	21.15	202.16
Boric acid @ 0.12% + $ZnSO_4$ @ 0.50% (T_9)	16.97	54.08	21.05	206.38
Boric acid @ 0.25% + $ZnSO_4$ @ 0.12% (T_{10})	19.79	63.10	24.54	208.92
Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11})	22.07	70.39	27.36	215.96
Boric acid @ 0.25% + $ZnSO_4$ @ 0.50% (T_{12})	20.38	64.98	25.27	213.94
Boric acid @ 0.50% + $ZnSO_4$ @ 0.12% (T_{13})	17.05	54.34	21.15	212.32
Boric acid @ 0.50% + $ZnSO_4$ @ 0.25% (T_{14})	18.88	60.19	23.41	211.28
Boric acid @ 0.50% + $ZnSO_4$ @ 0.50% (T_{15})	17.39	55.42	21.57	207.64
S.E.$\pm$	0.01	0.98	0.40	0 81
C.D. (P=0.05)	0.020	2.02	0.83	1.66

Table 2 : Interaction effect of boron and zinc on yield and yield attributing characters of guava cv. 'Lalit'

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit volume (cm^3)	Fruit weight (g)	Fruit yield (kg/tree)	Fruit yield (t/ha)
Control (T_0)	7.50	6.60	87.17	119.12	23.79	6.61
Boric acid @ 0.12% + $ZnSO_4$ @ 0.12% (T_7)	7.95	7.05	141.92	173.87	36.46	10.13
Boric acid @ 0.12% + $ZnSO_4$ @ 0.25% (T_8)	8.23	7.33	176.92	208.87	43.73	12.15
Boric acid @ 0.12% + $ZnSO_4$ @ 0.50% (T_9)	8.21	7.31	178.00	213.12	45.50	12.64
Boric acid @ 0.25% + $ZnSO_4$ @ 0.12% (T_{10})	8.44	7.54	203.50	209.95	45.37	12.60
Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11})	8.32	7.84	232.25	264.20	58.57	16.27
Boric acid @ 0.25% + $ZnSO_4$ @ 0.50% (T_{12})	8.54	7.64	220.67	252.62	55.56	15.43
Boric acid @ 0.50% + $ZnSO_4$ @ 0.12% (T_{13})	8.66	7.76	192.42	235.45	51.51	14.31
Boric acid @ 0.50% + $ZnSO_4$ @ 0.25% (T_{14})	8.74	7.42	181.75	224.37	48.92	13.59
Boric acid @ 0.50% + $ZnSO_4$ @ 0.50% (T_{15})	8.35	7.45	181.17	213.70	45.89	12.75
S.E.$\pm$	0.02	0.02	0.07	0.08	1.93	0.54
C.D. (P=0.05)	0.04	0.04	0.13	0.16	3.96	1.10

Table 3: Interaction effect of boron and zinc on quality parameters of guava cv. 'Lalit'

Treatments	Total soluble solids (%)	Acidity (%)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100 g)	Pectin (%)
Control (T_0)	11.25	0.34	3.50	1.78	5.28	196.06	0.82
Boric acid @ 0.12% + $ZnSO_4$ @ 0.12% (T_7)	13.67	0.30	4.42	2.18	6.61	225.86	1.16
Boric acid @ 0.12% + $ZnSO_4$ @ 0.25% (T_8)	12.77	0.28	4.71	2.36	7.06	243.10	1.24
Boric acid @ 0.12% + $ZnSO_4$ @ 0.50% (T_9)	14.63	0.26	4.31	2.16	6.47	240.67	1.26
Boric acid @ 0.25% + $ZnSO_4$ @ 0.12% (T_{10})	14.57	0.26	4.94	2.47	7.42	238.00	1.32
Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11})	15.87	0.23	5.06	2.54	7.60	268.25	1.36
Boric acid @ 0.25% + $ZnSO_4$ @ 0.50% (T_{12})	15.66	0.25	4.92	2.46	7.38	257.99	1.32
Boric acid @ 0.50% + $ZnSO_4$ @ 0.12% (T_{13})	15.47	0.26	4.82	2.41	7.23	245.04	1.30
Boric acid @ 0.50% + $ZnSO_4$ @ 0.25% (T_{14})	15.33	0.28	4.57	2.29	6.85	246.39	1.29
Boric acid @ 0.50% + $ZnSO_4$ @ 0.50% (T_{15})	14.73	0.28	4.54	2.28	6.82	238.09	1.25
S.E.±	0.01	0.01	0.02	0.03	0.004	9.03	0.05
C.D. (P=0.05)	0.02	NS	0.05	0.06	0.009	18.53	0.09

effect of boric acid and zinc sulphate showed significant effect on yield attributing characters. The longest (8.74 cm) fruit length was recorded under Boric acid @ 0.50% + $ZnSO_4$ @ 0.25% (T_{14}). The maximum (7.84 cm) fruit diameter, (232.25 cm^3) fruit volume and (264.20 g) fruit were recorded in Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11}). The interaction effect of Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11}) treatment showed the significant difference over other treatments. It might be due to the application of optimum dose of boron and zinc was promote the production of more photosynthesis required to increase fruit length and diameter that ultimately increases fruit volume and good fruit weight and its components. These findings are in line with earlier reports of Lal and Sen (2000); Kumawat *et al.* (2012) and Meena *et al.* (2023).

Yield parameters:

The data presented in Table 2 further revealed that the interaction effect of boric acid and zinc sulphate showed significant effect on fruit yield per tree. Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11}) produced (58.57 kg/tree) and (16.27 t/ha) fruits followed by (55.56 kg/ tree) and (15.43 t/ha) fruit yield in Boric acid @ 0.25% + $ZnSO_4$ @ 0.50% (T_{12}). Micronutrients application may be attributed to enhanced photosynthesis activity and increased production and accumulation of carbohydrates and favorable effect on fruits, which increased number of fruits per plant besides increasing the size. These results are in agreement with the findings of Ullah *et al.* (2012); Kaur and Singh (2022) and Meena *et al.* (2023).

Quality parameters:

It apparent from the data presented in Table 3 revealed that the maximum (15.87%) TSS, (5.06%) reducing sugar, (2.54%) non-reducing sugar, (7.60%) total sugar, (268.25 mg/100 g) ascorbic acid and (1.36%) pectin were recorded in Boric acid @ 0.25% + $ZnSO_4$ @ 0.25% (T_{11}). Foliar application of B and Zn increased the yield of chilli significantly as it enhanced the vegetative growth, retention of flowers and fruits, speeds up the process of photosynthesis which resultantly increased the photosynthates (CH_2O) by the result of which it increased the no. and weight of fruits and ultimately increased the yield. Almost similar results were also clarified by Bhatia *et al.* (2001); Rajkumar *et al.* (2016) and Meena *et al.* (2023).

Conclusion:

Based from current results obtained, we can infer that exogenous application of boric acid and zinc sulphate at fruit pea sized stage markedly increased fruit growth, improved fruit quality and yield of guava. Positive results can be achieved by foliar application ofBoric acid @ 0.25% + $ZnSO_4$ @ 0.25%.

REFERENCES

Arnon, D.I. and Stout, P.R. (1939). The essentiality of certain elements in minute quantity for plants with special reference to copper. *Plant physiology*, **14** (2): 371-372.

Bhatia, S. K., Yadav, S., Ahlawat, V. P. and Dahiya, S. S. (2001). Effect of foliar application of nutrients on the yield and fruit quality of winter season guava cv.L-49. *Haryana Journal of*

Horticulture Science, **30** (1-2) : 6-7.

Hayes, W.B. (1970). *Fruit growing in India,* Kitabistan, Allahabad, 297.

Kaur, A. and Singh, A. (2022). Effect of foliar application of micro nutrients on yield and quality of guava cv. Sardar, *Annals of Horticulture*,**10** (2) : 240 – 242.

Kumar, J., Kumar, R., Rai Ratna and Mishra, S. (2015). Response of Pant Prabhat guava trees to foliar sprays of zinc, boron, calcium and potassium at different plant growth 65 stages. *The Bioscan*, **10** (2) : 495-498.

Kumawat, K.L., Sarolia, D.K. and Shukla, A.K. (2012). Growth, yield and quality of rejuvenated guava as influenced by thinning-bending and micronutrients, *Ind. J. Hort*., **69** (4) : 478-483.

Lal, G., Sen, N.L. and Jat, R.G. (2000). Yield and leaf nutrient composition of guava as influenced by nutrients. *Ind. J. Hort*., **57** (2) : 130-132.

Meena, K., Verma, R.S., Yadav, S., Singh, V., Kumar, L. and Meena, D. (2023). Effect of zinc and boron on growth parameters of guava (*Psidium guajava* L.) cv. L-49, *The Pharma Innovation Journal,* **12** (3) : 5209-5211.

National Horticulture Board (2021). State–wise and commodity–wise Area and Production of Fruits (1920-21). Ministry of Agriculture, Govt. of India. http://www.hortibiz india.nic.in/aicsfhtm.

Rajkumar, Kaur, G., Mann, A., Lata, C., Singh, A. and Kumar, A. (2016). Biochemical changes in guava (*Psidium guajava* L.) cv. Allahabad Safeda fruits at different maturity stages during summer and winter seasons. *Indian Journal of Agricultural Sciences,* **86** (12): 1595–1600.

Sharma, A.S., Sehrawat, S.K., Singhrot, R.S. and Boora, K.S. (2007). Assesment of genetic diversity and relationship among *Psidium* spp. through RAPD analysis. *Acta Horticulturae*, **735** : 71- 78.

Singh, P. N. and Chhonkar, V. S. (1983). Effect of zinc, boron and molybdenum asfoliar spray on chemical composition of guava fruit. *Punj. Hort. J.*, **23** (1-2) : 34-37.

Singh, R. (1998). Guava. *In*: Fruits (*Ed*.). *National Book Trust India,* pp. 93-106.

Srivastava, A.K. and Singh, S. (2005). Boron nutrition in citrus-current status and future strategies – review. Agricultural Reviews, **26** (3) : 173-186.

Ullah, S., Khan, A.S., Malik, A.U., Afzal, I., Shahid, M. and Razzaq, K. (2012). Foliar application of boron influences the leaf mineral status, vegetative and reproductive growth, yield and fruit quality of 'kinnow' mandarin (*Citrus 69 reticulata* Blanco.). *Journal of Plant Nutrition*, **35** (13) : 2067-2079.