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Efficacy of Foliar Feeding of Ca, Zn and Cu with and without Borax on Fruit Drop and Bio-Chemical Attributes of Winter Season Guava (*Psidium guajava* L.) cv. L-49

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The present investigation entitled "Efficacy of foliar feeding of Ca, Zn and Cu with and without Borax on Fruit drop and Bio-Chemical attributes of winter season guava (*Psidium guajava* L.) cv. L-49" was conducted at guava orchard of Kalyanpur nursery, Department of Fruit Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur 208002 during 2019-2020. 39

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guava trees with even size and vigour were selected and were sprayed with various concentrations of different nutrients ($Ca(NO_3)_2$ @ 0.50% and 1%), ($ZnSO_4$ @ 0.50% and 1.0%) and ($CuSO_4$ @ 0.60% and 0.80%) with and without Borax (1%). Thirteen treatments were replicated three times as part of the RBD (Randomised Block Design) investigation. Fruits were examined in the laboratory of the Department of Fruit Science, C.S.A.U.A&T., Kanpur, for their physical and biochemical characteristics. The results of the present study revealed that fruit drop (33.94%) and bio-chemical attributes that is, Total soluble solids (13.54 ^{0}Brix), Acidity (0.46 %) and Ascorbic acid (194.30 mg/100g pulp) were improved significantly with the use of $ZnSO_4$ 1.0% + Borax 1.0% (T_{10}).

Keywords: Borax; guava; quality; yield; zink sulphate.

1. INTRODUCTION

Guava (*Psidium guajava* L.) “Apple of the tropics” is one of the most encouraging fruit crops of India and is viewed as one of the impeccable healthfully important remunerative crops [1], “Because of its wider edapho-climatic adaptability, resistance to biotic and abiotic stresses, precocious and prolific bearing habit, high-quality fruit with a medicinal quality, use both as fresh fruit and after processing in various value-added products, and classification as a multipurpose tree because of its utility as a fruit, fuel, fodder, and timber” [2]. “Guava was first introduced to India by the Portuguese in the 17th century and is a member of the 'Myrtaceae' family with a basic chromosomal number of n=11. It is indigenous to Tropical America, from Mexico to Peru, and has subsequently spread to countries including Brazil, Mexico, China, Malaysia, the Hawaiian Islands, Cuba, and India as a commercially significant crop” [3]. It is a hard fruit that may thrive in arid, alkaline, or poorly drained soil. It may grow on soil with a pH of between 4.5 and 7.5. Even with meagre rainfall of less than 25 cm, it can tolerate temperatures as high as 46^{0}C. However, there are three separate growing and fruiting seasons in a subtropical environment. Ambebahar, Mrigbahar, and Hastabahar are these three distinct periods [4].

“The ripe fruit is 79.50 percent moisture, 15.25 percent dry matter, 3.20 percent crude fibre, and has very little ash. TSS varies from 8.5 to 10.5 percent. Fructose is the primary sugar found in mature green guava fruit. Many volatile compounds, including as hydrocarbons, alcohol, and carbonyls, have been implicated in the guava's distinctive flavour. As a fruit mature, the astringency lessens due to leuco-anthocyanin polymerization. The nutritional value in guava fruit are found (per 100g of fruit pulp) as total sugar 5.0 to 10.25g, protein 0.9 to 1.40g, crude fat 0.10 to 0.70g, vitamin A 250 I.U., vitamin C 210 to 305mg, pectin 0.5 to 1.8g, niacin 0.20 to 2.30mg, thiamine 0.02 to 0.06mg, riboflavin 0.02 to 0.04mg, calcium 10.50 to 31.80mg, phosphorus 21.00 to 39.60mg and iron 0.55 to 1.36mg” [5].

Zinc helps in the production of plant growth hormone, chlorophyll, and plays a beneficial role in photosynthesis and nitrogen metabolism. Zinc is necessary for the production of auxin and proteins, the development of seeds, and proper maturation. It also increases the fruit's size and yield. Mineral boron is present in cell membranes and necessary for cell division. By balancing the potassium/calcium ratio inside the plant, it aids in nitrate uptake and sugar translocation. The availability of nitrogen to the plant is also improved. Several enzymes involved in the formation of lignin in plants are stimulated by copper, which is necessary for many enzyme systems. Furthermore, it affects photosynthesis as well as how proteins and carbohydrates are metabolised in plants [6].

Calcium is a key component for chromosome stability, root development, and cell division. Furthermore, it appears to regulate respiration and a number of metabolic diseases. It is also very important in the process of neutralising various organic acids. It stopped the accumulation of oxalic acid in plants. Fruit quality is developed with the help of calcium [7].

2. MATERIALS AND METHODS

During the academic year 2019-2020, the current study was conducted at guava orchard of Kalyanpur nursery, Department of Fruit Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.) India. The experimental site has a semi-arid and subtropical climate. The soil of the orchard is sandy loam, which is well drained and aerated. The soil's texture was fairly loose, which was good for the growth of plant roots. Twelve-year-old, uniform guava plants were taken for this investigation, spaced 6 metres apart. The proposed package of techniques for applying guava nutrients and other orchard management procedures were used. The experiment had three replications and was set up using a Randomised Block Design in the month of June 2019. The unit of analysis was one plant per plot. Thirteen treatments in tot viz., T_1 (Ca $(NO_3)_2$ 0.50%), T_2 (Ca $(NO_3)_2$ 1.0%),T_3 ($ZnSO_4$ 0.50%), T_4 ($ZnSO_4$ 1.0%),T_5 ($CuSO_4$ 0.60%), T_6 ($CuSO_4$ 0.80%), T_7 (Ca $(NO_3)_2$ 0.50%) + Borax (1.0%), T_8 (Ca $(NO_3)_2$ 1.0%) + Borax (1.0%), T_9 ($ZnSO_4$ 0.50%) + Borax (1.0%), T_{10} ($ZnSO_4$ 1.0%) + Borax (1.0%), T_{11} ($CuSO_4$ 0.60%) + Borax (1.0%), T_{12} ($CuSO_4$ 0.80%) + Borax (1.0%), T_{13} Control (water spray) were sprayed (foliar feeding) 20 sept. 2019 (18 days before first flowering) nd on 14 Nov. 2019 (after fruit setting).

Fruit drop was calculated by count method from the number of fruits retained on the five tagged branches, ten days before harvest and expressed in percentage. Bio-chemical parameters viz., total soluble solids were estimated at ambient temperature by digital hand refractometer. Titratable acidity was calculated by titrating the fruit pulp extract with 0.1N NaOH using phenolphthalein indicator (Ranganna,2010). Ascorbic acid content in fruit sample were estimated by the method described by Ranganna (2010). The statistical analysis of the data obtained in several sets of experiments was calculated according to Panse and Sukhatme's recommendations [8].

3. RESULTS AND DISCUSSION

In this respect data displayed In Table 1. Foliar application of micronutrients encouraged to inhibition of fruit drop in guava fruit. Treatment of $ZnSO_4$ 1.0% + Borax 1.0% (T_{10}) consistently and significantly reduced to fruit drop and showed 33.94% drop in this respect followed by treatment of $ZnSO_4$ 1.0% (T_4) (36.98%). The maximum (59.01%) drop was presented under control. Application of zinc at higher increased the foliar zinc content which ultimately encourage the endogenous production of auxin and that reduces the fruit drop [9] as well as borax response was also more positive due to Boron which play an important role in transportation of Carbohydrates and auxin synthesis which stimulated to reducing fruit drop in guava. Due to considerably above prominent combined role of Boron and Zinc, minimum fruit drop was observed in present investigation. These findings are in conformity with the reports of Kundu and Mitra [10], Yadav et al*.,* [11] in guava and Verma et al*.,* [12] in aonla.

It is apparent from data showed in finding that all treatments influenced significantly on TSS over control. The maximum 13.54^{0}Brix TSS content was expressed under the treatment of $ZnSO_4$ 1.0% + Borax 1.0% (T_{10}) followed by treatment of $ZnSO_4$ 1.0% (13.39^{0}Brix) against control revealing 10.06^{0}Brix TSS. This tune of enhancement on TSS content in guava fruit was probably might have been caused by the micronutrients zinc and Boron. Boron helps in transmembrane sugar transportation which may be possible cause for improvement in TSS content. Boron spray on trees a notable character of Boron is found that its directly affect the photosynthesis activity of plant. Zinc also essential for carbohydrate and phosphorous

Table 1. Influence of foliar feeding of Ca, Zn and Cu with and without Borax on Physical Parameters of winter season guava (*Psidium guajava* L.) cv. L-49

Treatments	Fruit drop (%)	Total soluble solid (^{0}Brix)	Acidity (%)	Ascorbic acid (mg/100g pulp)
T_1 (Ca $(NO_3)_2$ 0.50%)	51.20	11.07	0.56	176.22
T_2 (Ca $(NO_3)_2$ 1.0%)	46.25	11.76	0.53	179.55
T_3 ($ZnSO_4$ 0.50%)	44.40	12.05	0.52	183.40
T_4 ($ZnSO_4$ 1.0%)	36.98	13.39	0.49	190.92
T_5 ($CuSO_4$ 0.60%)	43.05	10.98	0.57	182.46
T_6 ($CuSO_4$ 0.80%)	41.85	11.09	0.52	187.30
T_7 (Ca $(NO_3)_2$ 0.50%) + Borax (1.0%)	48.36	11.28	0.54	180.03
T_8 (Ca $(NO_3)_2$ 1.0%) + Borax (1.0%)	43.30	11.92	0.50	183.09
T_9 ($ZnSO_4$ 0.50%) + Borax (1.0%)	41.25	12.24	0.48	186.91
T_{10} ($ZnSO_4$ 1.0%) + Borax (1.0%)	33.94	13.54	0.46	194.30
T_{11} ($CuSO_4$ 0.60%) + Borax (1.0%)	39.95	11.20	0.55	185.28
T_{12} ($CuSO_4$ 0.80%) + Borax (1.0%)	38.79	11.31	0.51	191.10
T_{13} Control (water spray)	59.01	10.06	0.73	167.45
S.E. (d)	1.13	0.24	0.03	1.36
C.D. at 5%	2.33	0.50	0.5	2.81

metabolism and it is essential for carbon dioxide utilization and evolution that's why acceleration of TSS may obtained in this investigation. These role in combined treatments of Boron and Zinc were clearly and consistently seen. These results are corroborated with the findings of Yadav et al*.,* [13], Zagade et al*.,* [6], Yadav et al*.,* [14] and Singh et al*.,* [15] in guava.

In the present finding of investigation indicated that acidity content of guava fruit was statistically decreased by different treatments significantly lesser (0.46%) acidity was revealed under the treatment of $ZnSO_4$ 1.0% + Borax 1.0% (T_{10}) closely followed by $ZnSO_4$ 0.5% + Borax 1.0% (0.48%) over control. Micronutrient treated fruits which might be due to early ripening induced by above these combined treatments of boron and zinc which creates degradation of acid might have obtained in fruits. These findings are in line with the reports of Awasthi and Lal [16], Trivedi et. al., [17], Singh et. al., [18] and Yadav et. al., [3] in guava.

The foliar application of micro nutrients in the present study has been found to play an important role in improving the ascorbic acid content of guava fruits. Maximum ascorbic acid 194.30 mg/100g pulp was expressed with the foliar application of $ZnSO_4$ 1.0% + Borax 1.0% (T_{10}) followed by treatment of $CuSO_4$ 0.80% + Borax 1.0% (T_{12}) recorded 191.10 mg/100g pulp ascorbic acid [19,20]. It is might be due to borax spraying which provide Boron to the plants and the role of Boron is to activate the synthesis of ascorbic acid (Jain et al*.,* 1985). Similarly, Zinc also play important role in enhancing the ascorbic acid which seems to be due to increase growth and availability of more metabolites for ascorbic Acid synthesis. The results are in accordance with the finding of Trivedi et. al., [17], Yadav et, al., [13] and Yadav et, al. [3] in guava and in pomegranate.

4. CONCLUSION AND RECOMMENDATIONS

The scenario of the experiment revealed that all the growth, yield and quality attributes with respect to T.S.S, acidity and ascorbic acid were obtained maximum with the foliar application of $ZnSO_4$ 1.0% + Borax 1.0% (T_{10}). Second effective treatment was $ZnSO_4$ 1.0% (T_4) in investigation.

So, it is advised to guava growers and orchardist to spraying of $ZnSO_4$ 1.0% + Borax 1.0% (T_{10}) for obtaining optimum and better yield quality of winter season guava fruits.

CONFERENCE DISCLAIMER

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Singh, Anubhav, Kaur, Gurpinder. Effect of foliar application of micronutrients on yield and quality of guava cv. Sardar. Journal of Pharmacognosy and Phytochemistry. 2019;SP1:156-158.
2. Suman, Mahaveer, Dubalgunde SV, Poobalan Ooty, Sangma Pency D. Effect of foliar application of micronutrients on yield and economics of guava (*Psidium guajava* L.) CV. L-49. International Journal of Agriculture, Environment and Biotechnology. 2016;9(2):221-224.
3. Yadav Ajay, Ram RB, Verma RS, Kumar Viplaw, Yadav RK. Effect of foliar application of micronutrients on Bio-chemical attributes of winter season guava (*Psidium guajava* L.) cv. Lalit. Journal of Pharmacognosy and Phytochemistry. 2018;7(2):3196-3197.

4. Shukla AK, Kaushik RA, Pandey D, Sarolia DK. In: Guava. Published by Maharana Pratap University of Agriculture and technology, Udaipur (RAJASTHAN) India. 2008;7.
5. Adsule RN, Kadam SS. Guava In: Hand Book of Fruit Science and Technology: Production, Composition, Storage and Processing. 2005;419-433.
6. Zagade PM, Munde GR, Shirsath AH. Effect of foliar application of micronutrients on yield and quality of Guava (*Psidium guajava* L.) cv. Sardar. Journal of Pharmacy and Biological Sciences. 2017;12(5):56-58.
7. Shanker Karuna, Misra Sanyat, Topwal Mukesh, Singh VK. A research review on use of micronutrient in fruit crops. International Journal of Current Microbiology and Applied Sciences. 2019;8(8):3014-3025.
8. Panse VG, Sukhatme PV. Statistical method of agriculture workers, ICAR, New Delhi; 1985.
9. Meena D, Tiwari R, Singh OP. Effect of nutrient spray on growth, fruit yield and quality of aonla. Annals Plant and Soil Res. 2014;16(3):242-245.
10. Kundu S, Mitra SK. Response of guava to foliar spray of copper, boron and zinc. Indian Agriculturist. 1999;43(1/2):49-54.
11. Yadav HC, Yadav AL, Yadav DK, Yadav PK. Effect of foliar application of micronutrients and GA_3 on fruit yield and quality of rainy season guava (*Psidium guajava* L.) cv. L-49. Plant Archives. 2011;11(1):147-149.
12. Verma Shashank, Katiyar PN, Rajvanshi Sandeep Kumar, Singh Madhvendra. The effect of foliar application of micronutrients zinc sulphate, borax, copper sulphate and calcium chloride on quality attributes of Aonla. Res. Environ. Life Sci. 2016;9(5):566-569.
13. Yadav RK, Ram RB, Meena ML, Kumar Vikash, Singh HD. Response of foliar spray of micronutrients on fruit set, yield and quality of winter season guava (*Psidium guajava* L.) cv. Allahabad Safeda. Environment and Ecology. 2015;33(1B): 444-447.
14. Yadav RK, Ram RB, Kumar Vikash, Meena ML, Singh HD. Impact of micronutrients on fruit set and fruit drop of winter season guava (*Psidium guajava* L.) cv. Allahabad Safeda. Indian Journal of Science and Technology. 2014;7(9):1451–1453.
15. Singh G, Singh AK, Pandey D. Effect of cropping patterns on fruiting behaviour of guava. Annals of Agricultural Research. 2000;21(2):175-82.
16. Awasthi Priya, Lal Shant. Effect of foliar sprays calcium, boron and zinc on the yield and quality of guava (*Psidium guajava* L.). Pantnagar Journal of Research. 2009;7(2):223-225.
17. Trivedi Nitin, Singh Devi, Bahadur Vijay, Prasad VM, Collis JP. Effect of foliar application of zinc and boron on yield and fruit quality of guava (*Psidium guajava* L.). HortFlora Research Spectrum. 2012;1 (3):281-283.
18. Singh Yatendra Kumar, Singh SS, Singh RajKumar, Prasad VM, Yadav Atul. Assess the effect of different levels of micronutrient on quality attributes of Guava (*Psidium guajava* L.) cv. Allahabad Safeda. Journal of Pharmacognosy and Phytochemistry. 2017;6(6):1340-1345.
19. Kadam SS. Guava In: Hand book of fruit science and technology: Production, composition, storage and processing. 2005;419-433.
20. Ravi Pratap RKS, Gautam Vishal Gangwar, Pradeep Kumar and Rahul Kumar Yadav. Influence of foliar feeding of Ca, Zn and Cu with and without borax on physical parameters of winter season guava (*Psidium guajava* L.) cv. L-49. Biological Forum – An International Journal. 2022;14(2):1282-1285.

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