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Effect of Foliar Application of Micronutrients and Plant Growth Regulators on Quality of Guava (*Psidium Guajava* L.) Cv. Lalit

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ABSTRACT

Lalit guava known for its distinct sweetness and vibrant red color is a favored variety among growers for its exceptional flavor and nutritional qualities. A field experiment was carried out during the year 2020–2021 on seven-year-old red guava trees at a farmer's orchard located in Semmangalam, Anathur, in the Villupuram district. The study aimed to identify the most suitable treatment for improving fruit quality in guava. The trial followed a Randomized Block Design with ten treatment combinations of T_1 (Control), T_2(Boric acid@ 0.4% + GA_3@ 150 ppm), T_3 (Chelated Zinc @ 0.5% + GA_3@ 150 ppm %), T_4(Boric acid @ 0.4% + Chelated Zinc @ 0.5% + GA_3@ 150 ppm), T_5 (Boric acid @ 0.4% + NAA @ 100 ppm), T_6 (Chelated Zinc @ 0.5% + NAA @ 100 ppm), T_7 (Boric acid @ 0.4% + Chelated Zinc @ 0.5% + NAA @ 100 ppm), T_8 (Boric acid @ 0.4% + SA @ 100 ppm) and T_9 (Chelated Zinc @ 0.5% + SA @ 100 ppm), T_{10} (Boric acid@ 0.4% + Chelated Zinc @ 0.5% + SA @ 100 ppm).each replicated three times. For optimal quality parameters such as total soluble solids, total sugars, reducing and non-reducing sugars, TSS/acid and minimal acidity, T_4 (Boric acid @ 0.4% + Chelated zinc @ 0.5% + GA_3 @ 150 ppm) exhibited superior results compared to the control. In contrast, T_7 (Boric acid @ 0.4% + Chelated Zinc @ 0.5% + NAA @ 100 ppm) was found to be most effective in enhancing the ascorbic acid and pectin content when compared to the untreated control.

Keywords: Fruit quality, Guava, Pectin content, Total sugar.

INTRODUCTION

Guava (*Psidium guajava* L.), a member of the Myrtaceae family, is extensively cultivated across tropical and subtropical regions. In India, it holds significant economic importance and is often dubbed the "Apple of the Tropics." This fruit is highly valued for its abundance of pectin and Vitamin C, and it also provides moderate levels of Vitamin A, calcium, phosphorus, pantothenic acid, riboflavin, thiamine, and niacin. Nutritionally, guava contains about 82.5% moisture, 2.45% acidity, 4.45% reducing sugars, 5.25% non-reducing sugars, 9.73 °Brix total soluble solids (TSS), and approximately 260 mg of Vitamin C per 100 grams of fresh fruit. It is especially suited for jelly production, and its juice is often used in ice cream formulations (Shahroon *et al*., 2018). In addition to its nutritional profile, guava exhibits strong antioxidant activity due to its high Vitamin C levels and the presence of bioactive compounds such as carotenoids, isoflavonoids, and polyphenols. Although foliar sprays of micronutrients and plant growth regulators have been shown to improve fruit quality individually, there is limited research on their synergistic effects in guava cultivation.

MATERIALS AND METHODS

The research entitled "Effect of Foliar Application of Micronutrients and Plant Growth Regulators on Quality of Guava (*Psidium guajava* L.) cv. Lalit" was carried out during the year 2020–2021 using seven-year-old red-fleshed guava trees. The study site was a farmer's field located in Semmangalam, Anathur, in the Villupuram district. A Randomized Block Design (RBD) was employed, comprising 10 treatment combinations with three replications each, involving a total of 300 guava plants. The trees were planted at a spacing of 9 × 9 meters to ensure adequate growth and canopy development. The foliar treatments of T_1 (Control), T_2 (Boric acid @ 0.4% + GA_3 @ 150 ppm), T_3 (Chelated Zinc @ 0.5% + GA_3@ 150 ppm %), T_4(Boric acid@ 0.4% + Chelated Zinc @ 0.5% + GA_3 @ 150 ppm), T_5 (Boric acid @ 0.4% + NAA @ 100 ppm), T_6 (Chelated Zinc @ 0.5% + NAA @ 100 ppm), T_7 (Boric acid @ 0.4% + Chelated Zinc @ 0.5% +

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Table 1. Effect of foliar application of micronutrients and plant growth regulators on total sugars, reducing sugar and non-reducing sugar of guava cv. Lalit (*Psidium guajava*).

Treatment	Details	TSS (^{0}Brix)	Total sugars (%)	Reducing sugar (%)	Non-reducing sugar (%)
T_1	Control	7.89	8.03	4.19	3.84
T_2	Boric acid @ 0.4 % + GA_3@ 150 ppm	9.57	9.17	4.81	4.36
T_3	Chelated zinc @ 0.5 % + GA_3@ 150 ppm	8.53	8.38	4.39	3.99
T_4	Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + GA_3@ 150 ppm	12.23	10.65	5.63	5.02
T_5	Boric acid @ 0.4 % + NAA @ 100 ppm	11.59	10.31	5.43	4.88
T_6	Chelated zinc @ 0.5 % + NAA @ 100 ppm	9.17	8.74	4.59	4.15
T_7	Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + NAA @ 100 ppm	10.95	9.96	5.23	4.73
T_8	Boric acid @ 0.4 % + SA @ 100 ppm	10.21	9.52	5.01	4.51
T_9	Chelated zinc @ 0.5 % + SA @ 100 ppm	9.37	9.09	4.79	4.30
T_{10}	Boric acid@ 0.4 % + Chelated zinc @ 0.5 % + SA @ 100 ppm	10.85	9.87	5.21	4.66
S. ED		0.29	0.27	0.14	0.13
CD (p=0.05)		0.61	0.58	0.31	0.27

NAA @ 100 ppm), T_8 (Boric acid @ 0.4% + SA @ 100 ppm) and T_9 (Chelated Zinc @ 0.5% + SA @ 100 ppm), T_{10} (Boric acid@ 0.4% + Chelated Zinc @ 0.5% + SA @ 100 ppm). consisting of various micronutrients and plant growth regulators, were administered at three stages: immediately after pruning, 30 days post-pruning, and 60 days after pruning. Data obtained from the experiment were analyzed statistically in accordance with the methodology proposed by Panse and Sukhatme (1961).

RESULTS AND DISCUSSION

The data (Table 1) indicated significant variations among treatments regarding parameters such as total soluble solids, total sugars, reducing and non-reducing sugars. Significantly higher Total Soluble Solids are observed with the treatment (T_4) with 12.23 °B over control (T_1) 7.89ºB. The observed increase in Total Soluble Solids (TSS) may be attributed to the application of GA_3, which is known to enhance the accumulation of assimilates in developing fruits. GA_3 likely facilitates the mobilization of carbohydrates, promoting the conversion of complex polysaccharides into simpler sugars. Additionally, the role of boron in improving TSS could be linked to its involvement in transmembrane sugar transport. Boron is essential for several physiological and biochemical processes, including chlorophyll synthesis, enzymatic activities, respiration, and photosynthesis. Since sugars are the primary product of photosynthesis, an increase in photosynthetic activity due to boron application may lead to higher sugar synthesis, thereby contributing to greater TSS content in fruit juice (Ram and Bose, 2000). These results were in conformity with the results reported by Kale *et al* (1999) in Ber. The increase in TSS has also been recorded by Yadav *et al* (2018), Lal and Das (2017) and Singh *et al* (2020) in guava.

The perusal of data on total sugars showed that the treatment T4 (Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + GA_3 @ 150 ppm) recorded maximum total sugars of 10.65 % over control (T_1) 8.03 %. This might be due to the fact that GA_3 increases the activity of the enzymes such as amylases, which hydrolyses the complex polysaccharides in to simple sugars.

The data on reducing sugars showed that the treatment T_4(Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + GA_3@ 150 ppm) recorded that maximum reducing sugar of 5.63 % over control (T_1) 4.19 %. This may be due to the fact that boron promotes cell division and development in the growth regions of the plant near the tips of shoots and roots.

Statistically significant variation was recorded for Non-reducing sugar with the application of Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + GA_3 @ 150 ppm. The data on Non-reducing sugar showed that, the treatment T4 recorded that maximum non-reducing sugar of 5.02 % over control (T_1) 3.84 %. The increase in sugar content could be attributed to the higher concentration of GA_3, which enhances the hydrolysis of starch into simpler sugars. The elevated levels of total sugars, including both reducing and non-reducing sugars, may result from the efficient translocation of photosynthates to the developing fruits, regulated by the action of GA_3. This hormone likely facilitates the mobilization of carbohydrates, contributing to improved sugar accumulation in the fruit. These findings are supported by the results obtained by

Table 2. Effect of foliar application of micronutrients and plant growth regulators on acidity, Total Soluble Solids and TSS/acid ratio of guava cv. Lalit (*Psidium guajava*L.)

Treatment	Detail	Acidity (%)	TSS/ Acid	Ascorbic acid (mg/100 g)	Pectin (%)
T_1	Control	0.48	16.60	159.85	0.49
T_2	Boric acid @ 0.4 % + GA_3@ 150 ppm	0.39	25.26	177.58	1.08
T_3	Chelated zinc @ 0.5 % + GA_3@ 150 ppm	0.45	19.13	166.05	0.70
T_4	Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + GA_3@ 150 ppm	0.24	50.96	188.99	1.45
T_5	Boric acid @ 0.4 % + NAA @ 100 ppm	0.27	42.93	194.15	1.66
T_6	Chelated zinc @ 0.5 % + NAA @ 100 ppm	0.42	22.02	171.21	0.86
T_7	Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + NAA @ 100 ppm	0.31	35.32	200.35	1.87
T_8	Boric acid @ 0.4 % + SA @ 100 ppm	0.36	28.36	182.74	1.24
T_9	Chelated zinc @ 0.5 % + SA @ 100 ppm	0.40	24.13	176.37	1.03
T_{10}	Boric acid@ 0.4 % + Chelated zinc @ 0.5 % + SA @ 100 ppm	0.32	33.91	187.90	1.41
S. ED		0.29	0.01	0.87	5.27
CD (p=0.05)		0.61	0.02	1.83	11.07

Agrawal and Dikshit (2010) in sapota and Garasiya *et al* (2013) in guava.

The data presented in Table 2 Statistically significant variation was recorded for acidity with the application of micronutrients and plant growth regulators. A closer observation of data on acidity showed that, the treatment T_4 (Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + $GA_3$150 ppm) recorded as minimum acidity of 0.24 % over control (T_1) 0.45 %. The reduction in acidity content may be attributed to the influence of boron, which becomes neutralized through plant metabolic pathways and is also utilized as a substrate in respiratory processes. The decreased acidity observed in the fruits could also be linked to the advancement of ripening triggered by the application of micronutrients, during which the degradation of organic acids likely takes place. These results are in accordance with the findings of Singh *et al* (2017) and Dutta and Banik (2005) in guava.

The data on ascorbic acid showed that, the treatment T_7 (Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + NAA @ 100 ppm) recorded as maximum ascorbic acid content (200.35 mg) over control T_1 (159.85 mg). An increased in vitamin C content was due to catalytic influence of NAA on bio synthesis of vitamin C.
or both. Similar trend was also observed by Brahmachari *et al* (1997), Dubey *et al* (2002) and Garasiya *et al* (2013) in guava.

The data on pectin content showed that, the treatment T_7 (Boric acid @ 0.4 % + Chelated zinc @ 0.5 % + NAA @ 100 ppm) recorded that maximum pectin content of 0.24 % over control (T_1) 0.49 %. This effect may be attributed to the application of NAA, which facilitates the solubilization of pectic substances from the middle lamella, thereby contributing to an increase in pectin content. Kumar *et al*. (2010) also observed that the application of NAA in guava proved effective in increasing pectin content. Similar trend was also observed by Suman *et al* (2021) and Kumari *et al* (2021).

CONCLUSION

The study highlighted the significant influence of micronutrients and plant growth regulators on fruit quality parameters. Treatment T_4 (Boric acid @ 0.4% + Chelated zinc @ 0.5% + GA3 @ 150 ppm) proved most effective in enhancing total soluble solids, total sugars, reducing sugars, and non-reducing sugars while reducing acidity. Meanwhile, T_7 (Boric acid @ 0.4% + Chelated zinc @ 0.5% + NAA @ 100 ppm) significantly increased ascorbic acid and pectin content. These findings suggested that the combined application of micronutrients and PGRs can effectively improve fruit quality, warranting further research for optimized formulations.

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