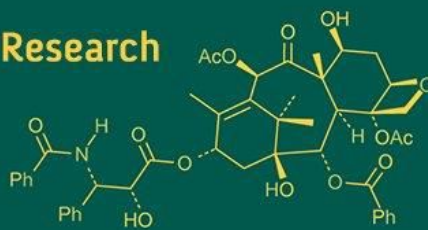


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; SP-8(10): 1418-1420
www.biochemjournal.com
Received: 07-08-2024
Accepted: 11-09-2024

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Studies on pre-harvest spray of plant growth regulators and nutrients to improve the quality of guava (*Psidium guajava* L.) cv. Sardar

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DOI: <https://doi.org/10.33545/26174693.2024.v8.i10Sq.2735>

Abstract

Experiment conducted on Studies on pre-harvest spray of plant growth regulators and nutrients to improve the quality of guava (*Psidium guajava* L.) cv. Sardar in sixteen year old guava under factorial randomized block design at College of Agriculture, Latur VNMKV Parbhani Maharashtra. In interaction effects of GA₃ 50 ppm + Chelated zinc 1.5% has recorded highest fruit diameter (8.13 cm), fruit length (7.48 cm), fruit volume (176.83 ml) and fruit weight (179.23 g). NAA - 50 ppm + Chelated zinc -1.5% has recorded significantly highest fruit set (73.30%), yield per tree (53.65 kg), yield per hectare (148.61 q), was superior in improving the yield guava cv. Sardar.

Keywords: Guava, chelated zinc, NAA, GA₃, fruit set, yield

Introduction

Guava (*Psidium guajava* L.), known as the "apple of the tropics," is a widely grown fruit in tropical, sub-tropical, and some arid regions of India. This fruit, part of the Myrtaceae family, is an excellent and affordable source of vitamin C and pectin (Agnihotri *et al.* 1962) [2]. Its hardy nature allows it to endure harsh climatic conditions and flourish in various soil types, from sandy loam to clay loam (Dhaliwal and Singla 2002) [4]. Guava is a prolific producer and highly profitable, even with minimal care. Thus, it is an ideal fruit crop for yield, nutritional security and economic growth.

The application of plant growth regulators has led to remarkable improvements in various fruit crops, enhancing growth, yield, and quality. Parameters such as average fruit weight, the number of fruits per tree, and yield per tree have all increased with the use of growth regulators. Specifically, GA₃ application enhances the size, shape and weight of fruits, as well as fruit set and retention. The highest fruit yield in guava was observed with a GA₃ spray at 150 ppm. Additionally, NAA application synchronizes flowering and boosts fruit set by reducing fruit drop. NAA has significantly impacted vegetative growth, yield and fruit quality in guava.

Micronutrients are essential for plant growth and development, playing crucial roles in various enzymatic activities and synthesis processes. Acute deficiencies in these elements can cause significant issues (Kumar, 2002) [6]. Improper management of micronutrients can lead to decreased yields and poor fruit quality. Addressing micronutrient-related problems in fruits is crucial to combat hidden hunger. Zinc is vital for chlorophyll formation and enzyme function, while boron is important for pollination and seed development, which are critical for normal fruit development.

Materials and Methods

An experiment was conducted in sixteen years old, well grown, uniform statured trees of guava cv. sardar spaced at 6x6m Studies on pre-harvest spray of plant growth regulators and nutrients to improve the quality of guava (*Psidium guajava* L.) cv. Sardar during July, 2023 to January, 2024 (Hasta bahar crop) at College of Agriculture, Latur VNMKV Parbhani Maharashtra. The experiment was laid out in a randomized block design with factorial concept (FRBD) replicated thrice. The study was carried out with 16 different treatments involving different combinations of PGRs and micronutrients.

Treatmental trees were selected by random numbers. The fruits were harvested based on their maturity indices viz., change in colour of the fruit from dark green to yellowish green.

Aqueous solutions of the PGRs were prepared. Naphthalene acetic acid 50 ppm stock solution was prepared in a beaker, Dissolve it completely by addition of small quantity of 1N NaOH, then made the volume up to 9 litres by addition of distilled water. Gibberellic acid 50 ppm stock solutions were prepared by taking into a beaker by dissolving completely with little quantity of alcohol and the volume was made up to 9 litres by adding distilled water. The calcium nitrate and chelated zinc solutions at 1.5% concentrations were prepared by weighing 1.5gm of calcium nitrate and chelated zinc and dissolving them in little quantity of distilled water, then diluted to 9 litre of water respectively. Plant growth regulators and micronutrients were sprayed using a hand sprayer.

Statistical analysis

The data recorded on yield and yield attributing parameters, physical parameters of the fruit and the quality parameters of guava fruits were tabulated and statistically analyzed by adopting factorial randomized block design with suggested by Panse and Sukhatme (1967) [13]. The differences among the treatment means were tested for significance by F value at 5% level. The critical difference values were calculated at 0.05 levels where ever the treatment mean differences were found to be significant.

Results and Discussion

The data furnished in tables clearly indicate that treated plants with PGRs and micronutrients foliar spray performed significantly increased the quality of fruit.

Fruit set (%)

The effect of growth regulators and micronutrients on fruit set in guava cv. Sardar was presented in the table 1. Significant differences were observed in interaction effect between plant growth regulators and micronutrients on fruit. The maximum fruit set percentage was noticed in treatment P4M4 (NAA 50 ppm + Chelated Zinc 1.5%) (73.30%) which was at par with treatment P4M3 (NAA 50 ppm + Chelated Zinc 1%) (70.13%) and minimum fruit set was noticed in treatment P1M1 (GA₃ 30 ppm + Ca(NO₃)₂ 1%) (53.33%).

The increased fruit set resulting from a heightened concentration of growth substances application, as a consequence of the interaction effect, is likely attributed to the translocation of hormones and food substances, as well as the establishment of favorable conditions for pollination and fertilization of flowers.

Diameter of fruit (cm)

The effect of growth regulators and micronutrients on fruit diameter in guava cv. Sardar was presented in the table 1. Significant differences were observed in interaction effect between plant growth regulators and micronutrients on fruit. Maximum fruit diameter was recorded in GA₃ 50 ppm + chelated zinc 1.5% (8.13 cm). Minimum fruit diameter was recorded in NAA 50 ppm + Calcium nitrate 1% (5.63 cm). The increase in fruit diameter from applying growth regulators is likely due to the accelerated rate of fruit growth, which results from rapid cell division and enlargement. Additionally zinc play a direct role in speeding up cell division and elongation, (Vani NU., 2021) [10] (Shinde *et al.* 2019) [9] thereby improving the size and weight of the fruits.

Length of fruit (cm)

The effect of growth regulators and micronutrients on fruit

length in guava cv. Sardar was presented in the table 1. Significant differences were observed in interaction effect between plant growth regulators and micronutrients on fruit length in guava. Maximum fruit length was recorded in GA₃ 50 ppm + chelated zinc 1.5% (7.48 cm). Minimum fruit length was recorded in NAA 50 ppm + Calcium nitrate 1% (5.26 cm).

In the present investigation, GA₃ 50 ppm found almost equally effective in influencing the fruit length in guava cv. L-49. The increase in fruit length with GA₃ 50 ppm can be linked to the promotion of cell division through the indirect biosynthesis of auxins (Lal *et al.*, 2013) [7]. The enhancement in fruit size is attributed to the accelerated rate of cell division and enlargement, along with increased intercellular space due to the application of higher concentrations of growth substances. Additionally zinc play a direct role in speeding up cell division and elongation, thereby improving the size and weight of the fruits.

Weight of Fruit (g)

The effect of growth regulators and micronutrients on fruit weight in guava cv. Sardar was presented in the table 1. Maximum fruit weight was recorded in GA₃ 50 ppm + chelated zinc 1.5% (179.23 g). Minimum fruit weight was recorded in NAA 50 ppm + Calcium nitrate 1% (141.49 g). GA₃ promoted the deposition of solids, leading to increased cell size by enhancing water accumulation in the intercellular spaces (Dhaker *et al.*, 2013) [3]. (Sayed *et al.* (2004) [11] observed that GA₃ sprays increased the weight, length and diameter of Valencia oranges.

Fruit volume (ml)

The effect of growth regulators and micronutrients on fruit volume in guava cv. Sardar was presented in the table 1. Maximum fruit volume was recorded in GA₃ 50 ppm + chelated zinc 1.5% (176.83 g). Minimum fruit weight was recorded in NAA 50 ppm + Calcium nitrate 1% (138.99 g). Hormone-mediated direct transport and accumulation, ensuring balanced distribution of photosynthetic assimilates to the developing fruit. This process supports the nutritional needs of the fruit throughout its development (Anawal *et al.*, 2015) [2] (Shinde *et al.* 2019) [9]. Consequently, the increase in fruit length and diameter significantly boosts the fruit's weight and fruit volume.

Yield per tree (kg)

The effect of growth regulators and micronutrients on yield per tree in guava cv. Sardar was presented in the table 1. Maximum yield per tree was recorded in NAA 50 ppm + chelated zinc 1.5% (53.65 kg). Minimum yield per tree was recorded in GA₃ 30 ppm + Calcium nitrate 1% (28.52 kg). NAA increases fruit set by reducing fruit drop and thereby higher fruit yield. The increase in yield by growth regulators and micronutrients was associated with higher rate of cell division, enlargement, photosynthesis and increase in enzymatic activities as well as involvement of biosynthesis of auxin, (Vani., 2021) [10] increase in the number of fruits, low percentage of fruit drop, more fruit retention and increased fruit size and weight and ultimately increased the yield (Mahaveer *et al.* 2017) [12].

Fruit yield per hectare (t ha⁻¹)

The effect of growth regulators and micronutrients on yield per hectare in guava cv. Sardar was presented in the table 1. Maximum yield per hectare was recorded in NAA 50 ppm + chelated zinc 1.5% (148.61 q). Minimum yield per tree was recorded in GA₃ 30 ppm + Calcium nitrate 1% (79.00 q). The increase in yield per hectare can be attributed to the enhanced volume and weight of the fruit resulting from the combined application of PGRs and micronutrients. There is a positive and significant correlation between fruit length

and diameter with fruit weight, (Vani NU., 2021) ^[10] as well as an increased number of fruits, reduced fruit drop and

improved fruit retention. These factors collectively contribute to higher yield per tree and ultimately per hectare.

Table 1: Effect of pre harvest spray of PGRs and micronutrients on fruit size, weight and yield of guava cv. Sardar

Treatments	Fruit set (%)	Diameter of fruit (cm)	Length of fruit (cm)	Weight of fruit (g)	Volume of fruit (ml)	Yield per tree (kg)	Fruit yield per hectare (t ha ⁻¹)
Plant growth regulators							
GA ₃ – 30 ppm	57.23	6.77	6.28	165.55	163.11	31.32	86.76
GA ₃ – 50 ppm	59.97	7.42	6.82	174.47	172.07	34.74	96.24
NAA – 30 ppm	61.91	6.13	5.61	154.52	152.04	36.34	100.67
NAA – 50 ppm	65.28	6.62	5.99	160.66	158.28	42.67	118.19
S.E ±	2.44	0.37	0.36	5.41	5.39	2.42	6.70
C.D. at 5%	7.05	1.06	1.03	15.62	15.58	6.98	19.34
Micronutrients							
Ca(NO ₃) ₂ - 1%	55.72	5.92	5.45	153.69	151.27	30.79	85.29
Ca(NO ₃) ₂ - 1.5%	59.51	6.40	5.86	160.91	158.42	33.28	92.19
Chelated Zinc - 1%	63.26	7.11	6.51	168.09	165.63	38.94	107.88
Chelated Zinc – 1.5%	65.90	7.51	6.89	172.51	170.20	42.06	116.50
S.E +	2.44	0.37	0.36	5.41	5.39	2.42	6.70
C.D. at 5%	7.05	1.06	1.03	15.62	15.58	6.98	19.34
Interaction (PxM)							
GA ₃ – 30 ppm + Ca(NO ₃) ₂ -1%	53.33	5.70	5.32	158.07	155.57	28.52	79.00
GA ₃ – 30 ppm + Ca(NO ₃) ₂ -1.5%	57.30	6.07	5.59	165.23	162.63	31.00	85.86
GA ₃ – 30 ppm + Chelated zinc -1%	58.13	7.64	7.05	166.75	164.19	32.26	89.36
GA ₃ – 30 ppm + Chelated zinc -1.5%	60.17	7.68	7.16	172.14	170.07	33.50	92.80
GA ₃ – 50 ppm + Ca(NO ₃) ₂ -1%	55.90	6.20	5.64	168.50	166.24	30.39	84.18
GA ₃ – 50 ppm + Ca(NO ₃) ₂ -1.5%	59.83	7.53	6.95	172.91	170.41	32.52	90.07
GA ₃ – 50 ppm + Chelated zinc -1%	61.12	7.80	7.23	177.24	174.81	35.92	99.49
GA ₃ – 50 ppm + Chelated zinc -1.5%	63.03	8.13	7.48	179.23	176.83	40.15	111.23
NAA – 30 ppm + Ca(NO ₃) ₂ -1%	56.63	5.63	5.26	141.49	138.99	31.97	88.57
NAA – 30 ppm + Ca(NO ₃) ₂ -1.5%	60.25	5.80	5.31	142.58	140.08	33.17	91.88
NAA – 30 ppm + Chelated zinc -1%	63.67	6.33	5.72	163.67	161.16	39.29	108.85
NAA – 30 ppm + Chelated zinc -1.5%	67.10	6.76	6.16	170.34	167.94	40.93	113.38
NAA – 50 ppm + Ca(NO ₃) ₂ -1%	57.00	6.14	5.56	146.71	144.28	32.27	89.40
NAA – 50 ppm + Ca(NO ₃) ₂ -1.5%	60.67	6.20	5.58	162.91	160.54	36.44	100.94
NAA – 50 ppm + Chelated zinc -1%	70.13	6.66	6.06	164.71	162.34	48.31	133.81
NAA – 50 ppm + Chelated zinc -1.5%	73.30	7.47	6.76	168.31	165.94	53.65	148.61
S.E(m) ±	1.63	0.25	0.24	3.61	3.60	1.61	4.47
CD at 5%	4.70	0.71	0.69	10.42	10.38	4.66	12.90

Conclusion

Keeping in view the results summarized above, T₈ GA₃ 50 ppm + chelated zinc 1.5% has recorded significantly maximum fruit weight, fruit volume, fruit diameter and fruit length. Maximum yield per tree was recorded in T₁₆ NAA 50 ppm + chelated zinc 1.5% is best treatment to improve the yield of guava cv. Sardar.

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