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Effect of Foliar Spray of NAA and Zinc on Growth, Flowering and Yield Parameters of Guava *(Psidium guajava)* cv. Lucknow-49 under Western Uttar Pradesh conditions

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ABSTRACT: An experiment was carried out at Horticulture Research Centre, Department of Fruit Science, Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut (U.P.), India, during two consecutive years i.e., 2021-22 and 2022-23 to assess the Influence of foliar application of NAA and Zinc on growth, flowering, fruiting and yield of guava cv. Lucknow-49 under western Uttar Pradesh conditions. By supplying the nutritional requirements of fruit crops, the foliar application of micronutrients and plant growth regulators plays a significant role in controlling numerous physiological phenomena, boosting the yield and quality, and increasing the productivity of plants. Twelve treatments *viz.*, three levels each of NAA (0, 50, 75, and 100 ppm) and Zinc (0, 0.4, 0.6, and 0.8%) with their combinations were used, which were replicated thrice in FRBD from the experiments. Out of the Twelve treatment applied, the results revealed that treatment T12 recorded the highest number of leaves per shoot (15.11 and 15.26), number flower per shoot (20.14 and 20.65) and Maximum fruit yield kg/plant (59.56 and 58.81 kg/plant). Among urea and zinc doses, T4 and T9 were found to be best. In the western Indian Indo-Gangetic plains, the combination can be perfect and advised for the cultivation of guava.

Keywords: Guava, NAA, Zinc, Growth, Flowering, Yield Parameters, Foliar Spray.

INTRODUCTION

The guava (*Psidium guajava* L.), a resilient fruit crop vital for commerce, is planted across the world's tropical and subtropical climates (Negi *et al.*, 1998). Guava, a member of the Myrtaceae family, is thought to have originated in Tropical America, namely from Mexico to Peru, and has a chromosome number of 2n = 22 (Menzel, 1985; Boora, 2012). However, according to Raman *et al.* (1971), the triploid guava species without seeds has chromosomal number 2n = 33. It is sometimes referred to as "Apple of the Tropics" due to its wide range of applications as a staple fruit of the tropics and typically eaten as a fresh fruit (Webber, 1944; Menzel, 1985). However, precise blooming and fruiting times are seen in areas where seasons are well defined owing to variations in temperature, precipitation, or both. Ambebahar (February-March), Mrigbahar (June-July), and Hasta bahar (October-November) are the three distinct guava flowering seasons, and the respective fruiting times are in these seasons (Shukla *et al.*, 2008).

According to the National Nutrient Database published by the United States Department of Agriculture (USDA) in 2018, 100 g of guava fruit includes 14.3 g crabs, 5.4 g total dietary fiber, 8.92 g sugar, and 2.55 g protein. In addition, it is a good source of vitamin C (228 mg), vitamin A (31 g), potassium (417 mg), phosphorus (40 mg), magnesium (22 mg), calcium (18 mg), and iron (0.26 mg) (Anonymous, 2018). Pectin (0.78%) is another abundant substance found in the guava fruit. In recent years, it has become clear how crucial synthetic plant bioregulators and micronutrients are for increasing yields. Micronutrients play a crucial part in the metabolism of plants, from the construction of cell walls through respiration, photosynthesis, chlorophyll creation, enzyme activity, hormone synthesis, nitrogen fixation, and reduction. They also aid in the absorption of larger nutrients. However, the physical, chemical, and reproductive factors are enhanced with the use of plant bio-regulators, resulting in greater fruit set and fruit yield without degrading fruit quality. Fruit tree foliar feeding has grown in relevance in recent years as the amount of nutrients needed to be delivered via the soil has increased due to leaching.

The auxin group's key growth regulator, naphthalene acetic acid (NAA), boosts fruit set, lowers fruit drop, and improves the quality of many fruits. NAA is used in agriculture. To notice the predominance of the improvement in growth and blooming, several scientific studies have been conducted in this context on various fruit crops, including guava. Qualities related to fruiting and yield quality. According to Gardner (1951), plants' auxin content is increasing, which inhibits abscission. The movement of carbohydrates, the production of auxin, enhanced pollen viability and fertilization, ovule development, pollen tube expansion, and fruit set are all significantly influenced by boron. These actions enhance the diameter and length of the fruits, increasing their production in the process and High auxin content in the abscission zone prevents the fruit drop (Briggs and Leopoid 1958).

MATERIALS AND METHODS

The current investigation, titled Effect of Foliar Spray of NAA and Zinc on Growth, Flowering and Yield Parameters of guava (*Psidium guajava*) cv. Lucknow-49 under Western Uttar Pradesh conditions" was conducted in the years 2021–2022 and 2022–2023 at the Horticultural Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology in Meerut, Uttar Pradesh, India. Experimental field is positioned 237.75 meters above mean sea level, at 29°04 North latitude and 77° 42 East longitudes. It was decided to examine the Lucknow-49 variety. The trial period was conducted with plants spaced 6 × 6 m apart and with consistent cultural practices. Fruit yield (q/ha) and the quantity of fruits per tree were all observed over the time period. There were 12 treatments in the study, each duplicated three times, and it was set up using a Factorial Randomized Block Design (FRBD). Number of leaves per shoot, Number of flower per shoot and yield kg/ plant was recorded as the growth, flowering and yield characteristics.

Table 1: Treatment details.

Treatment	Treatment combination	Dose
T_1	NAA_0Zn_0 (Control)	Water Spray
T_2	NAA_0Zn_1	Zinc 0.4%
T_3	NAA_0Zn_2	Zinc 0.6%
T_4	NAA_0Zn_3	Zinc 0.8%
T_5	NAA_1Zn_0	NAA 50 ppm
T_6	NAA_1Zn_1	NAA 50 ppm+ Zinc 0.4%
T_7	NAA_1Zn_2	NAA 50 ppm + Zinc 0.6%
T_8	NAA_1Zn_3	NAA 50 ppm + Zinc 0.9 0.8%
T_9	NAA_2Zn_0	NAA 75 ppm
T_{10}	NAA_2Zn_1	NAA 75 ppm + Zinc 0.4%
T_{11}	NAA_2Zn_2	NAA 75 ppm + Zinc 0.6%
T_{12}	NAA_2Zn_3	NAA 75 ppm + Zinc 0.8%

A. Parameters of study

(i) Number of leaves per shoot. At the time of measuring the length of the tagged shoots for each treatment, the total number of leaves was noted. The average number of leaves for each treatment was determined, and the results were statistically analyzed.

(ii) Number of flower per shoot. Shoots that were used to document the characteristics of vegetative growth were also used to note the observations of fruiting and blooming characteristics.

(iii) Yield (kg/plant). At each harvesting under each treatment, the weight of the fruits was noted, and at the final harvesting, the total yield per tree was determined.

B. Statistical Analysis

The observations recorded during the course of the investigation were subjected to statistical analysis by adopting appropriate model analysis of variance (ANOVA) According to the procedure described by Panse and Sukhantme (1985). Critical differences (CD) within the treatment were calculated to compare the treatment at (1 percent 5 percent level) of significance only:

(1) C.F. = $\frac{GT^2}{N}$

(2) T.S.S = $(X^2_1 + X^2_2 + X^2_3 X^2_n)$ - C.F.

(3) S.S. for error = TSS – Tr.S.S.

(4) Table for analysis of variance

RESULTS AND DISCUSSION

A. Number of leaves per shoot

During both the years, application of NAA, zinc and their combination significantly influenced the number of leaves per shoot as depicted in Table 2 and Fig. 1. Highest number of leaves per shoot with the application of NAA and zinc singly and their combination was recorded in, treatment T9 NAA_2Zn_0 NAA 75 ppm (12.04 and 12.16) and treatment T4 NAA_0Zn_3 Zinc 0.8% (11.07 and 11.18) and treatment T12 NAA_2Zn_3 NAA 75 ppm + Zinc 0.8% (15.11 and 15.26) in both the years, respectively while, the lowest number of leaves per shoot was recorded in T1 - control i.e. 10.33 and 10.44, respectively. Treatment T2, T6 and were found to be at par with treatment both the year. The results are partially consistent with findings of by EI-Sherif *et al*. (2000); Balakrishnan (2001), Sarolia *et al*. (2007) The reason for increase in number of leaves per shoot Zinc and NAA therapy may be responsible for the increase in the number of leaves in the current study as its presence, particularly at the conductive tissues, plays a significant role in promoting the vegetative growth of fruit plants. The water relationship in cells, which encourages the transfer of major and micronutrients and, in turn, increases the number of leaves in fruit plants, is another area where zinc is thought to have a role.

B. Number of flowers per shoot

During both the years, application of NAA, zinc and their combination significantly influenced the number of flower per shoot as depicted in Table 3 and Fig. 1. Highest number of flower per shoot with the application of NAA and zinc singly and their combination was recorded in, treatment T9 NAA_2Zn_0 NAA 75 ppm (15.62 and 16.02) and treatment T4 NAA_0Zn_3 Zinc 0.8% (15.20 and 15.58) and treatment T12 NAA_2Zn_3 NAA 75 ppm + Zinc 0.8% (20.14 and 20.65) in both the years, respectively while, the lowest number of flower per shoot was recorded in T1 - control i.e. 12.09 and 12.40, respectively. Treatment T2, T6 and were found to be at par with treatment both the year. The results are partially consistent with findings of by Anand *et al.* (2003); Vani *et al.* (2020), Lenka *et al.* (2019); Sahay *et al.* (2018) in Litchi, Prajapati and Singh (2018), The reason for increase in number of flower per shoot The enhanced expansion of the guava's terminal and lateral branches may have contributed to the rise in blooming and fruiting characteristics by causing a greater number of flower buds to develop and The exogenous administration of NAA in the current experiment may have prevented the abscission layer, increasing fruit retention. Auxin treatment has been suggested as a way to improve fruit quality.

C. Yield (kg/plant)

NAA and Zinc combination significantly influenced the fruit yield kg/plant as depicted in Table 4 and Fig. 1 Highest fruit yield kg/ plant with the application of NAA and zinc singly and their combination was recorded in treatment T9 NAA_2Zn_0 NAA 75 ppm (46.49 and 45.89 kg/plant), treatment T4 NAA_0Zn_3 Zinc 0.8% (45.74 and 45.15 kg/plant) and treatment T12 NAA_2Zn_3 NAA 75 ppm + Zinc 0.8% (59.56 and 58.81 kg/plant) in both the years, respectively. The lowest yield kg/pant in both the years was recorded in T1 - control i.e. 37.23 and 36.75 kg, respectively. Treatment T5 and T7 were found to be at par with treatment T11 in the first year only. The results are consistent with the findings of Dutta and Banik (2007); Awasthi and Lal (2009); Kumar *et al.* (2010); Badal and Tripathi (2021) and Pratap *et al.* (2022). The reason for increase in yield kg/ plant Every researcher's primary objectives are to increase quantitative yields and elevate the caliber of the materials gathered. It is well recognized that foliar feeding plants with micronutrients or growth hormones alters their metabolic processes, enhancing yields and other plant potential. The plant's yield metrics in the current study were significantly impacted by treatments with zinc and NAA. Larger, heavier, and higher fruit sets may be the cause of this increase in yield.

Table 2: Effect of foliar sprays of NAA, Zinc and their interactions on Number of leaves per shoot of guava cv L-49.

	2021-22					2022-23				
	Control (Zn_0)	Zn_1 (0.4)	Zn_2 (0.6)	Zn_3 (0.8)	Mean	Control (Zn_0)	Zn_1 (0.4)	Zn_2 (0.6)	Zn_3 (0.8)	Mean
Control NAA(N_0)	10.33	10.48	10.94	11.07	10.71	10.44	10.59	11.05	11.18	10.82
NAA 50ppm (N_1)	10.77	12.98	14.16	14.72	13.16	10.88	13.11	14.31	14.87	13.29
NAA 75ppm (N_2)	12.04	13.98	14.51	15.11	13.91	12.16	14.12	14.66	15.26	14.05
Mean	11.05	12.48	13.20	13.63		11.16	12.61	13.34	13.77	
	N	**Z**	**NXZ**			**N**	**Z**	**NXZ**		
C. D	0.68	0.78	1.35			0.69	0.79	1.37		
S. E. (d)	0.33	0.38	0.65			0.33	0.38	0.66		

Table 3: Effect of foliar sprays of NAA, Zinc and their interactions on Number of flower per shoot of guava cv L-49.

	2021-22					2022-23				
	Control (Zn_0)	Zn_1 (0.4)	Zn_2 (0.6)	Zn_3 (0.8)	Mean	Control (Zn_0)	Zn_1 (0.4)	Zn_2 (0.6)	Zn_3 (0.8)	Mean
Control NAA(N_0)	12.09	13.08	14.07	15.20	13.61	12.40	13.41	14.42	15.58	13.95
NAA 50ppm (N_1)	14.91	16.42	17.90	18.65	16.97	15.29	16.84	18.36	19.13	17.40
NAA 75ppm (N_2)	15.62	17.31	19.47	20.14	18.14	16.02	17.75	19.97	20.65	18.60
Mean	14.21	15.60	17.15	18.00		14.57	16.00	17.58	18.46	
	N	**Z**	**NXZ**			**N**	**Z**	**NXZ**		
C. D	0.87	1.01	NS			1.02	1.18	NS		
S. E. (d)	0.42	0.49	0.84			0.49	0.57	0.98		

Table 4: Effect of foliar sprays of NAA, Zinc and their interactions on yield (kg/plant) of guava cv L-49.

	2021-22					2022-23				
	Control (Zn_0)	Zn_1 (0.4)	Zn_2 (0.6)	Zn_3 (0.8)	Mean	Control (Zn_0)	Zn_1 (0.4)	Zn_2 (0.6)	Zn_3 (0.8)	Mean
Control NAA(N_0)	37.23	39.70	42.16	45.74	41.21	36.75	39.18	41.62	45.15	40.67
NAA 50ppm (N_1)	46.16	49.84	54.17	56.28	51.61	45.57	49.21	53.48	55.56	50.95
NAA 75ppm (N_2)	46.49	51.31	57.63	59.56	53.75	45.89	50.65	56.90	58.81	53.06
Mean	43.29	46.95	51.32	53.86		42.73	46.35	50.66	53.17	
	N	**Z**	**NXZ**			**N**	**Z**	**NXZ**		
C. D	1.22	1.41	2.44			1.18	1.36	2.35		
S. E. (d)	0.59	0.68	1.18			0.57	0.65	1.13		

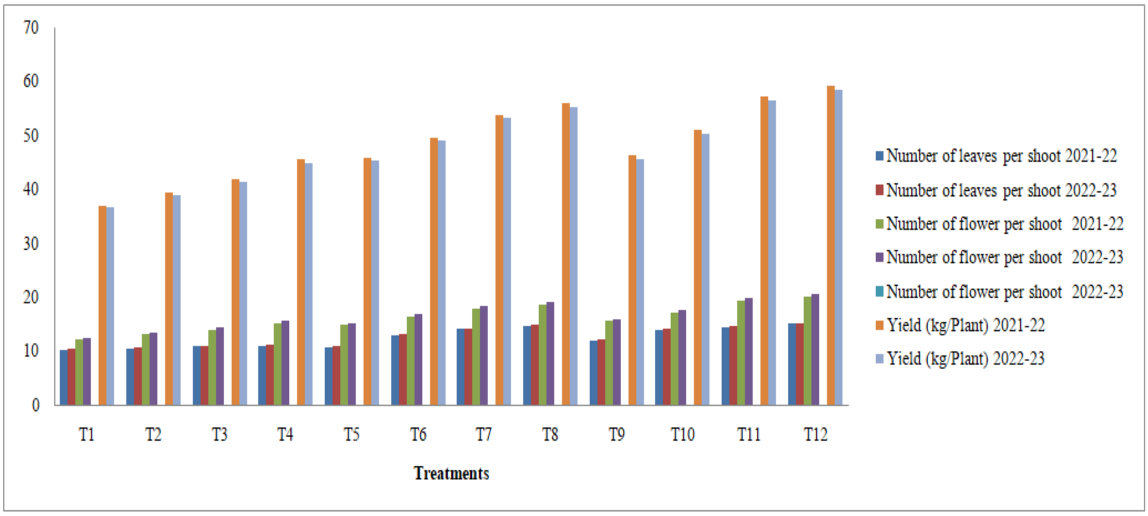

Fig. 1. Effect of foliar sprays of NAA, Zinc and their interactions on Number of flower per shoot, Number of leaves per shoot, fruit yield kg/ plant of guava cv L-49.

CONCLUSIONS

Based on the aforementioned experiment, it was shown that NAA and zinc had a substantial impact on the development, blooming, and yield characteristics of the guava cv. L-49. One may draw the conclusion that guava plants sprayed with a mixture of NAA 75 ppm + Zinc 0.8% produced the highest possible number of leaves per shoot, flowers per shoot, and yield kg/plant. Zinc 0.8% and NAA 75 ppm worked the best as single dosages. Therefore, it is suggested that under the conditions of western Uttar Pradesh, guava trees be sprayed with a mixture of NAA 75 ppm and zinc (0.8%) three times, beginning one month prior to flowering, at full bloom, and at fruit set, along with suggested cultural practices.

FUTURE SCOPE

The study's potential holds considerable and advantageous effects on the yield characteristics of guava trees, boosting the fruit sector. To improve plant development, nitrogen absorption, and total production, these cutting-edge nutrient delivery technologies and new agricultural practices are used. Guava plants may more effectively absorb and use nutrients if zinc formulations are used. Increased fruit output and total yield might result from this improved nutrient availability, which would boost farmers' financial returns.

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Conflict of Interest. None.

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