Original Research Article

Effect of plant growth regulators on Growth, Fruit setting and Quality of Guava (*Psidium guajava* L.) in meadow orchard

ABSTRACT

The current study, **"Effect of Plant Growth Regulators on Growth, Fruit setting, and Quality of Guava (*Psidium guajava* L.) in Meadow Orchard,"** was carried out in the years 2021–2022, at Central Research Farm, Department of Horticulture, Sam Higginbottom Institute of Agriculture & Sciences, Prayagraj (U.P.). Ten treatments make up the experiment: one control, three concentrations of gibberellic acid (GA_3) at 75, 100, and 125 ppm, three concentrations of naphthalene acetic acid (NAA) at 200, 250, and 300 ppm, and three concentrations of chlormequat (CCC) at 400, 500, and 600 ppm. These treatment were evaluated in Randomized Blocked Design with three replications. According to the experiment's findings, a combination of different plant growth regulators had a significant impact on the guava plant's growth and yield parameters, including its height (5.81 m), total number of flowers per plant (178.58), fruiting buds per plant (151.80), number of fruits per plant (127.13), fruit set (71.19 percent), plant spread (E-W-6.00 m & N-S- 5.89 m), fresh fruit weight (115.47g), and dry (78.52g), Fruit diameter (polar-8.46cm & radial-8.16cm), total soluble solids (TSS) 10.170Brix, total sugar (9.2%), and yield/plant (14.68kg) were all found to be higher under the treatment T4 Naphthalene acetic acid (NAA) @200ppm, whereas acidity (0.56 percent) was at its highest in T_0 Control. T_4 Naphthalene acetic acid (NAA) had significant effect on vegetative growth , yield and quality of fruit.

Key words: *Guava, GA_3, NAA, CCC, yield, Economics.*

INTRODUCTION

Guava (*Psidium guajava* L.), belongs to the Myrtaceae family, it is a fruit that originated in Mexico or Central America and is now found across tropical America and the Caribbean. It was first introduced to India in the 17th century. It is known as the apple of the tropics and is a crucial tropical fruit crop that is produced throughout tropical and subtropical regions. It is referred to as poor man's fruit. Guavas are a highly common and well-liked fruit because of

its affordable pricing, nutritional content, and pleasant taste. Although the fruit (berry) has a great source of pectin (0.5–1.8%) and ascorbic acid, it is poor in calories (Adsule & Kadam, 1995). Due to its hardy nature and prolific bearing even on marginal lands, the guava is a significant fruit crop throughout the country's tropical and subtropical areas. Its cultivation takes minimal attention and resources. The production method for this crop, however, has recently undergone a paradigm change from subsistence farming to commercial agriculture. Due to the extensive tree canopy, the traditional style of farming sometimes presented difficulties in achieving required levels of output. As a result, it became necessary to enhance the current manufacturing system in addition to raising its productivity. Modern fruit farming techniques like the Meadow Orchard use tiny or dwarf trees with modified canopies. This system can support 5000 plants per hectare, which are planted at a 2.0 x 1.0 m spacing and are regularly topped at especially during initial stages. Guava topping and hedging are useful for limiting tree growth and increasing fruit supply. To assess the potential of this method, a comparison between the meadow orchard system and the conventional method of fruit cultivation is required. The best-quality fruits are produced by Uttar Pradesh, the major producer. But since they are so fragile, the fruits are blemished, and biochemical post-harvest alterations make them softer, causing rotting. Fresh fruit rotting can be efficiently reduced, however its storage life can be extended. Plant growth regulators, such as auxins, gibberellins, and growth retardants, such as cycocel, have been employed in recent years to enhance fruit quality, postpone storage-related degradation, and lengthen shelf life (Katiyar et al., 2008).

MATERIALS AND METHOD

A field experiment was conducted during 2021-22 at Central Research Farm, Department of Horticulture, Sam Higginbottom Institute of Agriculture & Sciences, Prayagraj (U.P.). The experiment was conducted in randomized block design. The experiment consist of ten treatments of foliar spray of GA_3, NAA and CCC. The treatment were control (T_0) Gibberellic acid (GA_3) @75ppm (T_1), Gibberellic acid (GA_3) @100ppm (T_2), Gibberellic

acid (GA_3) @125ppm (T_3), Naphthalene acetic acid (NAA) @200ppm (T_4), Naphthalene acetic acid (NAA) @250ppm (T_5), Naphthalene acetic acid (NAA) @300ppm (T_6) Chlormequat (CCC) @400ppm (T_7), Chlormequat (CCC) @500ppm (T_8), Chlormequat (CCC) @600ppm (T_9). The growth criteria are, Plant girth (cm), quantity of blooms per plant overall, a plant's fruiting bud count, fruit yields per plant, At the time of application of the treatment and at harvest, the spread of the plants was measured with the use of a measuring equipment, and the increase in that spread during the course of the experiment was determined. By randomly choosing five branches from a tree's various directions, flowering and fruiting traits were noted. The observations on the fruit yield factors were noted, and the yield per tree (in kg) was calculated using the average fruit weight of five fruits and the total number of fruits. Fruit quality characteristics were noted in the data. Utilizing average-sized fruits randomly selected from each replication, physical and chemical characteristics of fruits were assessed. A hand refractometer was used to calculate the TSS (0Brix). A.O.A.C.'s simple acid-alkali titration technique was used to assess acidity (1970). The Nelson technique was used to determine the sugars in fruits (1944). Ranganna's instructions for the ascorbic acid assay technique were followed (1977).

RESULT AND DISCUSSION

The effects of several treatments on the tree's growth parameter traits were considerable (Table 1). Maximum height growth, number of fruiting buds per plant, and total number of flowers per plant fruit yields per plant, With foliar NAA @200ppm treatment, plant spread in N-S and E-W directions may be attributable to auxins' rapid absorption, which raised the endogenous auxin level and caused cell elongation and boosted vegetative development. The most fruit was recorded after using a foliar spray of NAA at 200 ppm Jain and Dashora (2007) and Prajapati and Singh (2008) both reported findings that were similar (2015). Deblossoming of crops during the wet season, which raised the carbohydrate content and shoot and was supposed to enhance fruit set in the winter, is the cause of the increased fruit.

Application of various PGR has a substantial impact on the parameters relating to distinct Fruit development Characteristics (Table 2). Maximum yield per plant (14.68 kg) was obtained with foliar spray of @200ppm NAA. Maximum fresh fruit weight (g) (115.47), dry fruit weight (g) (78.52), fruit diameter (cm) at harvest Polar (8.46 cm) and Radial (8.16 cm), according to Garasiya et al. (2012).

According to the findings (Table 3), applying different PGR greatly enhanced the fruit quality of guavas in terms of TSS (^{0}Brix) total sugars, fruit acidity content, and ascorbic acid percentage.

According to the results of the current experiment, the administration of treatment T_4 (Naphthalene acetic acid (NAA) @ 200 ppm had a substantial impact on the vegetative development, yield, and fruit quality of guava (Psidium guajava L.) under Prayagraj conditions. The experiment used a straightforward RBD design with three replications and 10 treatments. Foliar sprays applied at intervals of 15 days were employed together with three growth regulators with nine concentrations. Below is a summary of the investigation's findings:

Since the F Cal value was higher than the F Tab value, the plant height data suggests that the differences were considerable. The maximum plant height was substantially recorded by treatment T_4 (5.81 m), which was followed by T5 (5.67 m), whereas the lowest plant height was significantly recorded by treatment T_0 Control (3.73 m). Additionally, it was discovered that Treatment T_5 was on par with Treatment T_4.

Because the F Cal value was higher than the F Tab value, the impact of plant growth regulators on the plant spread (m) (E-W) and (N-S) of guava was determined to be significant. Treatment T_0 Control recorded significantly the lowest Plant spread (m) (E-W) and (N-S) of Guava, i.e., 4.21 m and 3.28 m respectively. Treatment T_4 was found to be the best and recorded significantly the highest Plant spread (m) (E-W) and (N-S) of Guava, i.e., 6 m and 5.9 m respectively. This was followed by T_5, i.e., 5.87 m and 5.

The data on the number of guava (*Psidium guajava* L.) blooms per plant shows that the differences were substantial since the F Cal value was higher than the F Tab value. The results showed that Treatment T_4 produced considerably more guava flowers per plant (178.58), followed by Treatment T_5 (176.06), whereas Treatment T_0 Control produced significantly less guava flowers per plant (144.33).

Since the F Cal value was higher than the F Tab value, the data on the number of fruiting buds per plant of guava (*Psidium guajava* L.) suggests that the differences were significant. In comparison to treatment T_0 Control, which recorded considerably the lowest number of flowers per plant of guava (122.68), treatment T_4 was shown to be the best and recorded significantly the largest number of fruiting buds per plant of guava (151.80), followed by T_5.

The statistics on the number of guava (*Psidium guajava* L.) fruits produced per plant shows that the differences were substantial since the F Cal value was higher than the F Tab value. The results showed that treatment T_4 produced the maximum number of guava fruits per plant (127.13), followed by treatment T_5 (123.08), whereas treatment T_0 Control produced the fewest number of guava fruits per plant (82.94).

The data in the table makes it clear that there were substantial differences between the treatments in terms of the fresh weight of the fruits. The treatment T_4 (Spray of NAA 200 ppm), which was much better than all the treatments, produced the highest fresh weight (115.47g). In terms of statistics, treatment T_5 (250 ppm) was comparable to T_4 and T_6. 114.05 grammes were reported. Under T_0, the smallest fresh weight (84.04grams) was noted (Control).

The information in the table confirms that there were substantial differences between the treatments in terms of the plant's total number of blooms. The treatment T_4 (Spray of NAA@ 200 ppm), which was statistically comparable to T_4 but considerably better than all other treatments except for T_5, produced the largest dry weight of fruit (78.52g). Fruits' smallest dry weight (57.14 g) was reported under T_0 (Control).

The F Cal value was higher than the F Tab value, according to the data on the Fruit polar and radial diameter (cm) of Guava (*Psidium guajava* L.), indicating that the differences were significant. Treatment T0 Control recorded significantly the lowest Fruit polar and radial diameter (cm) of Guava, i.e., 6.46 cm & 6.66 cm. Treatment T_4 was found to be the best and recorded significantly the highest Fruit polar and radial diameter (cm) of Guava, i.e., 8.46 cm & 8.16 cm, respectively. This was followed by T_5, i.e., 8.42 cm & 8.11 cm.

All of the treatments had a noticeable impact on the percentage of fruit set. The information in the table above shows that NAA usage had a favourable impact on the plants' ability to produce fruit. The treatment T_4 (Spray of NAA @ 200 ppm), which was discovered to behave much better than all the treatments under evaluation, produced the highest fruit set percentage (71.19 percent). Under T_0, the smallest fruit set percentage (57.47%) was seen (Control).

The treatment T_4 (Spray of NAA @ 200 ppm), which was discovered to behave much better than all the treatments under evaluation, had the highest fruit output per plant (14.68 kg). Under T_0, the smallest fruit output per plant (6.97 kg per plant) was noted (Control).

The treatment of NAA @ 200 ppm (T_4) recorded the highest TSS (10.17 °Brix), which was noticeably better than the other treatments. Whereas the control group had the lowest TSS (8.08 °Brix) (T_0).

Treatments	Plant height	Flowers/Plant	Buds/Plant	Fruits/Plant	Plant Spread (m)

The findings demonstrated that treatment of NAA at 200 ppm resulted in the least amount of acidity (0.40 percent) (T_4). A high of 0.52 percent acidity was found in the control treatment (T_0), in contrast.

The treatment with NAA @ 200 ppm (T_4) had the highest Total Sugars (9.20 percent), outperforming all other treatments statistically except for T_5, which was statistically equal to it. In contrast, the control group had the lowest level of total sugars (6.48 percent) (T_0).

The treatment with NAA at 200 ppm (T_4) had the highest amount of ascorbic acid in the fruit (201.63 mg/100g pulp), and it was statistically comparable to the other treatments with the exception of T_5 (which had the highest ascorbic acid content overall). Contrarily, the control group's minimal amount of ascorbic acid in the fruit (171.76 mg/100g pulp) was found (T_0).

The treatment with NAA @ 200 ppm (T_4) recorded the highest pectin content of the fruit (1.58 percent), which was substantially higher than the other treatments. In contrast, the control group's fruit had the lowest pectin content (0.71 percent) (T_0).

Table no. 1 : Effect of Plant growth regulators on growth attributes of Guava

					(E-W)	(N-S)
T_0 CONTROL (Water spray)	3.73	144.33	122.68	82.94	4.21	3.28
T_1 GA_3 (75 ppm)	4.75	148.36	126.11	87.34	5.15	4.55
T_2 GA_3 (100 ppm)	5.02	152.51	129.63	92.12	5.37	4.83
T_3 GA_3(125 ppm)	5.25	156.41	132.95	97.24	5.60	5.17
T_4 NAA (200 ppm)	**5.81**	**178.58**	**151.80**	**127.13**	**6.00**	**5.89**
T_5 NAA (250 ppm)	5.67	176.06	149.65	123.08	5.87	5.68
T_6 NAA (300 ppm)	5.50	175.73	149.37	120.07	5.78	5.52
T_7 CCC (400 ppm)	4.49	168.60	143.31	112.46	4.91	4.21
T_8 CCC (500 ppm)	4.25	164.64	139.95	107.57	4.66	3.92
T_9 CCC (600 ppm)	4.01	160.68	136.58	102.41	4.44	3.61
F- test	S	**S**	**S**	**S**	**S**	**S**
C.D (5%)	0.13	2.65	2.26	1.94	0.21	0.24

Table no.2:Effect of plant growth regulators on fruit development characteristics of guava

Treatments	Fresh fruit weight (g)	Dry fruit weight (g)	Yield/plant (kg)	Fruit diameter (cm)	
				Polar	Radial
T_0 CONTROL (Water spray)	84.04	57.14	6.97	6.46	6.66
T_1 GA_3 (75 ppm)	88.75	60.35	7.75	6.75	6.86
T_2 GA_3 (100 ppm)	92.43	62.85	8.51	7.03	7.06
T_3 GA_3(125 ppm)	96.16	65.39	9.35	7.26	7.25
T_4 NAA (200 ppm)	**115.47**	**78.52**	**14.68**	**8.46**	**8.16**
T_5 NAA (250 ppm)	114.05	77.56	14.04	8.42	8.11
T_6 NAA (300 ppm)	113.67	76.96	13.65	8.29	8.08
T_7 CCC (400 ppm)	107.11	72.83	12.05	8.08	7.85
T_8 CCC (500 ppm)	103.45	70.35	11.13	7.82	7.66
T_9 CCC (600 ppm)	99.82	67.87	10.22	7.54	7.46
F- test	S	S	S	**S**	**S**
C.D (5%)	1.48	1.43	0,26	1.43	0.1

Table no.3: Effect of Plant growth regulators on Yield attributes of Guava

Treatment	(TSS)^{0}Brix	Total sugar (%)	Acidity(%)	Ascorbic acid (mg/100 ml)	Pectin content (%)
T_0 CONTROL (Water spray)	8.08	6.48	0.56	171.76	0.71
T_1 GA_3 (75 ppm)	8.34	6.75	0.41	175.53	0.79
T_2 GA_3 (100 ppm)	8.59	7.15	0.44	179.08	0.9
T_3 GA_3(125 ppm)	8.86	7.34	0.46	182.63	0.99
T_4 NAA (200 ppm)	**10.17**	**9.2**	**0.4**	**201.63**	**1.58**
T_5 NAA (250 ppm)	10.03	9.05	0.56	199.57	1.55
T_6 NAA (300 ppm)	9.94	8.72	0.54	199.06	1.41
T_7 CCC (400 ppm)	9.66	8.36	0.52	193.64	1.31
T_8 CCC (500 ppm)	9.38	8.09	0.5	189.73	1.19
T_9 CCC (600 ppm)	9.12	7.67	0.48	186.18	1.1
F- test	S	S	S	S	S
C.D (5%)	0.08	0.151	0.014	2.3	0.036

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