Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-7: 3355-3361

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-7 pp. 3355-3361**
Journal homepage: http://www.ijcmas.com

Original Research Article

Effect of Plant Growth Regulators on Flowering, Fruit Growth and Quality of Guava (*Psidium guajava* L.). cv. Allahabad Safeda

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A B S T R A C T

A field experiment was conducted during *Rabi* 2014-15 at Instructional Farm, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture & Sciences (Deemed-to-be-University), Allahabad (U.P). The experiment consisted of seven treatments (One control, two Gibberellic acid (GA_3) @100ppm and @200ppm, two levels of Naphthalene acetic acid (NAA) @200ppm and @300ppm Chlormequat (CCC) @300ppm and @600ppm.These treatments were evaluated in randomized block design with three replications. The results obtained from the experiment show that combination of different plant growth regulators significantly affected the growth parameters of Guava such as plant height (413.19), Total number of flowers per plant (61.12), Number of fruiting bud per plant (49.79), Numbers of fruits per plant (46.10), Plant spread (cm) (120.05), Fresh Fruit weight (g) (173.31), Dry fruit weight (g) (166.64), Fruit length diameter ratio(cm) (7.13), Total soluble solids (TSS) ^{0}Brix (11.76), Total sugar(%) (8.11), and Yield / plant (kg) (23.43) were found to be higher under the treatment T_3 (Naphthalene acetic acid (NAA), while Acidity (%) was maximum in T0 Control (1.51) T3 [Naphthalene acetic acid (NAA)] had a significant effect on the vegetative growth yield and fruit quality.

Keywords

Guava, Gibberellic acid (GA3), Naphthalene acetic acid (NAA) and Chlormequat (CCC)

Introduction

Guava (*Psidium guajava* L.) is very important tropical fruit crop grown throughout the tropical and sub-tropical areas. it is also called the apple of tropics guava is native of tropical America probably Mexico to Peru an it was introduce In India 17th century it belong to the natural order myrtles and the botanical family myrtaceae

Guava (*Psidium guajava* L.) is one of the most important and extensively cultivated fruit crop of India. It is good source of vitamin-C and pectin and widely used for making of jelly. The three times flowering seasons have been observed in North Indian conditions while two flowering seasons have been reported in the climatic condition of Assam regulators in the ovary, the ovary enlarge and fruit development is initiated. However, good fruit set is prevented by adverse weather which hinders pollen production, pollination and fertilization and also low level of auxin. The auxin from the pollen grain and pollen tube might be responsible for the early stage of fruit growth. However, small amount of pollen

grains necessary to pollinate a flower may not carry enough auxin to account for early fruit development. The growing pollen tube may secrete auxin which helps in fruit growth (lal *et al.,* 2013) The percentage of flowering and fruiting, poor fruit retention, poor yield and quality fruits are of major concern of the fruit growers. So, the present investigation was undertaken to find out response of plant growth regulators on flowering, fruit growth and quality of guava.

Uttar Pradesh, the largest grower produces best quality of fruits. But the fruits are blemished being highly delicate in nature besides the biochemical post-harvest changes soften it leading to spoilage. However, the storage life of fresh fruits can be effectively increased and spoilage can be reduced. In recent years, plant growth regulators like auxins, gibberellins and growth retardants like cycocel are being used for improving the fruit quality, delaying deterioration in storage and increasing the shelf life (Katiyar *et al.,* 2008)

Materials and Methods

The experiment was conducted at the Department of Horticulture Research Farm, Sam Higginbottom Institute of Agriculture & Technology Sciences –Deemed to be-University, Allahabad during Rabi season 2014-15. On five year old guava tree cv. Allahabad safeda and sardar. The experiment was conducted in randomized block design. The experiment comprised of 7 treatments consisting of foliar spray of GA3, NAA, CCC and control. The treatments were control (T0), Gibberellic acid (GA_3) @100ppm (T1), Gibberellic acid (GA_3) @200ppm(T2), Naphthalene acetic acid (NAA) @200ppm (T3), Naphthalene acetic acid (NAA) @300ppm (T4), Chlormequat (CCC) @300ppm (T5), Chlormequat (CCC) @600ppm (T6). The growth parameters like. Plant height (cm),Total number of flowers per plant, Number of fruiting bud per plant, Numbers of fruits per plant, Plant spread was measured with the help of measuring device at the time of treatment application and at harvest and increase in same during the experimental period was calculated. Flowering and fruiting characters were recorded by selecting four branches randomly from all directions of a tree. The observations on yield parameters of fruits were recorded and yield per tree (in kg) were worked out by average fruit weight of four fruits and multiplied by the total number of fruit. The data on quality parameters of fruits were recorded. Physical and chemical parameters of fruits were determined using to average size fruits collected randomly from each replication. The TSS (^{0}Brix) was determined with the help of a hand refractometer. Acidity was estimated by simple acid– alkali titration method as described in A.O.A.C. (1970). Sugars in fruits were estimated by the method suggested by Nelson (1944). Assay method of ascorbic acid was followed as given by Ranganna (1977).

Results and Discussion

The growth parameter characters of the tree were significantly influenced by different treatments (Table 1). Maximum increment in. Plant height, Total number of flowers per plant, Number of fruiting bud per plant, Numbers of fruits per plant, Plant spread in N-S and E-W direction with foliar application of NAA @200ppm may be due to immediate absorption of auxins, which increased the endogenous auxin level that resulted in cell elongation and enhanced vegetative growth. Maximum fruit was reported with application of foliar spray of @ 200ppm NAA. Similar findings are

reported by Jain and Dashora (2007). Increased fruit can be attributed to deblossoming of rainy season crop which increased the carbohydrate content and shoot and high carbohydrate was thought to increase fruit set in following winter.

The various Fruit development Characteristics parameters were significantly influenced by application of different PGR (Table 2). Maximum Fresh Fruit weight (g) (173.31), Dry fruit weight (g) (166.64) Fruit length diameter ratio (cm) at harvest (7.13 cm), Garasiya *et al.,* (2012) was and maximum yield /plant (23.43 kg) recorded with foliar spray of @200ppm NAA.

Increment in length of terminal shoots formed more internodes as compared to lesser length. Ultimately these produced more number of leaves and flower buds. This might have lead to increase in size of fruits (Dubey *et al.,* 2002). Maximum fruit length at harvest and minimum seed weight were recorded with 200 ppm NAA. Application of auxin accelerated the development of fruit. Similar findings were reported by Yadav *et al.,* (2001) in guava

The data (Table 3) indicate that application of various PGR significantly improved the fruit quality of guava in terms of TSS (^{0}Brix) total sugars, acidity content of fruit, and ascorbic acid per cent of fruit (Table 4). The maximum total soluble solids the treatment T3 with [Naphthalene acetic acid (NAA)] has maximum total soluble solids (11.76).

The maximum total sugar the treatment T3 with @200ppmNAA has maximum total sugar (8.11).The maximum acidity T0 Control (1.51) followed by treatment T1 (GA_3) (1.41). The acidity was minimum (1.20) in treatment T3 @200ppm NAA. The T3 200ppm NAA has maximum Ascorbic acid (221.40) Agnihotri *et al.,* (2013) followed by treatment T2 (GA_3)] (187.48). The Ascorbic acid was be minimum (155.50) in treatment To (control)

From present investigation it is concluded that,in respect of cultivation of Guava (*Psidium guajava* L.) under Allahabad condition, the application of treatment T_3 (Naphthalene acetic acid (NAA) @ 200 ppm had a significant effect on the vegetative growth, yield and fruit quality of guava

The design of the Experiment was simple RBD with three replication and seven treatment. Three growth regulators with six concentration were used and foliar sprays were iven at 30, 60 and 90 days. The results of present investigation are summarized below:

The Maximum plant height (413.19cm) was recorded in treatment T_3 [Naphthalene acetic acid (NAA)] followed by T_2 [Gibberellic acid (GA_3)] (382.06cm).

Minimum plant height (242.95) was recorded in treatment T_0 control.

The maximum number of flowers per plant treatment T3 with [Naphthalene acetic acid (NAA)] has maximum number of flowers per plant (61.12) followed by treatment T2 [Gibberellic acid (GA_3)] (59.07). The number of flowers per plant was minimum (21.20) in treatment To (Control).

The maximum number of number fruiting bud per plant treatment T3 with [Naphthalene acetic acid (NAA)] has maximum number of fruiting per plant (49.79) followed by treatment T2 [Gibberellic acid (GA_3)] (43.76). The number of fruiting bud per plant was minimum (38.92) in treatment To (Control).

Table.1 Effect of Plant growth regulators on growth parameters of guava plant

Treatments	Plant height **(cm) 30 DAT**	Plant height **(cm) 60 DAT**	Plant height **(cm) 90 DAT**	flowers/plant **(%)**	Bud/plant **(%)**	Fruit/plant **(%)**	Plant spread **(cm)**
T_0 Control	193.20	223.95	242.95	52.54	38.92	34.75	95.63
T_1 (GA_3) @100ppm	293.13	323.81	343.81	57.60	42.67	38.10	109.36
T_2 (GA_3) @ 200ppm	347.10	363.06	382.06	59.07	43.76	39.07	100.52
T_3 **(NAA) @ 200ppm**	373.43	394.19	413.19	**61.12**	**49.79**	**46.10**	**120.05**
T_4 (NAA) @ 300ppm	213.25	244.23	263.23	54.40	40.30	35.98	138.17
T_5 (CCC) @ 300ppm	273.19	304.28	323.28	57.60	42.67	38.10	149.99
T_6 (CCC) @ 600ppm	360.26	373.12	392.12	55.60	41.19	36.77	166.49
F- test	S	S	S	S	S	S	S
C. D. (P = 0.05)	6.909	5.541	3.948	2.085	1.989	2.274	2.353

Table.2 Effect of Plant growth regulating on Fruit development Characteristics parameter of guava fruit

Treatments	Fresh Fruit weight (g)	Dry fruit weight (g)	Fruit diameter (cm)	Yield/plant (kg)
T_0 Control	106.00	99.33	6.37	17.20
T_1 (GA_3) @100ppm	115.16	108.49	6.52	21.13
T_2 (GA_3) @ 200ppm	165.31	158.64	7.05	21.09
T_3 **(NAA) @ 200ppm**	**173.31**	**166.64**	**7.13**	**23.43**
T_4 (NAA) @ 300ppm	158.93	152.26	6.71	19.83
T_5 (CCC) @ 300ppm	143.72	137.05	5.85	20.61
T_6 (CCC) @ 600ppm	134.28	127.61	5.96	18.06
F- test	S	S	S	S
C. D. (P = 0.05)	2.085	2.085	0.783	0.037

Table.3 Effect of plant growth regulators on quality parameters of guava fruit

Treatments	(TSS) ^{0}Brix	Total sugar(%)	Acidity(%)	Ascorbic acid (mg/100g pulp)
T_0 Control	9.86	7.40	**1.51**	155.50
T_1 (GA_3) @100ppm	10.43	7.78	1.41	170.20
T_2 (GA_3) @ 200ppm	10.59	7.95	1.33	187.48
T_3 **(NAA) @ 200ppm**	**11.76**	**8.11**	1.20	**221.40**
T_4 (NAA) @ 300ppm	10.46	7.92	1.45	180.34
T_5 (CCC) @ 300ppm	10.48	7.85	1.46	160.42
T_6 (CCC) @ 600ppm	10.30	7.77	1.46	163.50
F- test	S	S	S	S
C. D. (P = 0.05)	0.615	0.179	0.037	0.859

The maximum number of fruiting per plant treatment T3 with [Naphthalene acetic acid (NAA)] has maximum number of fruit per plant (46.10) followed by treatment T2 [Gibberellic acid (GA_3)] (39.07).

The number of fruiting per plant was minimum (34.75) in treatment To (Control).

The maximum plant spread treatment T3 with [Naphthalene acetic acid (NAA)] has maximum plant spread (120.05) followed by treatment T2 [Gibberellic acid (GA_3)] (100.52). The plant spread was minimum (95.63) in treatment To (Control).

The maximum fresh fruit weight (gm) treatment T3 with [Naphthalene acetic acid (NAA)] has maximum fresh fruit weight (173.31) followed by treatment T2 [Gibberellic acid (GA_3)] (165.31). The fresh fruit weight was minimum (106.00) in treatment To (Control).

The maximum dry fruit weight the treatment T3 with [Naphthalene acetic acid (NAA)] has maximum dry fruit weight (166.64) followed by treatment T2 [Gibberellic acid (GA_3)] (158.64). The dry fruit weight was minimum (99.33) in treatment To (Control).

The maximum fruit length diameter treatment T3 with [Naphthalene acetic acid (NAA)] has maximum fruit length diameter ratio (7.13 cm) followed by treatment T2 [Gibberellic acid (GA_3)] (7.05 cm). The fruit length diameter was minimum (6.37) in treatment To (Control).

The maximum total soluble solids the treatment T3 with [Naphthalene acetic acid (NAA)] has maximum total soluble solids (11.76) followed by treatment T2 [Gibberellic acid (GA_3)] (10.59). The total soluble solids was minimum (9.86) in treatment To (Control).

The maximum total sugar the treatment T3 with [Naphthalene acetic acid (NAA)] has maximum total sugar (8.11) followed by treatment T2 [Gibberellic acid (GA_3)] (7.95). The total sugar was minimum (7.40) in treatment To (Control).

The maximum acidity T0 Control has maximum acidity (1.51) followed by treatment T1 [Gibberellic acid (GA_3)] (1.41). The acidity was minimum (1.20) in treatment T3 [Naphthalene acetic acid (NAA)].

The data presented in table 4.11 indicated that difference due to various treatment were significant. It is recorded that the T3 Naphthalene acetic acid has maximum Ascorbic acid (221.40) followed by treatment T2 [Gibberellic acid (GA_3)] (187.48). The Ascorbic acid was be minimum (155.50) in treatment To (control)

The maximum yield per plant the treatment T3 [Naphthalene acetic acid (NAA)] has maximum yield per plant (23.43 kg) and followed by treatment T2 [Gibberellic acid (GA_3)] (21.09 kg). The yield per plant was minimum (17.20) in treatment To (control).

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