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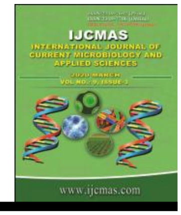

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Effect of Plant Growth Regulators on Yield and Quality of Custard Apple (*Annona squamosa* L.)

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A B S T R A C T

A trial conducted to evaluate different plant growth regulators *viz.*, NAA (50, 75 and 100 ppm), GA_3 (50, 75 and 100 ppm), Ethrel (100, 200 and 300 ppm) and control was undertaken at farmers field Malegaon Tal. Badnapur, Dist- Jalna during the year 2016- 2017.The plant growth regulators were sprayed two times i.e. first spray given at flowering stage and second at fruit set stage. The maximum fruit weight (186.35g), fruit volume (180.20cc), fruit length (7.12cm), fruit breadth (7.24cm), pulp weight (115.30g) fruit yield (44.72 qt/ha) and minimum rind weight (59.41 g) was recorded with spraying of GA_3 75 ppm. Whereas, minimum number of seeds per fruit (38.22) was recorded in treatment of GA_3 100ppm, significantly the maximum total soluble solids (26.55 ^{o}B) was recorded in treatment of Ethrel 300 ppm.

Introduction

Custard apple (*Annonas quamosa* L.) is very important fruit, which belongs to family Annonaceae. It's native is tropical America. It is also known by several vernacular names such as sugar apple, sweet sop, *sitaphal* and *sharifa* in different part of the country. Custard apple thrives well in tropical and warmer sub-tropics parts of India. All annonaceous fruits are indigenous to tropical America. Custard apple is now grown in Brazil, Australia, Myanmar, Egypt, Mexico, South Africa, India and Sri Lanka. In India, custard apple is very popular in Deccan plateau and grown commercially on smaller scale in Maharashtra, Andhra Pradesh, Madhya Pradesh, Bihar, Uttar Pradesh, Tamil Nadu, Assam, Orissa and Gujarat.

The custard apple fruit is mostly used as a dessert fruit for its delicious taste and nutritive values. The proximate composition, mineral and sugar contents of the seed and juice of the fruit of *Annona cherimoya* (Custard apple) were determined using standard methods while the physico-chemical properties and chemical composition of the seed oil and juice respectively were also evaluated using standard methods. The protein content of the seed is 17.36% while it is 4.48% for juice. The fat content of the seed and juice are 29.39% and 1.56% respectively, while the values for crude fibre are 32.46% and 7.53%, respectively. There are comparable carbohydrate contents of 10.32 % and 10.52% for the seed the juice respectively. The food energy of the seed is 375.23 kcal while it is 74.04 kcal for the juice. The seed contains substantial amount of calcium. sodium, potassium and magnesium which are better than the values obtained for the juice. The juice given higher values of sugar than seed. The invert sugar of the juice is 161.27 while it is 17.40 for the seed. The fructose content of the juice is 167.27 while it is 17.45 for the seed. The juice contains 268.13 hydrated maltose while the seed contains 26.21. The physic-chemical properties of the oil extracted from the seed has specific gravity of 0.740, acid value of 11.04, peroxide value of 24.04 and saponification value of 52.11. The juice proves to be a good source of vitamins A and C with the values 16.63 µg/100g R.E. and 43.38 µg/100g respectively. The juice contains fixed acidity of 0.023% and volatile acidity of 0.004%. The total solid of the juice is 27.25% while the soluble solid is 10.00%. The analyses showed that *Annona cherimoya* fruit is a potential food source (Amoo *et al.,* 2008).

Custard apple played significant role in diversification risk moderation, value addition and enhancing income in rainfed areas. It provides a better choice in these areas because of its perennial nature, synchronization of fruit development with rains and deep root system, which can utilized the moisture from deeper soil layer and better adaptability in waste land where spotreclamation will be less expensive. It has however claimed that fruit yield and quality can be increased by hand pollination, but is considered to be time consuming and costly. Attempt made to substitute hand pollination, by growth regulators viz. GA**3**, NAA and IAA to enhance the fruit set and improved the production of custard apple by quantitatively and qualitatively.

The efficient pollination, fertilization and proper fruit development is prerequisite. For quality production one way to achieve this by hand pollination but it is time consuming and costly due to non availability of skill labours. Therefore, it is very urgent need to substitute hand pollination by growth regulators to enhance the flowering, fruit set, yield and quality of custard apple.

Materials and Methods

The experiment was conducted on five years old, healthy and vigorous and uniformly grown custard apple trees of cv. Balanagar at farmers field Malegaon Tal. Badnapur, Dist-Jalna in a Randomized Block Design with total ten treatments and three replications with two trees per treatment during the year 2016-17. The trees without any treatment served as control. Custard apple trees were sprayed with different plant growth regulators *viz.,* NAA (50, 75 and 100 ppm), GA3 (50, 75 and 100 ppm), Ethrel (100, 200 and 300 ppm).

The plant growth regulators were sprayed two times i.e. first spray given at flowering stage and second at fruit set stage. All the cultural operations like weeding, inter culturing and irrigation were adapted uniformly to all experimental plants. Observations of various fruit attribute characters and fruit yield were recorded. Results thus, obtained were subjected to statistical analysis. The observations were recorded on fruiting, physioc-chemical parameters and yield.

Fruit weight (g)

The fruit weight of selected fruits was recorded with the help of electronic balance and mean of fruit weight was calculated and recorded as fruit weight in gram.

Fruit volume (cubic centimeter)

The fruit volume of selected fruits was measured by water displacement method and after computing the mean it was recorded as average fruit volume in cubic centimeter.

Fruit size (length and breadth)(cm)

The length and breadth of selected fruits were measured with the help of verniercalliper and after computing mean. It was recorded as average length and breadth of fruit in centimeter.

Pulp weight per fruit (g)

After separating seeds and pulp of selected fruits, the pulp weight was recorded using electronic balance and after computing the mean it was recorded as average pulp weight per fruit in gram.

Rind weight per fruit (g)

After separating the pulp from rind of selected fruits the rind weight was recorded fusing electronic balance and ager computing the mean it was recorded as average rind weight per fruit in gram.

Number of seeds per fruit

After extracting seeds from pulp of selected fruits, the seeds were counted and recorded as average number of seeds per fruit.

Fruit yield (qt/ha)

From the yield per tree it was recorded. The yield per hectare was calculated by multiplying the value of yield/tree (kg) by total number of plants/hectare (400) and dividing the result by 100 and recorded as yield per hectare in qt.

Total soluble solids (°Brix**)**

Pulp was extracted from selected fruits and total soluble solids was determined with help of digital refractometer and recorded as total soluble solids in °Brix.

Results and Discussion

Fruit weight (g)

The results regarding fruit weight are presented in Table 1. The maximum fruit weight (186.35 g) were recorded in treatment of GA_3 @ 75 ppm (T_5), which was statistically at par with the treatments of GA_3 @ 50 ppm (179.53 g) (T_4), NAA @ 100 ppm (178.07 g) (T_3), GA_3 @ 100 ppm (176.19 g) (T_6) and NAA @ 75 ppm (170.17 g) (T_2), which were significantly superior over control and rest of the treatments. Minimum fruit weight (138.77 g) was recorded in control (T_{10}).The reason for increase in fruit weight, may be due to increase in volume of mesocarp cells. The results are in agreement with the findings reported by Chaudhari *et al.*, (2016), Patel *et al.,* (2010) in custard apple.

Fruit volume (cc)

The result regarding volume of fruit as affected by different plant growth regulator treatments are presented in Table 1. The maximum fruit volume (180.20 cc) was observed in treatment of GA_3@ 75 ppm (T_5), which was significantly superior over control and rest of the treatments under study, which was statistically at par with the treatments of GA_3 @ 50 ppm (171.90 cc) (T_4),NAA @ 300 ppm (170.85cc) (T_3), GA_3 @ 100 ppm(168.70cc) (T_6), NAA @ 75 ppm (162.45 cc) (T_2) and NAA @ 50 ppm (158.15cc) (T_1). Minimum fruit volume (130.55cc) was recorded in control (T_{10}). The reason for increasing in fruit volume might be due to increase the level of fruit size and accumulation of more pulp. The results are in agreement with the findings reported by Lal *et al.*, (2013).

Fruit size (length and breadth) (cm)

The results regarding fruit size as affected by various plant growth regulator treatments are presented in Table 1. The maximum fruit length (7.12 cm) were recorded in treatment of GA_3 @ 75 ppm (T_5), which was significantly superior over control. It was followed by treatments of GA3 @ 50 ppm (7.05 cm) (T4), NAA @ 100 ppm (7.00 cm) (T3), GA3 @ 100 ppm (6.95 cm) (T6), NAA @ 75 ppm (6.88 cm) (T2), and NAA @ 50 ppm (6.63 cm) (T1) which were statistically at par with each other. Significantly minimum fruit length (5.35 cm) was observed under control (T10). Maximum fruit breadth (7.24 cm) were recorded in treatment of GA3 @ 75 ppm (T5), which was significantly superior over control. It was followed by treatments GA3 @ 50 ppm (7.13 cm) (T4), NAA @ 100 ppm (7.12 cm) (T3), GA3 @ 100 ppm (7.08 cm) (T6), NAA @ 75 ppm (7.02 cm) (T2) and NAA @ 50 ppm (6.74 cm) (T1), which were statistically at par with each other. Significantly minimum fruit length (5.49 cm) was observed under control (T10).The increase in fruit size may be due to an increasing in the volume of mesocarp cells or it might be also due to increased level of carbohydrate and GA_3 might have stimulated cell division and cell elongation resulting in lager fruit size. The results are in agreement with the findings reported by Chaudhari *et al.*(2016), Patel *et al.*(2010) in custard apple, Lal *et al.*, (2013) in guava and Jagtap *et al.*, (2013) in acid lime.

Pulp weight per fruit (g)

The results regarding pulp weight per fruit are presented in Table 2. The maximum pulp weight (115.30 g) were recorded in treatment of GA3 @75 ppm (T5), which was statistically at par with the treatment T4 (104.45 g) which was significantly superior over control and rest of the treatments. Minimum pulp weight (49.45 g) was recorded under control (T10). The increase in fruit pulp weight may be due to the multiplication and cell enlargement or may be enhanced uptake of water and accumulation of sugar and other food reserves in greater amount as well as increased volume of intercellular spaces in the pulp of fruit due to GA3. The results are in agreement with the findings reported by Debnath *et al.*, (2012) in phalsa and Bhoye (2010), Patel *et al.*, (2010), Chaudhari *et al.*, (2016) in custard apple.

Rind weight per fruit (g)

Minimum rind weight (59.41 g) was recorded in treatment of GA3 @ 75ppm (T5), which was significantly superior over control and rest of the treatments under study, which was statistically at par with the treatments T4 (61.85 g), T3 (62.91 g), T6 (65.07) and T2 (66.65 g). Maximum rind weight of fruit (71.38 g) was recorded in control (T10)as presented in Table 2. The reason for decrease in rind weight may be due to the GA3 decreased rind thickness and rind percentage. The results are in agreement with the findings reported by Debaje *et al.*, (2011) in acid lime and Chaudhari *et al.*, (2016) in custard apple.

Number of seeds per fruit

The result regarding number of seeds per fruit as affected by various plant growth regulator treatments are presented in Table 2.Minimum number of seeds per fruit (38.22) were recorded in treatment of GA3 @ 100 ppm (T6), which was significantly superior over control and rest of the treatments under study, and it was at par with the treatment of GA3 @ 75 ppm (42.73) (T5).

Table.1 Effect of plant growth regulators on fruit weight, fruit volume and fruit size of custard apple

Tr. No.	Treatments	Fruit weight (g)	Fruit Volume (cubic centimeter)	Fruit size (cm)	
				Length of fruit (cm)	Breadth of fruit (cm)
T_1	NAA 50 ppm	165.17	158.15	6.63	6.74
T_2	NAA 75 ppm	170.17	162.45	6.88	7.02
T_3	NAA100 ppm	178.07	170.85	7.00	7.12
T_4	GA_3 50 ppm	179.53	171.90	7.05	7.13
T_5	GA_3 75 ppm	186.35	180.20	7.12	7.24
T_6	GA_3 100 ppm	176.19	168.70	6.95	7.08
T_7	Ethrel 100 ppm	145.26	138.18	6.11	6.24
T_8	Ethrel 200 ppm	144.10	136.90	6.03	6.14
T_9	Ethrel 300 ppm	143.09	135.60	5.95	6.09
T_{10}	Control	138.77	130.55	5.35	5.49
SE±		6.57	8.38	0.22	0.33
CD at 5 %		19.54	24.90	0.66	0.99

Table.2 Effect of plant growth regulators on pulp weight, rind weight, number of sees per fruit, fruit yield and T.S.S of custard apple

Tr. No.	Treatments	Pulp weight/fruit (g)	Rind weight/fruit (g)	Number of seeds per fruit	Yield (qt/ha)	T.S.S. (°Brix)
T_1	NAA 50 ppm	82.60	67.58	53.16	25.52	21.00
T_2	NAA 75 ppm	89.15	66.65	51.32	32.88	21.10
T_3	NAA100 ppm	101.20	62.91	48.50	39.92	24.15
T_4	GA_3 50 ppm	104.45	61.85	46.12	36.92	21.70
T_5	GA_3 75 ppm	115.30	59.41	42.73	44.72	25.38
T_6	GA_3 100 ppm	100.50	65.07	38.22	27.24	24.50
T_7	Ethrel 100 ppm	60.10	68.67	59.77	24.64	25.10
T_8	Ethrel 200 ppm	58.35	69.71	58.18	20.40	25.30
T_9	Ethrel 300 ppm	56.25	69.93	60.52	19.60	26.55
T_{10}	Control	49.45	71.38	63.78	16.72	20.08
SE±		3.79	2.42	1.91	2.22	1.07
CD at 5 %		11.28	7.21	5.70	6.22	3.20

Maximum number of seeds per fruit (63.78) was recorded in control (T10). The decrease in number of seeds per fruit might be due to parthenocarpic effect of gibberellic acid in multiseeded fruit. The results are in agreement with the findings reported by Debnath *et al.,* (2011) in phalsa, Bhujbal *et al.,* (2013) in sapota, Debaje *et al.,* (2011) and Jagtap *et al.,* (2013) in acid lime, and Chaudhari *et al.,* (2016), Patel *et al.,* (2010) in custard apple.

Fruit yield (qt/ha)

Maximum fruit yield (44.72 qt/ha) were recorded in treatment of GA3 @75 ppm (T5), which was significantly superior over control and rest of the treatments under study, which was statistically at par with the treatment of NAA @ 100 ppm (39.92 qt/ha) (T3). Minimum fruit yield (16.72 qt/ha) was recorded in control (T10)as presented in Table 2. The increased in yield under this growth regulators treatments was associated with increase in the number of fruit, low percentage of fruit drop, more fruit retention and increased fruit size and weight. The above results were in agreement with those of Lal *et al.,* (2013) in guava, Patel *et al.,* (2009) and Chaudhari *et al.,* (2016) in custard apple, and Thanaa *et al.,* (2012) in orange.

Total soluble solids (°Brix)

Significantly, the maximum T.S.S. of fruits (26.55 °Brix) were recorded in treatment of Ethrel @ 300 ppm (T9), which was significantly superior over control and rest of the treatments. It was followed by the treatments T5 (25.38 °Brix), T8 (25.30 °Brix), T7 (25.10 °Brix), T6 (24.50 °Brix), and T3 (24.15 °Brix), which were statistically at par with each other and significant over remaining treatments. The minimum T.S.S. of fruits (20.08 °Brix) was recorded in control (T10) as presented in Table 2. The increase in the T.S.S. by ethrel might be due to quick metabolic transformation of starch and pectin into soluble compounds and rapid translocation of sugars from the leaves to the developing fruits. The results are in agreement with the findings reported by Debenath *et al.,* (2011), Kacha *et al.,* (2012) in phalsa and Rajput *et al.,* (2015) in guava.

On the basis of present investigation the following conclusion can be drawn. That, there was improvement in fruit quality and yield of custard apple fruit due to application of plant growth regulators. The two foliar applications of GA_3 @ 75 ppm for custard apple trees at full bloom and fruit set stage is beneficial for getting higher yield of fruits.

References

Amoo, I. A., Emenike, A. E. and Akpambang, V. O. E. 2008.CompositionalEvaluation of Annona cherimoya (custard apple) Fruit. Trends in Applied Sci. Res. 3(2): 216-220.

Chaudhari, J. C., Patel, K. D., Yadav, L., Patel, U. I. and Varu, D. K. 2016.Effect of plant growth regulators on flowering, fruit set and yield of custard apple (*Annonas quamosa* L.) cv. Sindhan. Adv. in Life Sci. 5(4): 1202-1204.

Patel, N. M., Patil, D. K., Verma, L. R. and Patel, M. M. 2010.Effect of cultural and chemical treatments on fruit set and fruit yield of custard apple (*Annonas qamosa*L.) cv. Sindhan. The Asian J. of Hort. 5(2): 498-502.

Lal, N., Das, R. P. and Verma, L. R. 2013.Effect of plant growth regulators on flowering and fruit growth of guava (*Psidium guajava*L.) cv. Allahabad safeda. Asian J. Hort. 8(1): 54-56.

Jagtap, V. M., Patel, H. C., Nehete, D. S. and

Godage, S. S. 2013. Effect of foliar application of plant growth regulators and micronutrients on yield and quality of acid lime cv. Kagazi (*Citrus aurantifolia* Swingle). Asian J. Hort 8(1): 57-59.

Debnath, A., Vanajalatha, K., Momin, U. and Reddy, M. 2011.Effect of NAA, GA3, kietin and ethrel on yield and quality in phalsa (*Grewiasub-inaequalis*DC). Asian J. Hort. 6(2): 474-477.

Debaje, P. P., Shinde, E. D. and Ingale, H. V. 2011.Effect of plant growth regulators and nutrients on quality of acid lime (*Citrus aurantifolia* Swingle). Asian J. Hort. 6(1): 253-255.

Bhoye, D. V. 2010. Effect of GA3 and NAA on fruit set, yield and quality of custard apple. M. Sc. (Hort.) Research thesis, Akola.

Bhujbal, D. S., Naik, D. M. and Kale, S. A. 2013.Studies on effect of growth regulators on flowering, fruiting and quality of sapota.Internat. J. Agric. Sci. 9(1): 289-292.

Thanaa, M. E., Aly, M. A., Ekbal, Z. A., Ahmed and Khalaf, M. H. A. 2012.Effect of pre-harvest spraying on yield and fruit quality of Washington Navel orange fruits. J. Plant Production, Mansoura Univ. 3(8): 2335-2345.

Rajput, R. P., Senjaliya, H. J., Vala, G. S. and Mangroliya, G. S. 2015.Effect of various plant growth regulators on yield and quality of guava (*Psidium guajava* L.) cv. LUCKNOW-49.Internat. J. Agric. Sci. 11(1): 179-182.

Kacha, H. L., Viradia, R. R., Leua, H. N., Jat, G. and Tank, A. K. 2012.Effect of NAA, GA3 and ehrel on yield and quality of phalsa (*Grewia asiatica* L.) under south- saurashtra condition. Asian J. Hort.7(2): 242-245.

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