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Improving Fruit Set in Custard Apple (*Annona squamosa* L) by using Growth Regulators

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A B S T R A C T

Custard apple *(Annona squamosa* L.) is gaining popularity as dryland fruit crop in Maharashtra. But poor set is the limiting factor in the expansion of area under this crop. To circumvent this problem, the investigation was undertaken at Research Farm, Department of Horticulture, College of Agriculture, Dhule by using different growth regulators viz., NAA (15 ppm), GA (50 ppm), CPPU (1 and 2 ppm), Brassinosteroid (1 and 2 ppm), Potassium monohydrogen phosphate (0.5 and 1.0%), Potassium dihydrogen phosphate (0.5 and 1.0 %) and Boric acid (1 and 2 %). Three sprays of each treatment were given at monthly interval starting from April. The experimental results indicated that, though CPPU @ 2 ppm recorded highest number of flowers per shoot (32.83) followed by NAA @ 15 ppm (32.11 flowers per shoot), the highest fruit set (21.06%), fruit retention (70.59%), number of fruits per plant (60.0 fruits/plant) and yield (9.43 kg/plant) was registered by the spray treatment of NAA @ 15 ppm. Fruit weight and days to fruit harvesting were not influenced by the growth regulators studied. Further, it was observed that none of the growth regulators studied did not influence the physico-chemical characters of the fruit. Thus, the sprays of CPPU and NAA at flowering stage and spray of NAA from fruit set to harvest found to be beneficial in improving fruit set and fruit yield in custard apple.

Introduction

Custard apple (*Annona squamosa L.*) is proving boon to the arid zones of Maharashtra because of their wider adaptability, comparatively freeness from pests and diseases, hardy nature and escape from stray and grazing animals. However, low fruit set is a major constraint in expanding its commercial cultivation (Hays, 1957). Plant growth regulators have become important tool in the production of various fruit crops. Growth regulators as a means for enhancing flowering, fruit set; control of fruit drop, fruit size, yield and fruit quality have become important in agriculture (Guirguis, *et al*. 2010). However, research work on this aspect in custard apple is very sporadic. Moreover, new growth regulators like CPPU, Brassinosteroids are available in markets which are widely used in grapes, but, their suitability in the custard apple needs to be assessed. Being hardy crop, the cultivation of custard is increasing in North Maharashtra, the present study undertaken to generate data from farmers' point of view.

Materials and Methods

The present investigation was carried out on seven year old Custard apple cv. Balanagar during 2014-15 at Research Farm, Department of Horticulture, College of Agriculture, Dhule (Maharastra). The experiment was laid out in Randomized Block Design with thirteen treatments (Table 1) which were replicated three times and each treatment comprised of a unit of 2 plants. Three sprays of each treatment were given at monthly interval starting from April. The observations on fruit set, fruit retention, fruit weight, fruit yield and quality parameters namely pulp weight, TSS, total sugar's and acidity were recorded.

The percentage fruit set was calculated by using following formula-

$$\text{Fruit set (\%)} = \frac{\text{Total number of fruits set}}{\text{Total number of flowers per shoot}} \times 100$$

Fruit retention was recorded at the time of harvesting when the fruits attained appropriate maturity and the percentage was worked out as follows-

$$\text{Fruit retention (\%)} = \frac{\text{Total number of fruits carried to maturity}}{\text{Total number of fruits set}} \times 100$$

The data in respect of number of fruits at each picking was recorded and then summed up to get average number of fruits per plant. Fruits were randomly selected from each treatment and were brought to laboratory and the weight of fruits was recorded on the electronics weighing balance and weight was expressed in grams. Yield per plant was worked out by multiplying number of fruits and weight of the fruits harvested. The weight of pulp was measured on electronics weighing balance. Total soluble solids (T.S.S.) were recorded by hand refractometer (Erma Tokyo $A^0$32). The total sugars were worked out as per the method advocated by Ranganna (1985) and expressed as percentage. Acidity was worked out by simple method of titration of homogenized pulp against 0.1 N NaOH, using phenolphthalein as an indicator as per the method advocated by Ranganna (1985) and expressed as percentage. The data so generated were subjected to statistical analysis as per the method given by Panse and Sukhatme (1995).

Results and Discussion

Fruit set, fruit retention, yield and yield attributes

The data with respect to fruit set, fruit retention, yield and yield attributes is presented in Table 1.

Fruit set (%)

Results presented in Table 1 revealed that plant growth regulators under study significantly influenced fruit set. Significantly highest fruit set percentage was observed in the treatment T_1 i.e. NAA @ 15 ppm which recorded 21.06 % fruit set. The findings are in agreement with those obtained by Sundarajan (1968); Durate (1976); Keskar *et al.* (1986) and Kulkarni *et al.*, (1995) in custard apple.

Beneficial role of NAA in improving fruit set was also reported by Ghosh *et al.*, (2009 a) in pomegranate cv. Ruby; and Kaseem *et al.*, (2011) in ber. It is well known that auxins play an important role in control of fruit abscission (Osborne, 1989). Beneficial role of NAA in increasing fruit set may be explained from the fact that, auxins play significant role in fruit set due to their strong mobilization activity (Crane, 1969), which helps to maintain ongoing physiological and biochemical process of inhibition of abscission (Tomaszewska and Tomaszewska, 1970).

Fruit retention (%)

The highest fruit retention percentage was recorded in the treatment T_1 i.e. NAA 15 ppm (70.59%) which was significantly superior over rest of the treatments. Similar results were reported by Kulkarni (1991) in custard apple. The response of NAA in increasing fruit retention confirms the earlier findings of Improvement in fruit retention due to application of NAA has also been reported by Bal *et al.*, (1982) and Kaseem *et al.*, (2011) in ber; Ghosh *et al.*, (2009 a) in pomegranate and Saraswathi *et al.*, (2003) in mandraians (*C. reticulate*, Blanco). The NAA being auxin compound might have reduced the cellulose activity and the absicission process which would have resulted in increased fruit retention. (Randhava and Chadha (1994).

Number of fruits per plant

The highest number of fruits per plant was recorded in the treatment T_1 i.e. NAA 15 ppm which recorded 60 fruits per plant which was significantly superior over rest of the treatments. Present findings are in harmony with the findings of Kulkarni *et al.*, (1996). Patel *et. al.* (2010) in custard apple; Ghosh *et al.*, (2009 a) in pomegranate; Kaseem *et. al.* (2011) in ber and Nkansah *et al.*, (2012) in Keitt mangoes also reported the increase in number of fruits per plant due to the application of NAA. The increase in number of fruits per plant in the present investigation might be due to the corresponding significant increase in the fruit set and fruit retention percentage.

Table.1 Effect of different plant growth regulators on fruit set (%), number of fruits per plant, fruit weight (g) and yield per plant (kg)

Treat. No.	Treatments details	Fruit set (%)	Fruit retention (%)	Number of fruits/plant	Fruit weight (g)	Yield per plant (kg)
T_1	NAA (15 ppm)	21.06	70.59	60.00	157.13	9.43
T_2	GA (50 ppm)	17.33	52.79	50.00	158.45	7.92
T_3	CPPU (1 ppm)	14.50	46.87	51.33	173.50	8.88
T_4	CPPU (2 ppm)	13.08	29.31	55.00	147.61	8.11
T_5	Brassinosteroid (1 ppm)	12.00	53.63	45.66	180.00	8.23
T_6	Brassinosteroid (2 ppm)	13.75	51.26	45.00	162.91	7.34
T_7	m monohydrogen phosphate (0.5 %)	10.12	41.72	42..00	153.18	6.42
T_8	monohydrogen phosphate (1 %)	13.75	53.93	41.00	172.85	7.06
T_9	dihydrogen phosphate (0.5%)	12.49	45.80	41.00	153.40	6.29
T_{10}	dihydrogen phosphate (1.0%)	11.08	46.47	43.00	158.53	6.80
T_{11}	Boric acid (1.0 %)	11.19	39.22	39.00	160.41	6.88
T_{12}	Boric acid (2.0 %)	10.88	42.06	40.00	164.23	6.57
T_{13}	Control	09.84	42.43	43.00	179.10	6.99
	S. E. ±	1.13	5.55	1.22	10.13	0.54
	C. D. 0.5%	3.31	16.21	3.57	N. S.	1.58

Table.2 Effect of different plant growth regulators on pulp weight (g), Total Soluble Solids (T.S.S.) (%), acidity (%) and total sugars (%)

Treatment No.	Treatments details	Pulp weight (g)	T.S.S. (%)	Acidity (%)	Total Sugars (%)
T_1	NAA (15 ppm)	70.87	18.35	0.185	17.28
T_2	GA (50 ppm)	72.74	18.36	0.186	18.21
T_3	CPPU (1 ppm)	78.59	18.91	0.180	17.72
T_4	CPPU (2 ppm)	64.22	18.93	0.187	17.22
T_5	Brassinosteroid (1 ppm)	82.66	18.98	0.185	18.45
T_6	Brassinosteroid (2 ppm)	72.61	18.45	0.184	18.14
T_7	Potassium monohydrogen phosphate (0.5 %)	67.40	17.88	0.190	17.74
T_8	Potassium monohydrogen phosphate (1 %)	77.64	18.61	0.188	18.02
T_9	Potassium dihydrogen phosphate (0.5 %)	69.69	19.37	0.183	17.67
T_{10}	Potassium dihydrogen phosphate (1.0 %)	71.04	18.50	0.185	17.66
T_{11}	Boric acid (1.0 %)	72.93	19.08	0.188	18.42
T_{12}	Boric acid (2.0 %)	75.40	18.86	0.187	17.85
T_{13}	Control	79.39	18.48	0.187	17.51
	S. E. ±	4.32	0.28	0.00303	0.33
	C. D. 0.5%	N. S.	N. S.	N. S.	N.S.

Fruit weight

Although, fruit weight of custard apple in the present investigation was not influenced by application of growth regulators, numerically the highest fruit weight () was noticed in the treatment T_5 i.e. application of 1ppm brassinosteriod (180.0 g). However Kulkarni (1996) in Custard apple and Saraswathy *et al.*, (2003) in mandrian reported that growth regulators especially NAA and 2,4-D did not affect fruit weight.

Fruit yield

The highest yield per plant was recorded in the treatment T_1 i.e. NAA 15 ppm (9.43 kg/ plant) which were at par with the treatments and T_3 i.e. CPPU 1 ppm (8.88 kg/plant), T_5 i.e. Brassinosteroid 1 ppm (8.23 kg/ plant) , T_4 i.e. CPPU 2 ppm (8.11 kg/ plant) and T_2 i.e. GA 50 ppm (7.92 kg/ plant). Results are in close agreement with Kulkarni *et al.*, (1996). Parallel results were also obtained by Patel *et al.*, (2010) in custard apple due to the application of 20 ppm NAA. The increase in the yield might be due the increased number of fruits per plant which directly corresponds to the increased fruit set and fruit retention.

Fruit quality characters

The data with respect to pulp weight (g), Total Soluble Solids (T.S.S.) (%), acidity (%) and total sugars (%) is presented in Table 2.

Pulp weight (g)

Pulp weight was not affected by the applications of growth regulators under study. However, numerically the highest pulp weight (82.66 g) was recorded in the treatment T_5 i.e. application of 1 ppm brassinosteriod. Findings of Kulkarni (1991) in Custard apple suggested that growth regulators did not influence pulp weight.

TSS (%)

Results revealed that growth substances studied did not affect T.S.S. However, numerically the highest T.S.S. was registered in T_9 i.e. potassium dihydrogen phosphate (19.37%). The results are in accordance with

those obtained by Keskar *et al*., (1986) and Kulkarni (1991) in custard apple. Han and Lee (2004) while working on Kyoho grape reported that T.S.S. was not influenced by the application of GA_3, CPPU and ABA.

Total sugars (%)

The significant differences were not observed with respect to total sugar content of the fruits due to the application of various plant growth regulators. However, numerically the highest total sugar was registered in the treatment T_5 i.e. (Brassinosteroid @ 1 ppm) and it was 18.45 per cent. Lowest Total Sugar (%) was recorded in the treatment T_4 i.e. @ CPPU 2 ppm and it was 17.22 per cent. The present findings of non- influence of total sugars by growth regulators corroborate with Kulkarni *et al.,* (1996) in custard apple and Hesami and Abdi (2010) in date palm.

Acidity (%)

The acidity (%) of fruits did not differ significantly due to the application of various plant growth regulators studied. However, numerically the lowest acidity was found in the treatment T_3 i.e. CPPU 1 ppm and it was 0.180 %. Highest percentage of acidity % of 0.190 % was recorded in T_7 i.e. Potassium monohydrogen phosphate 0.5%. Non-influence of acidity due to growth regulators confirms the findings of Kulkarni *et al.,* (1996) in custard apple; Saraswathi *et al.,* (2003) in mandarin; Hesami and Abdi (2010) in date palm and Faissal and Aal (2007) in pear.

References

Bal, J. S., S. N. Singh and I. S. Randhava (1982). Effect of NAA and trichlorophenoxy acetic acid on fruit drop, size and quality of ber. Prog. Hort. 14(2/3) : 148-151.

Crane, J.C. (1969).The role of hormones in fruit set and development. HortScience, 4(2):108-111.

Durate, O., A. Ramirez and R. Franciosi (1976). Improving cherimoya fruit set by use of plant growth regulators. 459 Univ. Nacional Agraria, La Mo Lina, Lima, Peru (Plant Growth Regulators Abstr. 2: 1617).

Faissal F.A. and A.M.K.A. Aal (2007). Effect of concentration and date of spraying Sitofex (CPPU) on yield and quality of Le- Conte pears. African Crop Science Conference Proceedings, 8: 523-527.

Ghosh S.N., B. Bera, S. Roy and A. Kundu (2009a). Effect of plant growth regulators in yield and quality in pomegranate cv. Ruby. J. Hortl. Sci. Vol 4 (2): 158-160.

Guirguis,N.S.; E.S. Attala, G.B. Mikhael and M.A. Gabr (2010). Effect of Sitofex (CPPU) on fruit set, yield and fruit quality of 'Costata' Persimmon trees, J. Agric. Res. Kafer EI-Shiekh Univ., 36(2): 206-219.

Han D. H. and C.H. Lee (2004). The effects of GA_3, CPPU and ABA Applications on the quality of Kyoho (*Vitis vinifera* L. x *V. labrusca* L.) Grape.Proc. 9th Int. Symp. on Plant Bioregulators. (Eds.) S. M. Kang et al. Acta Hort.,653 :193-195.

Hesami, A. and Abdi Gholamreza (2010). Effect of some plant growth regulators on physicochemical characteristics of date palm (*Phoenix dactylifera* L. Kabkab) fruit. American-Eurasian J. Agric.and Environ. Sci., 7(3): 277-282.

Hays, H.B. (1957). Fruit growing in India. Kitabistan, Allahabad, pp. 358-387.

Kassem H.A., R.S. Al-Obeed, M.A. Ahmed and A.K.H. Omar. (2011). Productivity, fruit quality and profitability of Jujube trees improvement by preharvest application of agro-Chemicals. Middle-East J. of Scientific Res., 9 (5): 628-637.

Keskar, B.G., D.P. Bhore and S.D. Masalkar

(1986). Effect of NAA and mulch on yield of custard apple. J. Maharashtra Agric. Univ. 11(2): 235-236.

Kulkarni S.S. (1991). Effect of cultural and chemical treatments on fruit set, yield and quality of custard apple (*Annona squamosa*, L), M.Sc. Thesis submitted to MPKV Rahuri. pp.

Kulkarni S.S., U.T. Desai and S.D. Masalkar. (1995). Fruit set studies in custard apple under semi-arid conditions of western Maharashtra. J. Maharashtra Agric. Univ. 20 (2): 317-318.

Kulkarni, S.S., U.T. Desai, S.D. Masalkar and S.B. Desale (1996). Effect of cultural and chemical treatments on yield and physicochemical characteristics of custard apple. J. Maharashtra Agric. Univ. 21 (3) : 474-475.

Nkansah, G.O., J. Ofosu-Anim and A. Mawuli (2012). Gibberelic acid and Naphthalene Acetic Acid affect fruit retention, yield and quality of Keitt Mangoes in the Coastal Savanna Ecological Zone of Ghana. American J. of Pl. Physio., 7(6): 243-251.

Osborne, D.J. (1989). Abscission. Critical Rev. Plant Sci.. 8:103-129.

Panse, V. G. and Sukhatme, P. V. (1995). Statistical methods for Agricultural Workers. Revised Edn. ICAR, New Delhi.pp.

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

Randhawa G. S. and K. L. Chadha (1994). Fruit drop and its control in mango and citrus. ICAR Publication, pp:52

Ranganna, S. (1985). Manual of Analysis of Fruit and Vegetable Products. Tata McGraw-Hill Publishing Company Limited, New Delhi, i-ix +1-632.

Saraswathi, T., P. Rangaswami and R. S. Azhakiamanavalan (2003). Effect of preharvest spray of growth regulators on fruit retention and quality of mandarins (*Citrus reticulate*, Blanco). South Indian Hort. 51 (1-6): 110-112.

Sundarajan S., K. G. Shanmugavelu and S. Muthuswami. (1968). Effect of plant growth regulators on custard apple. (*Annona Squamosa L.*). South Indian Hort. 16 (3 &4): 63-64.

Tomaszewska E. and M.Tomaszewska, (1970). Endogenous growth regulators in fruit and leaf abscission. Zeszyty Nauk Biol., Copernicus Univ. Tourn Pol. 23: 45-53.

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